National Conference on Economics and Finance

8 April 2022

Kathmandu, Nepal

CONFERENCE PAPER AND PROCEEDINGS

Nepal Rastra Bank

Baluwatar, Kathmandu

Contents

National Conference on Economics and Finance

8 April 2022, Kathmandu, Nepal

PROGRAM BROCHURE

Nepal Rastra Bank
Baluwatar, Kathmandu

Background

Nepal Rastra Bank(NRB) has been organizing international conferences on a regular basis to provide a platform for policy makers, researchers and practitioners to discuss different economic and financial sector issues. The first international conference was organized in April 2012, followed by the second conference in February 2015 and the third conference in February 2020.

Because of Covid-19 pandemic, this time NRB has organized the conference only in national level. The present National conference is scheduled for **8 April 2022** in **Kathmandu,** Nepal. This event is expected to bring policy makers, practitioners and researchers in Nepal together to discuss a number of pertinent issues of economic and financial sector.

CONFERENCE ORGANIZING COMMITTEE

Dr. Neelam Dhungana (Timsina)
Deputy Governor, Nepal Rastra Bank

Mr. Rishikesh Bhatta
Executive Director, Assets & Service Management Department
Nepal Rastra Bank

Dr. Prakash Kumar Shrestha
Executive Director, Economic Research Department
Nepal Rastra Bank

Mr. Laxmi Prasad Prasai
Director, Economic Research Department
Nepal Rastra Bank

Mr. Shivaram Dawadi
Director, Information Technology Department
Nepal Rastra Bank

SCIENTIFIC COMMITTEE

Dr. Prakash Kumar Shrestha
Executive Director, Economic Research Department
Nepal Rastra Bank

Prof.Dr. Kushum Shakya
Dean, Faculty of Humanities and Social Sciences
Tribhuvan University

Prof.Dr. Shiva Raj Adhikari
Head of Department, Central Department of Economics
Tribhuvan University

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Director, Economic Research Department
Nepal Rastra Bank

Dr. Rajan Krishna Pant
Director, Economic Research Department
Nepal Rastra Bank

CONFERENCE ORGANIZING SUB-COMMITTEE

Mr. Laxmi Prasad Prasai
Director, Economic Research Department

Mr. Manoj Kumar K C
Deputy Director, Assets and Service Management Department

Mr. Chhabilal Ghimire
Deputy Director, Financial Management Department

Mr. Janak Raj Sapkota
Deputy Director, Economic Research Department

Mr. Bidhyaman Mahatara
Assistant Director, Economic Research Department

CONFERENCE VENUE

Hotel Radisson, Lazimpat, Kathmandu, Nepal

PROGRAM SUMMARY
FRIDAY, 8 APRIL 2022

08:30-09:00	Registration and Hi-Tea
09:00-10:00	Inaugural Program (Hall Nepadhuku)
10:00-10:15	Tea Break
10:15-11:45	Paper Presentation Sessions-I (2 Parallel sessions)
11:45-12:00	Tea Break
12:00-13:30	Paper Presentation Sessions-II (2 Parallel sessions)
13:30-14:30	Lunch Break
14:30-16:30	Paper Presentation Sessions-III (2 Parallel sessions)
16:30-16:45	Tea Break
17:00-18:00	Closing Ceremony
18:00-20:00	Dinner

PROGRAM DETAILS

08:30-09:00   **Registration and Hi-Tea**

09:00-10:00   **Inaugural Program (Hall Nepadhuku)**

Welcome Remarks
Dr. Neelam Dhungana (Timsina)
Deputy Governor and Coordinator, Conference
Organizing Committee, Nepal Rastra Bank

Special Paper Presentation
Brief presentation on Covid-19, Nepalese
Economy and Policy Response
Dr. Kalpana Khanal, Senior Research Fellow,
Policy Research Institute

Keynote Speech
Challenges to External Sector Stability
Mr. Maha Prasad Adhikari
Governor, Nepal Rastra Bank

Special Remarks
Dr. Biswo Nath Paudel
Vice-Chairman, National Planning Commission

Inauguration Remarks
Mr. Janardan Sharma
Honorable Minister of Finance
Government of Nepal

10:00-10:15 **Tea Break**

SESSION I-A

Venue: Nepa   Time: 10:15-11:45

Theme: Factors Affecting Economic Growth
Session Chair: Prof. Dr. Shiva Raj Adhikari

Equity Vs Efficiency: Assessment of The Relationship Between Income Inequality and Economic Growth in South Asia
➢ *Mr. Khubi Ram Acharya, Assistant Professor,*
Nepal Commerce Campus, TU
➢ *Mr. Himal Acharya, School of Arts, KU*

Role of Migrants' Remittances on Economic Growth: Evidence from Nepal
➢ *Mr. Ram Narayan Shrestha, South Asian University,*
New Delhi, India

Impact of Covid-19 on Nepal Stock Exchange (NEPSE): An Event Study Approach
➢ *Mr. Prabesh Acharya, School of Management, TU*
➢ *Ms. Bipana Panthi, School of Management, TU*

SESSION I-B

Venue: Dhuku   Time: 10:15-11:45

Theme: Gender, Employees and Corporate Payout

Session Chair: Prof. Dr. Kushum Shakya

Glass Ceiling and Women Career Development in The Banking Sector: A Case of Birgunj

➢ *Mr. Som Raj Nepali, Nepal Rastra Bank*

Assessment of Gender Diversity on Banking Performances in Nepal: Evidence from Binary Logit Estimation

➢ *Ms. Ranjana Koirala, Quest International College, Gwarko*
➢ *Ms. Sushma Adhikari, Quest International College, Gwarko*

Corporate Payout Policy and Test of Life Cycle Theory: Evidence from Nepal

➢ *Mr. Tej Prasad Devkota, Director, Securities Board of Nepal*
➢ *Mr. Ajaya Dhungana, Assistant Director, Securities Board of Nepal*

11:45-12:00   **Tea Break**

SESSION II-A

Venue: Nepa   Time: 12:00-13:30

Theme : Monetary Policy Transmission Mechanism and Sectoral Loan Distribution

Session Chair: Mr. Nara Bahadur Thapa

Assessing The Interest Rate Channel and Bank Lending Channel of Monetary Transmission in Nepalese Economy: A Vector Autoregression Approach

➢ *Mr. Kushal Shrestha, Nepal Rastra Bank, Baluwatar*

Forecasting of Loanable funds in the Banking System of Nepal

➢ *Mr. Homnath Gaire, PhD Scholar, Tribhuwan University*

Sectoral Loan Distribution: Evidence from Aggregate Data of Nepalese Banks and Financial Institutions

➢ *Mr. Post Raj Pokharel, Research Director,*
   Boston International College, Bharatpur

SESSION II-B

Venue: Dhuku   Time: 12:00-13:30

Theme: Stock Price and Profitability

   Session Chair: Dr. Gopal Prasad Bhatta

Examining the Causality of Assets Growth and Income on Share Price for Commercial Banks in Nepal

➢ *Mr. Serene Khatiwada, Business Planning Manager,*
   Standard Chartered Bank Nepal Limited
➢ *Mr. Prabhakar Jha, Nepal Rastra Bank*

Intellectual Capital and Profitability of Commercial Banks: New Evidence from Nepal

➢ *Prof. Dr. Jeevan Kumar Bhattarai, Nepal Commerce Campus, TU*
➢ *Prof. Dr. Ramji Gautam, Central Department of Management, TU*
➢ *Mr. Keshab Khatri Chettri, Faculty of Management, TU*

Factors Affecting Investment Decisions of Employees Working on Financial and Non-Financial Sectors of Nepal

➢ *Asso. Prof. Bharat Dhungana, School of Business,*
   Pokhara University
➢ *Asst. Prof. Ram Krishna Chapagain, School of Business,*
   Pokhara University

13:30-14:30   **Lunch Break**

SESSION III-A

Venue: Nepa   Time: 14:30-16:30

Theme: FDI, Tax System and Green Finance
Session Chair: Dr. Ram Kumar Phuyal

Productivity of Tax System of Nepal
➢ *Mr. Kul Prasad Prasai, Faculty Economics,*
   Apex College, Baneswor

A Nexus of Foreign Direct Investment and Trade Liberalization: An Empirical Analysis Through VECM Approach
➢ *Mr. Sudan Kumar Oli, PhD Scholar,*
   University of International Business and Economics, China
➢ *Prof. Yuantao Xie,*
   University of International Business and Economics, China

Greening the Financial System of Nepal-Why Green Finance?
➢ *Ms. Dipti Dhungel, Faculty of Environmental Management,*
   Prince of Songkla University, Thailand

SESSION III-B

Venue: Dhuku   Time: 14:30-16:30

Theme: Banking Sector Development and Disaster Risk
Session Chair: Prof. Dr. Dhruba Kumar Gautam

The Impact of Bank-Specific Factors on the Banking Sector Development in Nepal
➢ *Mr. Krishna Prasad Gwachha, PhD scholar, Tribhuwan University*

Financing Disaster Risks in Nepal: Theory to Practice
➢ *Mr. Dhanej Thapa, Director at Consortium for Land Research and Policy Dialogue (COLARP)*
➢ *Ms. Sony Adhikari, Nepal Rastra Bank*

Efficiency Measurement of Nepalese Commercial Banks Using CAMEL Rating

> *Mr. Janardhan Subedi, Pokhara University*

Effect of Merger and Acquisition on Employee's Satisfaction in Nepalese Banking Sectors

> *Mr. Saramsh Kharel, Quest International College, Gwarko*
> *Ms. Eliza Shrestha, Quest International College, Gwarko*

16:30-16:45	**Tea Break**

17:00-18:00   **Closing Ceremony**

Presentation of Certificates
Mr. Maha Prasad Adhikari
Governor, Nepal Rastra Bank

Remarks
Representative of Participants

Summary of Conference
Dr. Prakash Kumar Shrestha
Executive Director and Member
Conference Organizing Committee
Nepal Rastra Bank

Vote of Thanks
Mr. Laxmi Prasad Prasai
Director and Member Secretary
Conference Organizing Committee
Nepal Rastra Bank

Closing Remarks
Mr. Bam Bahadur Mishra
Deputy Governor, Nepal Rastra Bank

18:00-20:00   **Dinner**

Contact Persons and Address

Mr. Laxmi Prasad Prasai
Director, Economic Research Department

Mr. Janak Raj Sapkota
Deputy Director, Economic Research Department

Mr. Bidhyaman Mahatara
Assistant Director, Economic Research Department

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Nepal Rastra Bank
Central Office
Baluwatar, Kathmandu
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Inaugural Session

Nepal Rastra Bank organized the National Conference on Economics and Finance on April 8, 2022, in Kathmandu. The conference underlined Nepal Rastra Bank's support to provide a platform for policymakers, practitioners, and researchers to discuss contemporary economic and financial sector issues in Nepal.

Honorable Minister of Finance Mr. Janardan Sharma inaugurated the conference. In his opening remark, Honorable Minister Mr. Sharma emphasized the need for financial and external sector stability for overall economic stability in the current context. He also stressed that growing pressure on the foreign exchange reserve of the country is due to the high import of petroleum products, vehicles, and luxurious goods.

Mr. Sharma reflected on the necessity of promoting the consumption and exports of domestically produced goods and services to ameliorate the external sector. Furthermore, reiterated the importance of creating a conducive environment for creating job opportunities and accelerating the economic growth of the country.

In the conference's keynote speech titled "Challenges to External Sector Stability," Governor Mr. Maha Prasad Adhikari outlined the current situation, challenges of the external sector, and policy measures adopted for external sector stability. Governor underscored how the expansion of credit, the surge in imports, and the decline in tourism income have exerted pressure on the external sector.

Similarly, Governor Mr. Adhikari highlighted that the proceedings and discussion at the conference will aid policymakers in future deliberation on sustainable growth and a resilient financial system. He stressed on the necessity of the policies for optimal utilization of available resources in enhancing the productive capacity and creating employment opportunities.

He emphasized how Nepal Rastra Bank in coordination with the Government of Nepal, has adopted the policies such as raising bank rates, curtailing gold imports, incentives on foreign currency deposits, mobilization of foreign aid, and other provisions to address the challenges of the external sector. Moreover, he also noted that the coordinated efforts of all the stakeholders in increasing domestic production, export promotion, channeling remittances through formal sources, and creating a conducive environment for foreign investment are crucial for addressing the challenges associated with the external sector.

Deputy Governor Dr. Neelam Dhungana Timsina delivered the welcome speech during the inaugural session of the conference. Welcoming all distinguished guests and participants to the conference, Dr. Timsina highlighted that the conference will help policymakers and researchers to address national issues on economic and financial system and to enhance research skills and knowledge. Furthermore, Dr. Timsina emphasized increased liquidity pressure as an outcome of high trade deficits, and decreased inflows of remittances which have also posed challenges to the economy as a whole.

During the session, Dr. Kalpana Khanal, Senior Research Fellow at Policy Research Institute, presented "COVID-19, Nepalese Economy, and Policy Response" highlighting the current macroeconomic indicators and direction of the economy. Dr. Khanal outlined the impact of COVID-19 on major macroeconomic indicators such as economic growth, inflation (CPI), trade, the balance of payments, and the credit and deposit status of BFIs.

Moreover, Dr. Khanal summarized the government's key economic responses to limit the socio-economic impact of the COVID-19. She further stressed on the need of the gradual unwinding of accommodative monetary and regulatory policies for external and financial sector stability, increasing the capital expenditure on high return projects, export promotion of domestic goods, and developing the tourism sector. Full Paper presented by Dr. Khanal is presented below.

Socio-Economic Impact of the COVID-19 Pandemic and Policy Response for Recovery

Kalpana Khanal[*1]; **Rajendra Khanal**[2]; **Sharmila Tandukar**[3]; **Ashok Pandey**[4] **and Sabin Basi**[5]

I. BACKGROUND

Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2),a member of the Coronavirus family, emerged from Wuhan, China, was identified as the causative agent for the coronavirus disease (COVID-19) by World Health Organization (WHO)after genome sequencing (Zou et al., 2020; Li et al., 2020). Due to its rapid transmission, on March 11, WHO declared the outbreak a global pandemic (WHO, 2020). There are more than 5 million people in 222 countries affected and about 5,393,668deaths due to COVID-19 (Worldometer, 2021 December 23). COVID-19 was declared a public health emergency of international concern by the World Health Organization in February 2020.

Nepal is a landlocked country between China in the north and India in the east, west, and south. With India, Nepal shares a1, 800km open border, which is considered one of the highest risk factors for the pandemic. In Nepal, the first case of COVID -19 was recorded on January 13, 2020, by a person returning from China (Bastola et al., 2020). Gradually, more cases appeared, and most of them were imported cases that could be linked to improper border management (HEDMU, 2020). By the end of April 2020, the Nepal government categorized districts based on vulnerability (UNICEF, 2020). After receiving a huge number of test kits and RT-PCR reagents from foreign countries, the government of Nepal strategized the expansion of SARS-CoV-2 diagnosis from only affected areas to all the 77 districts of the country. With this modification in the diagnostic approach, the number of infected cases identified increased significantly. Despite the arrival of diagnostic materials, it is still insufficient since there is no manufacturing company available in the country, while testing is carried out irregularly and usually only in symptomatic cases or in contacts of symptomatic cases. Consequently, community surveillance has not been possible yet; however, a few types of research have been recently carried out in support of international funds which might not be sufficient.

In addition to originating a public health crisis, the COVID-19 pandemic has caused economic turmoil across the globe and has also adversely impacted the global supply and production chain (World Bank, 2020). For the first time in a generation, the pandemic has reversed gains in global poverty reduction and has also deepened the challenges of food insecurity and rising food prices for millions of people (World Bank, 2021). Right now, the world is experiencing a highly uneven recovery because the growth is concentrated in a few major economies. While most emerging markets and developing economies (EMDE) are lagging.

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[1, 2 ,3, 4and 5] *Affiliation: Policy Research Institute*

Despite all the difficulties, policymakers can use the post-pandemic recovery process to direct the country's policies onto a path of green, resilient, and inclusive development. Efforts should also be directed towards lowering trade costs so that trade can also become a robust engine of growth.

II. DATA AND METHODOLOGY

The paper offers analytical perspective on the macroeconomic impact of the COVID-19 pandemic on the Nepali economy. The analysis relies on the secondary macro-level data published by the Central Bureau of Statistics (CBS) and Nepal Rastra Bank (NRB). Some indicators and based on data from the fiscal year 2015/2016 up to the first seven months of 2021. The comparison shows how the Nepali economy was doing before the pandemic and how the Nepalese economy performed after the imposition of lockdown measures on March 24, 2020. Depending on the indicator either monthly or annual data is used.

Publications from the government sector of Nepal, journal articles, and bilateral and multilateral agencies are referred to draw comparative perspectives and for policy recommendations.

III. SOCIO-ECONOMIC IMPACT OF COVID-19

Globally, before the vaccination drive started, stringent preventive measures were adopted, since those were associated with short-term output loss as explained elsewhere (Maloney and Taskin, 2020; Hasell, 2020). Some of these containment measures included (i) school closures; (ii) workplace closures; (iii) cancellation of public events; (iv) restrictions on the size of gatherings; (v) closures of public transport; (vi) stay-at-home orders; (vii) restrictions on internal movement; and (viii) restrictions on international travel, among others. Similarly, the Nepal government also implemented a community awareness program including social distancing, frequent hand washing, and community containment followed by lockdown or emergency. But due to subsequent lockdown and delayed rolling out of vaccination, many EMDEs including Nepal, was severely affected.

The countries with better health systems in terms of epidemic management and prevention are expected to suffer smaller economic losses (Deb et al. 2020b). In contrast, the COVID-19 pandemic has taken a toll on Nepal's economy and has severely impacted people's health and livelihoods. Nepal's economy has also been going through a crisis and the recovery process has been constrained by elevated COVID-19 caseloads and obstacles to vaccination. In response to economic rescue, in the fiscal year 2021-22, the caretaker government of Nepal prioritized the health sector of the Nation, allocating over NPR (Nepalese Rupees) 122 billion, out of which 26.75 billion was set aside for the procurement of COVID-19 vaccines (Rayamajhi and Fehr, 23 July 2021). The finance minister further fledged NPR 37.57 billion to the curb pandemic, where, NPR 5.60 billion was allocated to purchase medicine and equipment (Asian News International, 29 May 2021).Amidst the current global health emergency, several countries and international institutions also helped Nepal (Appendix I). The following sections delve more into detail regarding the impact of theCOVID-19 pandemic on some of the Nepal macro-economic indicators.

3.1   GDP

GDP contracted in 2019/20 and it is expected to grow slightly in 2020/21 but at a slower rate (Table I). If we look at sector-wise GDP (see figure I), we can see that the agriculture sector was able to absorb the external shock related to the pandemic as compared to the industrial and service sectors because the growth rate of the agriculture sector in the middle of the pandemic was 2.4 % while the growth rate of the non-agriculture sector was negative.

Table 1: Impact on Real GDP

Real Sector (growth rate and ratio in percent)	Years				
	2016/17	2017/18	2018/19	2019/20	2020/21*
Real GDP a at basic price	8.6	7.4	6.4	-2.1	4.0
Real GDP at producers' price	9.0	7.6	6.7	-2.1	4.0
Nominal GDP at producer's price	18	12.3	11.7	1.4	9

* Preliminary estimation

Source: NRB 2021 Current Macroeconomic and Financial Situation of Nepal

Figure 1: **Growth rate of agriculture, Non-agriculture, and Gross Domestic Product (GDP)**
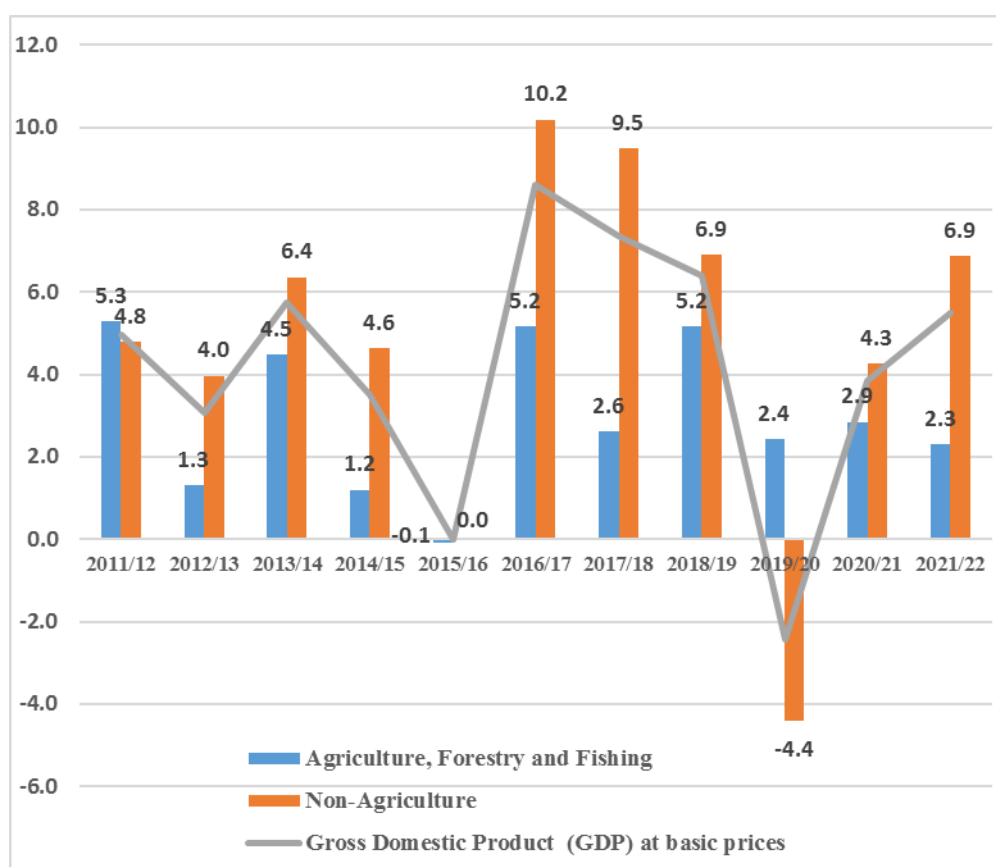
Source: Central Bureau of Statistics, 2022

The status of other major macroeconomic indicators such as price changes and external sector growth are presented in figure II and figure III below.

Recently published data on macroeconomic indicators (based on seven months' data ending mid-Feb, 2021/22) of 2021 by NRB reveals that year over year inflation is on the rise. The y-o-y consumer price inflation stood at 5.97 percent in the first seven month of 2021/22 compared to 4.19 percent a year ago. Food and beverage inflation stood at 6.00 percent whereas non-food and service inflation stood at 5.96 percent in the reviewed month. The rise in food prices is quite alarming and it is indicative of the fact that in the post-COVID scenario our policies should be geared toward increasing productivity in agriculture sector, thereby promoting import substitution in agriculture.

*Figure 2***: Price Change in percentage between 2016 and the first Seven Months of 2021**
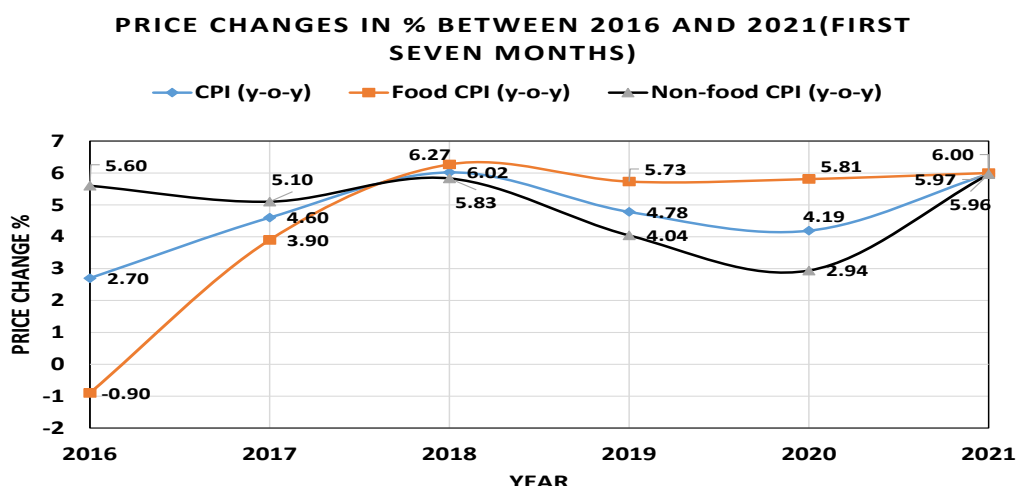
PRICE CHANGES IN % BETWEEN 2016 AND 2021(FIRST SEVEN MONTHS)

Source: NRB2021b, Current Macroeconomic and Financial Situation-Tables (based on seven months' data ending mid-Feb, 2021/22)

3.2 Export/ Import

During the pandemic period, export growth plummeted to 0.6% (2019/20) and 44.4% (2020/21) as compared to 19.4% (2018/19). And import declined to -15.6% in 2019/20 and increased to 28.7% in 2020/21 as compared to 13.9% (2018/19). Export was 88.3.3% during the first seven months of 2021 import grew by 41.86%. During 2020/21, current account was actually in a surplus. It is important to note here that the lockdown imposed by the pandemic made people rely more on local production. However, the current account deficit has skyrocketed to Rs. -413.9 billion during the first seven months of 2021. During the pandemic period, in 2019/20, the overall trade balance was Rs. -1099.1 billion that is estimated to be Rs. -1398.7 billion in 2020/21 and, increased to Rs. -1015.8 billion in first seven months in 2021/22. During the pandemic period, the foreign exchange reserve increased to Rs. 1401.8 billion in 2019/20, and that is estimated to be Rs. 1399 billion in 2020/21, however, has declined to Rs. 1173 billion in the first seven months of 2021(figure III). The state of current accounts is indicative of the fact that Nepal needs to focus on export promotion and import substitution type policies.

*Figure 3***: External Sector Growth between 2016/20and 17-2021/22.**

Source: NRB2021b, Current Macroeconomic and Financial Situation-Tables (Based on Seven Months data of 2021/22)

3.3 Tourism and Remittance

The adverse effect on GDP (see table I and figure I) can be attributed to the major decline in service sector employment, decline in tourist arrival, and the impact it has on the hospitality industry. The tourist inflow in Nepal for the year 2020 (Jan-Dec) was reduced by 80.8% compared to 2019.The total number of tourists who visited Nepal was 1,197,191, and 230,085 and 149,833 respectively in the years 2019, 2020, and 2021 (see Table II below). The reduction in the number of tourists from April 2020 to December 2021 was more than 95% compared to the same months in the previous year. The net change in foreign assets for the year 2020 was Rs. 282,410 million whereas for 2021 it was Rs 1,227 million. (Table IV). The net foreign assets were Rs. 984,783 million for 2019; 1,328,349 for 2020; and 1,335,620 for 2021 respectively. The decline in foreign currency reserves because of the decline of remittance flow and the decline in foreign currency reserves due to the decline in the number of tourists hints toward the need for diversification of sources of foreign reserves.

Table 2: Number of Tourist Arrival by Month

Month	2019	2020	2021
Jan	81273	79702	8874
Feb	102,423	98,190	9146
Mar	127,351	42,776	14977
Apr	109,399	14	22450
May	78,329	31	1468
Jun	74,883	102	1143
July	70,916	196	2991
Aug	94,749	267	5917
Sep	92,604	584	9898
Oct	134,096	2,025	23284
Nov	130,302	1,953	26135
Dec	100,866	4,245	23550
Total	1,197,191	230,085	149833

Source: NRB, 2021b, Current Macroeconomic and Financial Situation Tables Based on Annual Data of 2020.21-3. STATISTICAL TABLES, 2020/21, Nepal Rastra Bank

Impact on Remittance Flows

The outflow of migrant workers from Nepal reduced by 28% and 55%, respectively for 2019/20, and 2020/21 as compared to 2018/19 (Table III). Despite the decrease in the outflow of migrant workers, the net remittance received for the year FY 2019/20 declined just by 0.5%. The reasons could be twofold first probably because income-sensitive migrant workers send remittances to their care ones for the family management at the particular time of the pandemic. Secondly, maybe because of the pandemic the money that would otherwise be sent to Nepal through informal channels previously such as *Hundi* was sent through formal banking channels. Although in 2020/21, the increase in remittance inflow was initially estimated to increase by close to 12% (961.1Rs. in billion), the actual value reached Rs. 337.8 billion only, which is a decline of 38.6% compared to that of 2019/20. The remittance flow,

however, may not significantly increase during FY 2021/22, due to fewer migrant worker outflow from Nepal (see table III and figure III for details).

Table 3: Migrant workers outflow from Nepal

Categories	2018/19	2019/20	2020/21	2021/22 (7 months)
Migrant workers *	516486	371925	166699	
% change concerning last year		-28.0%	-55.2%	
Remittance Flows (Rs. in Billion)	879.4	875.0	961	540.1

* New, legalized, and renewal

Figure 3: Monthly Remittance Flow (Rs. in Billion) between March 2020 to February 2022.
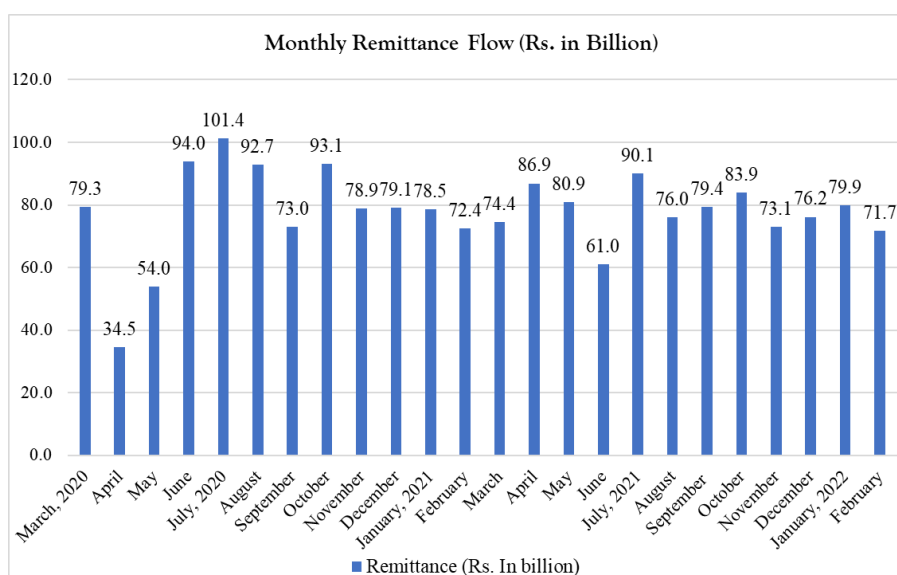
Source: NRB, 2021b, Current-Macroeconomic-and-Financial-Situation Tables based on Annual Data of2020.21-3, Statistical Tables, 2020/21, Nepal Rastra Bank

Table 4: Status of Foreign Currency Reserve 2016/17-2021/22 (First 7 months)

Years	Annual					Based on 7 months
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22
Gross Foreign Exchange Reserves (Rs. in Billion)	1079.40	1102.60	1038.90	1401.84	1462.03	1173.02
Gross Foreign Exchange Reserves (USD in Billion)	10.49	10.08	9.50	11.65	12.57	9.75

Source: NRB2021b, 2022

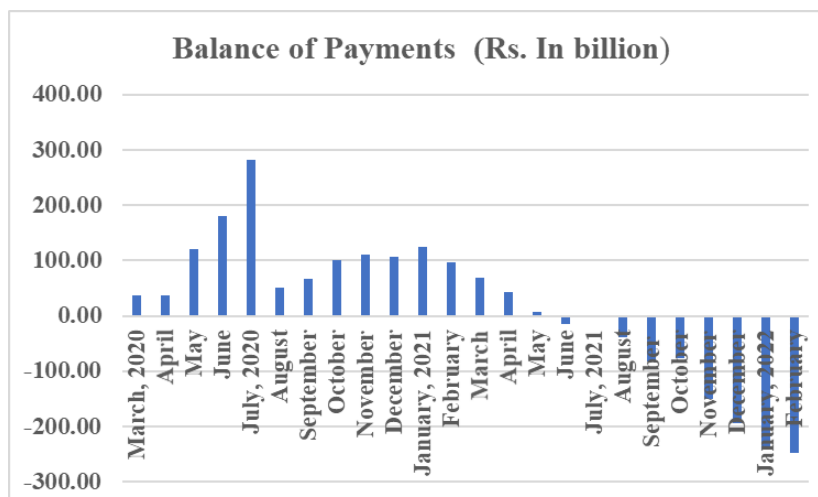**Figure 4: Balance of Payment Situation. Source: NRB2021b, 2022**

Source: NRB, 2021b, Current-Macroeconomic-and-Financial-Situation Tables based on Annual Data of2020.21-3, Statistical Tables, 2021/22, Nepal Rastra Bank

Imports declined slightly during pandemic period but has been constantly soaring after the second wave of the pandemic because of that Nepal's external sector is weakening as seen in figure IV.A decline in the number of tourists, the amount of remittance flow, and an increase in imports are depleting the foreign exchange reserves because of which the external sector position is in huge deficit after the third wave of the pandemic (see figure IV). The foreign currency reserve can currently support the import of merchandise and service for 6.7 months, this is quite alarming since the number of months has been constantly declining since August 2020 as seen in figure V.

Figure 5: Import Capacity in Months
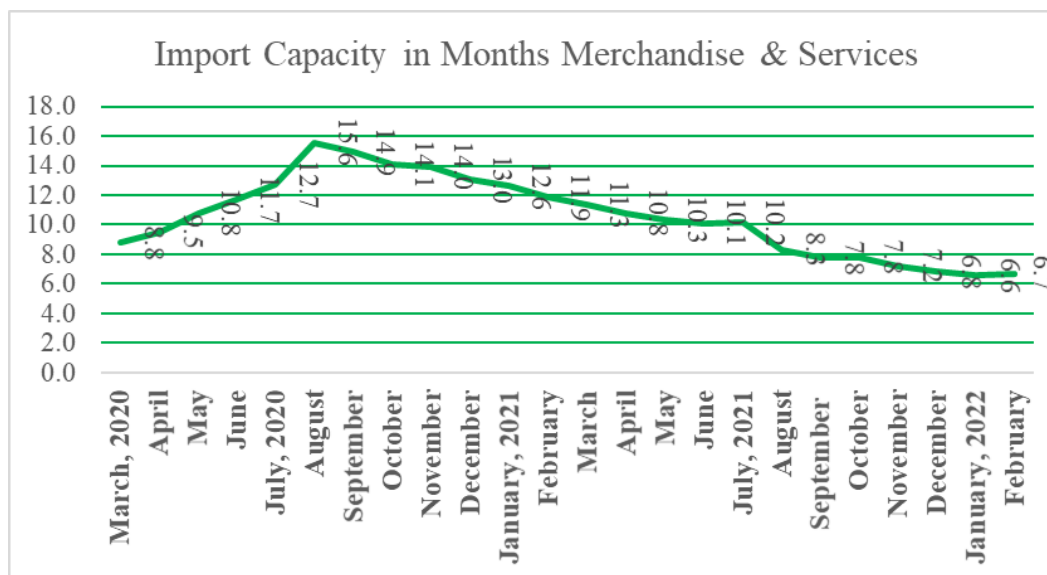
Source: NRB 2022.

3.4 Stock market

As of current information, NEPSE has not been affected by COVID-19 in Nepal. The NEPSE just before lockdown on Mar 22, 2020, in Nepal was 1,251.45, and after the opening of the lockdown for a couple of days on May 12, 2020, was 1,226.15, which reached a minimum of 1,188.70 on Jun 29, 2020, when NEPSE was finally opened (Table V). Since then, NEPSE

has attained an all-time high value of 3,198.60 on Aug 18, 2021. Overall, NEPSE just suffered a COVID-19 shock for the transaction of 4-5 days and regained an all-time high value. It is consistent with the earthquake shock of 2015 (when NEPSE retained its pre-earthquake value in a matter of 3 days), or other past experiences of natural disasters in the global stock market (Malkiel, 2003; Karki, 2020; Hamal and Gautam, 2021).

Table 5: Key Timelines of the NEPSE Index

Date	NEPSE index	Remarks
Dec 1, 2019	1,112.85	
Jan 1, 2020	1,169.50	Global eye on China
Jan 22, 2020	1,346.64	Nepal first detected covid-19
Jan 30, 2020	1,325.38	World health organization declares covid-19 as the virus of concern
Feb 3, 2020	1,349.13	
Mar 2, 2020	1,495.30	
Mar 11, 2020	1,423.09	WHO declared pandemic
Mar 22, 2020	1,251.45	NEPSE closing before lockdown on Mar 24, 2020
May 12, 2020	1,226.15	
Jun 29, 2020	1,188.70	The lowest, market opens
Jul 30, 2020	1,439.06	
Aug 31, 2020	1,484.99	
Sep 30, 2020	1,550.43	
Oct 29, 2020	1,645.67	
Nov 30, 2020	1,997.05	
Dec 31, 2020	2,087.27	
Apr 8, 2021	2,674.35	
Jun 30, 2021	2,823.87	
Aug 18, 2021	3,198.60	All-time high
Nov 30, 2021	2,628.37	
Dec 29, 2021	2,524.50	
Jan 31, 2022	2,872.05	
Feb 28, 2022	2,610.58	
March 30, 2022	2,544.31	

Source: NEPSE historical data, available at https://www.sharesansar.com/index-history-data accessed April 5 1, 2022)

The rising index in table V refers to the bullish trend, that is a sustained rise in share prices, in the financial market. The bullish trend brings optimism to new investors and they naturally tend to put more money in the financial market. Hence data reveals that people applying for Initial Public Offering (IPO) have an annual growth rate of 157%, rising from 0.7 million to 1.8 million. During the past 11months of the fiscal year 2020/2021, the share market turnover increased from Rs. 135 billion to Rs. 1.2 trillion (Baidar, 2021). Meanwhile, the NEPSE index stood at 2784.6 in mid-November 2021 compared to 1718.5 in mid-November 2020. And stock market capitalization in mid-November 2021 stood at Rs.3916.45 billion compared to Rs.2302.76 billion in mid-November 2020.

There are twofold reasons why the pandemic situation might have played a role in the growth of Nepal's stock market. First, because of the lockdown, there were limited investment options for the investors. Second, the pandemic also encouraged rapid adoption of digitization of various sectors in the economy including the adoption of online trading.

IV.   POLICY RESPONSE

The government utilized both monetary and fiscal policy to combat the adverse effects due to the pandemic.

4.1   Monetary Policies to Combat the Impact of COVID-19

Monetary policy measures introduced to address the impact on the economy focused on a. easing liquidity, b. reducing interest rates, and c. extending the moratorium period on loans. The monetary operations carried out by NRB in FY 2019/20 and FY 2020/21 are summarized in Table VI. Liquidity increased by 100% compared to the previous year, first to counter the balance of COVID-19 to release the funds in the market. At the same time, liquidity absorption was increased by 288.8% compared to the previous year, probably due to a lack of investment opportunities. In general, the net yearly liquidity injection compared to the previous year during 2020/21 was reduced by 4.4% compared to reduction of 36.5% in the year 2019/20.

Lately, news on liquidity crisis has dominated the frontier news media[1][2]. However, the concern regarding liquidity crisis is likely coming from the private sector because, BFIs have not been able to issue even the committed loans; which could pose a threat to businesses and investors. The reduced share of institutional deposits in the total deposit of BFIs stood at 39.79 percent in mid-November 2021 as compared to 42.66 percent in mid-November 2020, which might also be its result (NRB 2021).

The decline in liquidity can also be attributed to trade deficits (imports outweigh exports) because due to declining exports gross foreign exchange reserves decreased 11.0 percent to Rs.1244.85 billion in mid-November 2021 from Rs.1399.03 billion in mid-July 2021. The current amount of reserves is sufficient to cover the prospective merchandise imports of 7.9 months, and merchandise and services imports of 7.2 months as compared to 10.2 months in mid-July. Private-sector experts and stakeholders such as businessmen and bankers have suggested coming up with short-term, mid-term, and long-term solutions to solve the liquidity crisis in Nepal.

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[1]   https://kathmandupost.com/columns/2021/11/08/liquidity-crunch-and-low-capital-expenditure

[2]   https://english.onlinekhabar.com/liquidity-crunch-where-money.html#:~:text=Nepal%20Rastra%20Bank%20governor%20Maha,pandemic%20for%20the%20liquidity%20crunch.&text=It%20means%20the%20liquidity%20crunch,233%20billion%20in%202020%2D21.

Table 6: Summary of Monetary Operation (NRB, 2021b)

Details	(Rs. in Million)			% change concerning last year	
	2018/19	2019/20	2020/21	2019/20	2020/21
A. Liquidity Injection	**322,488.97**	**219,155.00**	**438,277.10**	**-32.0%**	**100.0%**
Repo	162,460.00	108,550.00	50,000.00	-33.2%	-53.9%
Repo Auction *	5,700.00	7,322.00	17,937.10	28.5%	145.0%
Standing Liquidity Facility	154,328.97	103,283.00	370,340.00	-33.1%	258.6%
B. Liquidity Absorption	**100,350.00**	**78,000.00**	**303,290.00**	**-22.3%**	**288.8%**
verse Repo	20,700.00	48,000.00	109,540.00	131.9%	128.2%
Deposit Collection Auction	79,650.00	30,000.00	193,750.00	-62.3%	545.8%
C. Net Liquidity Injection (+) / Absorption (-)	**222,138.97**	**41,155.00**	**134,987.10**	**-36.5%**	**-4.4%**

* Transaction under Interest Rate Corridor Source: NRB, 2021b, Current-Macroeconomic-and-Financial-Situation.-Tables.-Based-on-Annual-data-of-2020.21-3. STATISTICAL TABLES, 2020/21, Nepal Rastra Bank

The sectoral and major monetary policy interventions taken by Nepal Rastra Bank (NRB) to revive the Nepalese economy and reduce the burden of social and health implications based on FY 2019/20 AD (2076/77 BS) last quarter (Apr – June 2020 = Baishak – Ashar 2077) and FY 2020/21 AD (2077/78 BS) can be summarized as follows (NRB, 2020)

- Rs50 billion funds for economic assistance – the fund was allocated for the ones most affected by COVID, mainly for small and medium enterprises (SMEs and tourism and was allocated to provide basic salary to the employees. In addition, this fund was also allocated to provide loans to the SMEs, and individuals at a 5% interest rate

- Liquidity management:
  o Reduction of Cash Reserve Ratio (CRR) from 4% to 3%, and bank interest rate from 6% to 5%
  o Reduction of RIPO rate from 4.5% to 3.5%
  o Lowering of the interest rate by 2% for banking and financial institutes, and retail, wholesale, and microfinance financial institutions from 3% to 2%
  o Reduction of minimum cash balance in the bank from 4% to 3%
  o Abolishment of countercyclical capital buffer
  o Reduction of operation risk, market risk and overall risk from 5%, 3% and 5% to 3%, 1% and 3%, respectively
  o Temporary easing of investment on private equity, debt-equity conversion, and special purpose vehicle from the capital

- Easing of operation loan, an extension of the deadline for a loan or interest reimbursement, loan restructuring, and liquidity management
  o Rebate of 2% interest from the loan
  o Provision to provide an additional 20% working capital loan based on the balance of the capital loan
  o Extension of the deadline on submission of tax, interest, and the loan

The major impact of the monetary policy of 2020/21 has been reviewed in the following year 2021/22, and its impact on the overall monetary management, sectoral credit on agriculture

and energy; micro, cottage, small, and medium enterprise credit, and deprived sector lending can be summarized as follows (NRB, 2021a)

- Increase in broad money, on a y-o-y basis, by 21.8% in 2020/21 compared to the projection of 18%

- The claims of the monetary sector on the private sector grew by 26.3% in 2020/21 compared to the projection of 20.0%

- Rs. 438.28 billion liquidity was injected into the market

- Rs. 303.29 billion liquidity was mopped up

- Purchase of Rs. 425.94 billion worth of reserved USD from the commercial banks

- The weighted average interest rate of 91-days Treasury bills stood 4.55%

- The weighted average deposit and lending rate of commercial banks stood 4.65% and 8.43%, respectively.

4.2   Impact of 2020/21 Monetary Policy on Sectoral Credit (NRB, 2021a)

Agriculture and energy: The council of ministers decided to provide a 25% subsidy on transportation of agricultural products amid the COVID crisis in April 2020 (Kafle, 2020). Likewise, as of mid-July 2021, commercial banks have extended Rs. 425.83 billion loans (13.2% of their total credit), and Rs. 194.13 billion loans (6% of their total credit) in the energy sector.

Micro, cottage, small and medium enterprise credit: Commercial banks have to extend loans (not exceeding Rs. 10 million for an individual) in micro, cottage, small and medium enterprises sector of at least 11% of the total loan portfolio by mid-July 2021, 12 % by mid-July 2022, 14% by mid-July 2023, and 15% by mid-July 2024. Commercial banks have extended Rs. 327.80 billion (10.1% of their total credit) loan in this sector as of mid-July 2021.

Deprived sector lending: Total credit by the commercial banks, development banks, and finance companies to the deprived sector stood at 7% of total credit in mid-July 2021 compared to the minimum regulatory requirement of 5%.

Concessional loans: A total of Rs. 161.44 billion credit has been extended to 104,109 borrowers as of mid-July 2021. Of which, Rs. 106.98 billion has been extended to 46,057 borrowers for selected agriculture and livestock businesses. Likewise, Rs. 50.98 billion concessional loan has been extended to 55,551 women entrepreneurs and Rs. 3.48 billion has been extended to 2,501 borrowers from other remaining sectors.

4.3   Impact of 2020/21 monetary policy on COVID-19 Targeted Credit (NRB, 2021a)

Refinance: Rs. 148.75 billion has been approved to 48,890 borrowers.

Working capital loan: Providing additional working capital loans up to 20% of the existing outstanding working capital loans to the existing borrowers to facilitate the continuation of business and industries severely affected by the COVID-19, a total of Rs. 14.24 billion has been provided to 16,182 borrowers. In addition, under the provision of providing additional loans up to 10% to the borrowers who have taken only term loans against the same collateral, a total of Rs. 9.36 billion has been extended to 7,269 borrowers.

Extension of grace period of loans: The grace period has been provided to the loan amounting to Rs. 52 billion of which 6 month grace period to borrowers from relatively less

affected sectors, 9 months to borrowers from moderately affected sectors, and 1 year to the borrowers from hard-hit sectors of covid-19.

Extension of loan repayment time: The repayment schedule has been extended to the loans of Rs. 93.63 billion from 6 months, 9 months, and a year or two to the less, moderately, and severely covid-19 affected borrowers, respectively.

Loan restructuring and rescheduling: A total loan of Rs.129.21 billion to the sectors affected by COVID-19 have been restructured and rescheduled

Business continuity loan: The businesses related to tourism, and small and medium-scale enterprises affected by COVID-19 for their operation and the payment of wages, a total loan of Rs. 956.7 million have been approved, resulting in the outstanding amount of Rs. 736.8 million as of mid-July 2021.

V. WAY FORWARD

5.1   Global Context

The impact of the COVID-19 pandemic worldwide has been threefold with the convergence of health, economic and social crises. A profound question has been posted in front of policymakers and international agencies working in the field of development regarding the future direction for post-pandemic recovery. The leadership of the International Monetary fund (IMF) and the World Bank have recognized that "divergent recovery" should be avoided as a strategy for pandemic recovery, instead "build forward better" should be the guiding principle (Gopinath 2021, IMF 2021a).[3] Furthermore, World Bank Chief Economist Carman Reinhart, who mostly supported austerity measures in the past, is now advocating that developing countries should "first fight the war, then figure out how to pay for it" (FT, 2020). Economists like Martin Sandbu commented that a new Washington Consensus might have been born.[4] While the original Washington consensus relied on austerity measures the new Consensus deviates from it. According to Sandbu (2021) "fiscal probity…is no longer about reining in public spending but about getting value for money—and spending more where the value can be found".

Many developed countries in the global North have been dealing with the pandemic by increasing government spending following the policy prescription put forward by the economist John Maynard Keynes (Goodman 2020). Nevertheless, it is important to note that the pandemic has exposed health inequalities within and between the countries in the Global North and South. While the developed countries already have some amount of safety nets and are also able to provide counter-cyclical fiscal policies, the developing countries are less likely and capable to provide adequate counter-cyclical fiscal policies (Ghosh 2020b).

Equally, COVID 19 has created great imparity among the economies and societies (Oxfam, 2022). Nations pumping trillions of dollars into financial markets to save the economy have ended up in the few hands of billionaires through bio-medical, pharmaceuticals etc. The world's ten richest men more than doubled their fortunes from $700 billion to $1.5 trillion during the first two years of a pandemic that has over 160 million people forced into poverty. Likewise, the pandemic has set gender parity back from 99 years to now 135 years. Women collectively lost $800 billion in earnings in 2020, with 13 million fewer women in work now than there were in 2019. An increase in racial parity was also observed during this pandemic. In England, people of Bangladeshi origin were five times more likely to die of

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[3]   Divergent recovery is the type of recovery where some countries move ahead in terms of economic growth and others are left behind.

[4]   Martin Sandbu is a close observer of global governance at the Financial Times.

COVID-19 than the White British population. Black people in Brazil are 1.5 times more likely to die from COVID-19 than White people. Increasing gaps were observed also among the countries in terms of vaccine supply from the developed countries.

Under the current context, most economists are on the same page regarding spending more now for a robust economic recovery. However, Kentikelenis and Stubbs (2021) warn that in the long run completely abandoning austerity measures may not be feasible. They argue that as emergency assistance packages received by countries exhaust, these countries will have to resort to regular IMF loans which come with stringent policy conditionalities such as austerity measures and structural reforms such as privatization (Babb and Kentikelenis 2021; Ortiz and Cummins 2021). [5]   In this context as Organization for Economic Co-operation and Development (OECD), chief economist Laurence Boone advocated that emergency assistance should be replaced with greater investment because he said: "it would be dangerous to believe that governments are already doing enough to propel growth to a higher and better path" (Financial Times 2021).In order to curb the imparities among economies and societies, Oxfam (2022), recommends a. taxing huge new wealth makers, b. utilize those revenues in universal healthcare and social protection, c. strengthen workers' rights and protection, d. release Intellectual Property Rights of vaccine production among others.

5.2   National Context

Many low-income countries including Nepal are struggling to fill the financing gap to combat COVID-19 health and economic crises as well as external debt service. Studies show that because of debt services countries don't have enough social spending to protect the lives and livelihoods of populations during the pandemic (Jones 2020; UNICEF 2021). World Bank (2021b) estimates that external debt services might exceed average government health spending for 2020. Low-income countries spend 1.1 percent of GDP on health and 1.7 percent of GDP on debt servicing. G20 nations have established the Debt Service Suspension Initiative to temporarily suspend debt service repayment owed to bilateral creditors for 73 countries among low and poorer middle-income countries. The initiative is extended up to December 2021 (World bank 2021b). IMF has scaled up its operations and has extended grants to 29 low-income countries, totaling $0.73billion, although this can only be used for debt relief owed to the IMF.

Recently IMF and Nepal reached an agreement on the three-year US $400 million financing package under the Extended Credit Facility (ECF). Based on the agreement Nepal needs to fulfill some IMF conditionalities. The IMF-supported program has three main objectives (IMF 2021, December 6):

- To mitigate the COVID-19 impacts on health and economic activity, and protect vulnerable groups by increasing the budget for health, social protection, and job support.

- Maintain macroeconomic and financial stability by stabilizing prices and helping control inflation, maintaining adequate foreign reserves, and strengthening financial sector regulation and supervision.

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[5]   In the past crises when countries in the Global South looked up to IMF and World Bank for assistance, austerity backed up by conditional loans, has been the default policy response (Babb and Kentikelenis 2021). However, austery measures have been very contentious. While economists such as Alesina and Ardagna (2010) believe that austerity can lead to economic expansion; critics such as Ban (2016) see the logic of austerity as self-defeating and argue that austerity measures deepen pre-existing problems and undermine economic activities. Nevertheless, policy consensus among policymakers in the Global North has been that, in order to get access to international financial assistance austerity should be a prerequisite in order to prevent "moral hazard".

- Support a reform agenda that leads to sustained growth and poverty reduction over the medium term.

VI. CONCLUSION AND RECOMMENDATIONS FOR SOCIO-ECONOMIC RECOVERY

The pandemic has shown that fiscal spending on public health and social protection schemes is important for coping with pandemics (Ghosh, 2020a). For the post-pandemic recovery, fiscal policy must also be made effective in addition to monetary policy.

6.1   Fiscal Policy recommendations

- One of the main national policy goals should be to maximize capital expenditure; the major reason is that the government sector (both federal and provincial) hasn't been able to meet the targeted capital expenditure. A detailed study needs to be conducted regarding how this could be improved.
- To achieve equitable and sustainable growth as a part of post-pandemic relief government should emphasize increasing its spending on productive sectors to increase jobs and hence enhance effective demand, thereby creating a multiplier effect. For that reason, some productive projects and sectors need to be identified in the upcoming budget allocation.
- Trade deficit is another challenge facing Nepal right now. Therefore, the government should also emphasize import substitution policies, that might also include bilateral discussions on trade arrangements with the nations e.g. India.
- To avoid austerity measures, Nepal should utilize the grant received through International financial institutions such as IMF and the World Bank and should negotiate with these institutions for additional grant support without stringent conditionality in the future in order to bridge financing gaps.

6.2   Monetary Policy Recommendations

- Currently banking sector in Nepal is facing a liquidity crisis, one way to improve the situation could be to promote foreign direct investment (FDI). Reduce remittance inflow through an informal channel such as *Hundi.* One way this could be done is by making it mandatory for migrants, who received labor certification before leaving the country, to remit money through bank deposits.
- The monetary provisions loosened to stabilize the economy after COVID-19 pandemic (such as reduced interest rate on credit) should be tightened so as to improve the quality of issued credit.
- Nepal Rastra Bank could let the market determine the interest rates.
- Government sector should take initiative in getting a "sovereign credit rating" so that banking financial institutions can borrow money from foreign lenders when there is a credit crunch at home.

6.3   Policy recommendations for public health

In the aftermath of the pandemic, health systems have been receiving a lot of attention from global policymakers. UN Secretary-general AntónioGuterres (UNSG, 2020) used the catchphrase "we are only as strong as the weakest health system" to point out the importance of policies. Among others, the World Health Organization (2010) identifies service delivery, health workforce, access to medicines, etc. as building blocks of health systems. Here are some of the health sector-related policy recommendations:

- Ongoing vaccination campaign against COVID-19 as the national immunization plan remains key to Nepal's economic recovery so, strengthening the health care workforce, wisely utilizing existing health manpower, investing in and expanding the scope of health research, and establishing well-equipped laboratories, Nepal needs to be prepared for re-emergence or probably another outbreak.

- Human health is of critical importance during a pandemic. Despite significant progress in getting the COVID-19 vaccine from the COVAX program, service delivery including vaccination programs in the health sector remains weak. Nepal should ensure adequate funding, and appropriate allocation of resources for providing adequate health care services, that might involve public-private partnerships.

- The long-term battle with coronavirus may help people to win against COVID-19 by producing vaccines and medicines. In line with Oxfam, Nepal should stand to release IPR on vaccine and medicine production, together with other necessary support.

- Gender and social inclusions in entrepreneurship and other productive sectors, should be increased.

- To combat future outbreaks, the Government of Nepal should raise and secure a fund related to infectious diseases research to mitigate the control and future consequences of it.

- Community awareness and preparedness for infectious disease are essential in the national level.

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Appendix I: Major Support Granted by foreign governments and entities to fight COVID-19

Date	Country/Institution	Nature and Quantity of Support	Value	Remarks
13/4/20	Department for International Development, United Kingdom		$14 M	Grant
13/4/20	Xi'an Municipality, Shaanxi, China	30,000 medical masks, 1,000 N95 masks, 500 personal protective units, 100 goggles, 30 forehead thermometers, 1 ventilator	$0.12 M	Butwal Sub Metropolitan City
16/4/20	G20	Suspended debt service payments for world's poorest countries through the end of the year		G20 finance ministers' meeting
20/4/20	United Nations Population Fund	1200 PPE	$0.36 M	
22/4/20	Xizang AR. China	10000 N95 masks, 10000 PPE, 1000 infrared thermometers, 2000 testing kits, 20000 VTMs, 50 boxes wet wipes		Through Tatopani
22/4/20	India	825,000 dosages of essentials medicine, 320,000 dosages of paracetamol, 250,000 dosages of hydroxychloroquine		
25/4/20	Temasek Foundation	10,000 Fortitude Kit 2.0		
27/4/20	European Union	$ 0.11 M		NRs7.2 billion (S$1 million reorientation of existing funds/res new commitment)
29/4/20	Qatar	725,000 PPE		Qatar Fund for Development
30/4/20	Buddhist Association Hainan, China	200,000 medical masks, 10,000 N95 masks		Hingfa temple in Shenzhen city and Chinese temple in Lumbini
30/4/20	United Arab Emirates	7 tons of medical supplies		
2/5/20	Germany	3,000 PCR test kits		
9/5/20	International Monetary Fund	$300 M		Rapid credit facility (100 per cent of quota)
12/01/2022		$395.9 MECF arrangement about $110 M available for immediate disbursement.[6]		

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[6]   https://www.imf.org/en/News/Articles/2022/01/13/pr2206-nepal-imf-executive-board-approves-us-million-ecf-arrangement

Date	Country/Institution	Nature and Quantity of Support	Value	Remarks
11/5/20	China	40,000 units of diagnostic kits, 10,000 units of disposable coverall, 40,000 units of medical goggles, 200,000 units of N95 masks and 800,000 units of Surgical masks		Chinese Embassy in Kathmandu
1/6/2020	Asian Development Bank	$267.94M		Loan $250 M Guarantee: $10.57 M Technical assistance: $4.37 M Grant: $3 M[7]
1/6/2020	Tibet (China)	$0.65 M		PCR, ventilator and X-ray portable machine for Province 1
7/4/2020	World Bank[8]	$29 M		Soft loan
27/06/2021		$150 M		Concessional loan
9/06/2021	COVAX[9]	Over 7.725 MCOVID-19 vaccines over three million syringes and around 83,000 syringe safety boxes and ten specialized walk-in-coolers		Nepal among the first countries in Asia to receive COVID-19 vaccines from COVAX Facility
9/06/2021	China	108000 doses of Verocell 800 filled oxygen cylinders, 10 oxygen concentrators, five ventilators, 200 ICU beds and 15,000 antigen kits		
6/08/2021	Bhutan[10]	300,000 doses of AstraZeneca Covid-19 vaccines		
14/05/2021	Singapore	13 tons of medical equipment's Fortitude 2.0 PCRCovid-19 diagnostic test kits and oxygen concentrators		Lotus Life Foundation

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[7] https://www.adb.org/countries/nepal/covid-19-response

[8] https://www.worldbank.org/en/news/press-release/2021/06/27/government-of-nepal-and-world-bank-sign-150-million-agreement-to-support-nepal-s-resilient-recovery

[9] https://www.unicef.org/nepal/press-releases/over-7725-million-covid-19-vaccines-through-covax-facility-people-nepal

[10] https://thehimalayantimes.com/kathmandu/300000-doses-of-astrazeneca-vaccine-arrive-from-bhutan

Date	Country/Institution	Nature and Quantity of Support	Value	Remarks
14/05/2021	Switzerland	30 tons of medical supplies to Nepal, including 40 ventilators, oxygen concentrators, 1.1 million rapid antigen test kits and PPEs	$8 M	
14/05/2021	United Nations		$83.7 M in emergency relief	
14/05/2021	European Union (EU)		€ 75 M	
14/05/2021	Spain	50 oxygen cylinders, 10 oxygen concentrators, and 15 ventilators, apart from other medical kits		
14/05/2021	Finland, France, Germany, and Belgium[11]	50 oxygen cylinders, 20 concentrators. 77 ventilators, 14 respirators, 164,000 antigen tests, 3.4 million masks, 42,500 gloves, 30,000 isolation gowns, and 20,000 oxygen		
17/06/2020	UNICEF		$ 0.3 M	
21/05/2021	World Vision[12]	Oxygen cylinders (1,400 units), oxygen concentrators (20 units), PPE (1,225 sets), infrared thermometers (1,012 units), pulse oximeters (1,012 units) and hospital beds (25 units).		
01/05/2021	USA[13]	Scale-up its response at the community level, supporting the most vulnerable. Assistance	$8.5 M	

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[11] https://www.orfonline.org/expert-speak/international-support-to-nepal-during-covid-19-crisis/

[12] https://www.wvi.org/nepal-covid-19-emergency-response

[13] https://np.usembassy.gov/the-united-states-provides-additional-funding-support-to-nepal-amidst-the-second-wave-of-covid-19/

SESSION I

Theme: *Factors Affecting Economic Growth*

This session was chaired by Prof. Dr. Shiva Raj Adhikari, Head of the Central Department of Economics, Tribhuvan University. The paper presenter has presented the paper in the session as per the moderation of the session chair.

Theme: *Gender, Employees and Corporate Payout*

This session was chaired by Prof. Dr. Kushum Shakya, Dean of the Humanities and Social Sciences, Tribhuvan University. The paper presenter has presented the paper in the session as per the moderation of the session chair.

Equity versus Efficiency: Assessment of the Relationship between Income Inequality and Economic Growth in South Asia

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Himal Acharya[†]

Abstract

The trade-off between inequality and growth, and what should be done about it, are some of the most debated issues in economics. With different literature assessing different relationships between these two variables, the effect of inequality on growth is still a very ambiguous matter for researchers. The paucity of time series data on GINI ratio for South Asia has been one of the major reasons for a small to no contribution in the study of effects of inequality in growth in South Asia. Here, we use the data on the ratio of the income share of the top 10 percentile and bottom 50 percentile from 1980 to 2015 as a proxy for inequality and see its effects on growth. We find that inequality has a positive significant effect on growth which proves the existence of a trade-off between equity and efficiency. This gives rise to important policy implications for policymakers dealing with inequality.

Key Words: Inequality, Growth, South Asia

JEL Classification: D6, F43, 047

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I.   INTRODUCTION

An issue of both discussion and contention, the relationship between income inequality and growth has been of increasing concern since the end of World War II. One cannot speak of growth without serious consideration of the problem of inequality (Ray, 2004). Economists such as Kaldor and Kuznets have argued that there is a trade-off between reducing inequality and promoting growth. They claim that economic growth eventually leads to a reduction in inequality because the base of growth increases with time leading to a more equitable share of income between different income groups. Evidence from economic growth of industrial countries during 1950s and 1960s show that the marginalized population with small income share reaped a greater benefit than the population with higher income share growth.

However, with the onset of globalization and structural change of the economies around the world, late bloomer economies of East Asia have had relatively low levels of inequality coupled with high levels of growth rates. This phenomenon gave rise to a new body of literature that estimates a negative and just-significant relationship between inequality and economic growth. Although most of these papers focus on theories establishing a negative effect of inequality on growth, a careful reading of this literature suggests that this negative relationship is far less definitive than generally believed (Forbes, 2000).

The existing literature are said to have several major problems. Firstly, the negative association between inequality and growth is not robust and valid (Deininger and Squire, 1998). Secondly, these papers consist of two major econometric fallacies: measurement error and omitted variable bias. Thirdly, a cross-country work on inequality and growth is that policy question of how a country's level of inequality will affect growth within that country (Forbes, 2000).

This paper tackles each of these issues and builds a more robust model with an updated dataset in order to examine the relationship between inequality and growth. The following section provides an overview of the trend of growth and inequality in South Asia. Section III reviews and discusses the previous research on this issue. Section IV describes the dataset and model to be used. Section V estimates the model specified and explains the results. Our conclusion with policy implications can be found in section VI.

II.   INCOME INEQUALITY AND GROWTH IN SOUTH ASIA

With a long history of colonialism, feudal structure, autocratic regimes, and lack of broad human capital, South Asian economies were vastly unequal. With the onset of economic growth, the inequality has steadily risen and then has been falling which resembles Kuznets's curve. The inequality peaked during the period of 1998-2003 when South Asia was just starting to reap the benefits of globalization. After the 1998-2003 periods, the growth in South Asia has been comparatively equitable. When we take these standard indicators that are based on the monetary aspects of life, South Asia has a moderate level of inequality. The GINI ratio of South Asian countries lies between 0.28 and 0.40 which is lower than countries like China, South Africa, Mexico, etc. The consumption share of the different population groups suggests that inequality is modest in South Asian countries (Rama, 2014).

Diagram 1: Growth vs Inequality in South Asia

Growth vs Inequality in South Asia

Source: World Inequality Lab

South Asia saw sluggish and comparatively lower growth than the world because of its inability to catch up with the technological advancements during the 80s. But with the onset of globalization and the dot-com revolution, the growth trajectory of South Asia seems to be one of the best in the world. Increasing international trade, service industry, manufacturing industry, political stability, etc. are the main catalysts of this growth (ADB, 2017).

III.   LITERATURE REVIEW

Previous works on the relationship between income inequality and economic growth have produced mixed and conflicting results. Some draw the inference that greater the income inequality, lower the economic growth while others argue the opposite. The difference in results between these papers might be due to endogeneity bias and faulty identification strategy.

Using various approaches, the relationship between income inequality and economic growth has been highlighted as negative. Mo (2003) conducted a systematic cross-country analysis looking at four factors that are used in determining growth performance. The variables included the share of investment in GDP, the rate of population growth, the initial level of real GDP per capita, and the GINI coefficient. It was expected that the coefficients on the variables for the GINI coefficient would have a negative impact on total factor productivity in response to higher levels of inequality, and thus lead to a decrease in economic growth. The study found that a one percent increase in the GINI coefficient negatively impacts the growth rate of GDP by 2.16 percent. A decline in economic growth is also likely to have adverse effects on investment and subsequently a negative effect on human capital stock, which relies on it. The study showed that approximately 55 percent of the impact on the GDP growth rate can be explained by income inequality. The author also concludes that the impact of income inequality will differ depending on development.

Other studies focused closer attention on income inequality perpetuated by violence and civil conflict. Humphrey (2003) analyzed the role of conflict on economic growth and productivity,

highlighting inequality as a factor of GDP growth, along with government policy, wealth, poverty, economic structure, and trade. He found that economic policy leaves room for policymakers to promote conflict as a form of personal economic gain and that these policies often lead to economic, political, and financial inequality. The analysis looked at inequality as a measurement for economic productivity measured as overall inequality, defined as "inequality between individuals regardless of group membership," and horizontal inequality which is inequality among groups or regions. The differences in inequality and wealth are more aggravated in poorer countries and more likely to lead to decreased levels of economic performance as a result. The study also finds that a country with a GDP per person of 250 U.S. Dollars is likely to experience war with a probability of 15 percent compared to a 4 percent probability of nations with a GDP per person of $1250. Since extreme income inequality often leads to civil conflict, then it follows that increases in wealth disparities will decrease GDP per capita. The unequal allocation of resources and wealth has contributed to the lack of development of some countries and further exacerbated income disparities as a deterrent to economic growth and productivity.

Further literature that shows the mixed relationship between income inequality and economic growth took urban and rural differences within states into consideration. Odedokun and Round (2001) looked at the direct effect of inequality on growth by regressing growth on income distribution variables including initial level of per capita GDP, 5-year population average annual growth rate, and the share of consumption expenditure bore by the government. The explanatory power of these variables proved low so further research into urban and rural areas was conducted across a few countries. They found that the sign of the coefficient attached to the income share of the middle class was positive and statistically significant in rural areas, while it was negative and insignificant elsewhere. The analysis in this study was limited to fewer countries than previous studies which could potentially explain the conflicting results of income inequality on growth.

Panel and cross-sectional data taken from multiple countries can be utilized to see how different factors affect GDP and this was done by Barro (2000). Barro begins his analysis by identifying some macroeconomic consequences of income inequality, which include things such as the political economy, credit-market imperfections, and savings rates. He then draws upon a panel of roughly 100 different countries between the years 1960 and 1995 and uses regression models such as investments, terms of trade, democracy index, government consumption, among other variables to determine the growth rate within these countries. A large portion of the analysis used in this study uses the Gini coefficient to measure income inequality, which relates to the Lorenz curve that graphs the cumulated income shares and population shares against each other. One of the main conclusions that Barro arrived at after conducting his research is that income inequality tends to slow down growth in poor/developing countries, while having the inverse effect on rich/developed countries. More specifically, he concluded that growth tends to fall with inequality when per capita GDP is below $2000 (1985 $ value) and rises with inequality when per capita GDP is above $2000.

When it comes to comparing GDP and income inequality, the Kuznets Curve developed by Simon Kuznets (1955) is drawn upon in many literatures, including Barros'. His work utilized data from 3 countries; the United States, England, and Germany, with the main overview being that income inequality increases as a country is developing, specifically from a rural to an urban population, and inversely decreases when the modern structure becomes prevalent. This relation is shown in the Kuznets Curve, which illustrates an inverted U-shape for the relationship between income inequality and per capita income. Initially, the curve looks at the relationship between inequality and level of output, which created conflict between if it was detrimental or necessary, so current literature focuses more on the relationship between

growth and inequality. Kuznets stressed 3 aspects of his findings, the first being that the data he used was for income before direct taxes and excludes government contributions. Secondly, he states that reductions in the percentage of inequality were accompanied by drastic rises in real income per capita, meaning that countries that are classified as developed are experiencing an increase in income per capita if there is no conflict such as war. Lastly, he brings up the question of whether distributions by annual incomes properly reflect trends by secular income. This primarily speculates that long-term average incomes may show a smaller reduction in inequality compared to annual incomes.

Ikemoto and Uehara (2000) illustrate the Kuznets curve more specifically by looking at its relation to income inequality in Thailand. In their literature, they hypothesized that Thailand, which saw rapid economic growth in the 1980s and with the industrial sector absorbing the underemployed rural labor force in the 1990s, would soon see a decrease in income inequality. After conducting an analysis of the GINI coefficient to poverty across Thailand, they were surprised to find that after the country had already passed the Kuznet Curve, the income inequality increased again, meaning that the U-shaped curve was more like a N-shaped curve. Ikemoto and Uehara then revisited the Kuznets' hypothesis which is based off a transition from an agricultural economy to an industrial one, meaning it is only supposed to happen a single time during economic development. They then came to the conclusion that changes in new high productivity industry could affect the Kuznets Curve, and it should not be limited to only a change from an agricultural to industrial economy.

Banerjee (2003) looks at existing literature on the topic of income inequality and its effect on economic growth, analyzing why different approaches lead to mixed results. When using OLS regressions using one cross section, it is typically found that there is a positive relationship between inequality and growth, while the fixed effect approach produces a negative relation between changes in inequality and changes in growth rate. Banerjee believes that it may not be possible to interpret the evidence in these literature casually, and that variations in inequality could likely be credited to a range of unobservable factors associated with growth.

Together, Persson and Tabellini (1994) performed a study that focuses specifically on the effects of income inequality and public policies. They developed models that characterize an individual's utility, income, consumption, and political preferences in order to provide a variety of testable attributes. The primary hypothesis they set out to test was whether a more equal distribution of income and a higher average level of basic skills both increase growth. Interestingly, Persson and Tabellini used data dating back from the 1830s which included 8 countries in Europe as well as the United States. They also included data from the post-World War II period that involved a much larger set of countries due to improved data collection at the time. They measured average skills through data on schooling, and they also included political participation, investment, and initial GDP as regressors for growth. Persson and Tabellini had a different take than the previously mentioned authors, concluding that inequality harms growth by leading to policies that do not protect property rights or allow for full appropriation of returns on investment.

Jauch and Watzka (2016) extend the existing literature by using a larger database covering a longer time horizon and more countries. Their sample consists of 138 countries with observations covering the years from 1960 to 2008. They measure financial development as private credit divided by GDP. They believe it is a good proxy for financial development, because the correlation between private credit over GDP and access to finance is high. Since gross income excludes all income from non-private sources and net income includes all types of public transfers and deductions, they use both gross income and net income to measure

income inequality so that the number reflects both the actual amount of an individual to spend on and also the individuals' earning entitlements on pensions and other social benefits. Their results suggest that economic theories predicting an income inequality reducing effect of financial development should be rejected.

While some literatures declare a positive relationship and others support a negative one, there are some studies in which no position is taken and both sides of the debate are examined and analyzed. Shin (2012) chose not to pursue a particular stance on the topic but rather chose to examine reasons why this disparity exists. According to Shin (2012), there is a correlation between the positive/negative relationship between inequality and economic growth and whether the country is developed or not. Shin (2012) performed a case study of East Asian and South American countries, which are developing countries. The findings revealed a negative relationship between income inequality and economic growth in those countries. Conversely, in a case study of the United States and France, which are developed countries, a positive relationship between income inequality and econ growth was found. In an agreement with Barro (2000), Shin (2012) declared that the effect of income inequality on economic growth was contingent on the state of economic development. Specifically, Shin (2012) found that income inequality in poor countries retards economic growth; that is, in countries with GDP per capita below 2070, the effect of income inequality is negative. According to Shin (2012), this is caused by a lack of opportunity to invest by the population of a developed country. This in turn would lead to political and social instability, which contributes towards economic growth decline. Therefore, income inequality reduces economic growth. In contrast, income inequality in rich countries encourages growth; that is, in countries with GDP per capita over 2070, the effect is positive. Income redistribution from the rich to the poor reduces the saving rate of the economy which would lower the incentive for the rich to work hard. So, income equality would reduce economic growth. It can be inferred from this paper that the result of income inequality on economic growth varies depending on whether the country is developed or not.

IV. METHODOLOGY

Focusing on the case of developing countries, this paper estimates growth as a function of initial inequality, income, male and female human capital, market distortions, and country and period dummy. This model is very similar to the models used in most of the empirical works focusing on the relationship between income inequality and growth. The reason behind choosing this model is that it was used by Forbes (2000) in order to estimate a positive relationship between inequality and growth. However, because of the lack of data at the time being, the author could not use representative samples for poor countries. Similar to her model, this paper uses country dummies to control for time-invariant omitted variable bias, and the period dummies to control for global shocks, which might affect unexplained aggregate growth in any period. In order to reduce any endogeneity that may persist, the model focuses on stock variable measured at the start of the period, rather than flow variables measured throughout the periods. To summarize, the model central to this paper is

$$\text{Growth}_{it} = \beta_1 \text{Inequality}_{i,t-1} + \beta_2 \text{Income}_{i,t-1} + \beta_3 \text{MaleEducation}_{i,t-1} + \beta_4 \text{FemaleEducation}_{i,t-1} + \beta_5 \text{PPPI}_{i,t-1} + \alpha_i + \eta_t + \mu_{it} \qquad \text{.......... (1)}$$

Where, i represents each country and t represents each time period (t = 1, 2, …, T). Growth_{it} is the average annual growth for country i during time period t, $\text{Inequality}_{i,t-1}$, $\text{Income}_{i,t-1}$, $\text{MaleEducation}_{i,t-1}$, $\text{FemaleEducation}_{i,t-1}$, $\text{PPPI}_{i,t-1}$ are respectively, inequality, income, male and female education, and market distortions for country i during period t-1; α_i are country dummies; η_t are period dummies; and μ_{it} is the error term. The data used in this model is taken from three sources. Inequality is measured by taking the ratio of the income

share of top 10 percentile and the bottom 50 percentile of a country. The data of income share is taken from the World Inequality Database. Male education and female education is measured in terms of average schooling per year according to gender. This data is obtained from the Barro and Lee dataset. Income is measured in terms of GNI per capita and it is also obtained from the World Bank database. Market distortion is measured by PPPI and the data is obtained from Penn World Lab. Detailed sources and definition for each of these variables in listed in table 1.

Table 1: Summary Statistics and Sources of the Data

Variable	Definition	Sources	Year	Mean	Standard Deviation	Minimum	Maximum
Income	6 years period average of ln of Real GNP per capita, calculated using Atlas Method	World Bank	1980-1985	5.72	0.46	5.075	6.39
			1986-1991	5.92	0.44	5.28	6.63
			1992-1997	6.16	0.66	5.31	7.24
			1998-2003	6.41	0.81	5.45	7.84
			2004-2009	6.93	0.80	5.43	7.82
			2010-2015	7.47	0.88	5.90	8.46
Inequality	6 years of period average of income share of top 10 percentile and bottom 50 percentile	World Inequality Database	1980-1985	2.58	1.34	1.56	5.13
			1986-1991	2.78	1.20	1.78	5.15
			1992-1997	3.13	1.00	2.49	5.17
			1998-2003	3.27	1.01	2.31	5.09
			2004-2009	3.21	0.51	2.76	4.01
			2010-2015	3.04	0.64	2.56	4.13
Male Education	Average years of secondary schooling in the male population aged over 25	Barro and Lee	1980-1985	1.36	0.57	0.7	2.26
			1986-1991	1.46	0.38	1.13	2.05
			1992-1997	1.61	0.46	1.22	2.40
			1998-2003	1.91	0.83	1.00	3.20
			2004-2009	2.15	0.88	1.07	3.32
			2010-2015	2.39	0.76	1.48	3.40
Female Education	Average years of secondary schooling in the female population aged over 25	Barro and Lee	1980-1985	0.73	0.69	0.14	1.72
			1986-1991	0.82	0.65	0.31	1.87
			1992-1997	0.94	0.70	0.37	2.29
			1998-2003	1.21	0.94	0.48	3.07
			2004-2009	1.30	0.95	0.54	3.16
			2010-2015	1.59	0.83	0.78	3.17
PPPI	Price level of investment measured as the PPP of exchange rate relative to USD	Heston and Summers	1980-1985	51.95	0.69	0.14	1.72
			1986-1991	42.93	0.65	0.30	1.87
			1992-1997	43.06	0.70	0.37	2.29
			1998-2003	38.99	0.94	0.48	3.07
			2004-2009	43.94	0.96	0.54	3.16
			2010-2015	51.68	0.83	0.78	3.17

V. ECONOMETRIC ANALYSIS

A wide range of different estimation techniques can be used to estimate our panel model. Mostly, fixed effects and random effects estimations techniques are used. Between these two, random effects as they incorporate information across individual countries as well as across periods. But the problem with these two estimation methods is that our model contains a lagged endogenous, variable. In order to fix this problem, our panel model is rewritten with growth expressed as the difference in income level.

$$\text{Income}_{it} = \beta_1\text{Inequality}_{i,t-1} + \gamma_2\text{Income}_{i,t-1} + \beta_3\text{MaleEducation}_{i,t-1} +$$
$$\beta_4\text{FemaleEducation}_{i,t-1} + \beta_5\text{PPPI}_{i,t-1} + \alpha_i + \eta_t + \mu_{it} \quad \ldots\ldots (2)$$

with

$$\gamma_2 = \beta_2 + 1$$

To simplify, this can be written as

$$y_{it} = \gamma y_{i,t-1} + \mathbf{X'}_{i,t-1}\boldsymbol{\beta} + \alpha_i + \eta_t + \mu_{it} \quad \ldots\ldots (3)$$

Even if the lagged endogenous variable yi,t-1 error term, uit are not correlated, the estimation done by fixed effects and random effects are not consistent if t does not approach infinity (in our case t = 6). To fix the problems that lead to inconsistency of random effect estimates, Chamberlain's π-matrix technique is also used. But this method pre-requires exogeneity of a large subset of the explanatory variables. In our model, this condition is very unlikely to be fulfilled. A Hausman specification test or a matrix singularity test can check the exogeneity of our explanatory variables (other than income).

The Generalized Method of Moments (GMM) estimator formulated by Manuel Arellano and Stephen R. Bond (1991) can be an efficient estimator for our panel model because it corrects for bias introduced by the lagged endogenous bias introduced by the lagged endogenous variable and allows a certain degree of endogeneity in the explanatory variables. This estimator first-difference each variable to eliminate the country-specific effect and then uses all the possible lagged values of each of the variable as instruments (Forbes, 2000). Arellano and Bond rewrite the equation iii as

$$y_{it} - y_{i,t-1} = \gamma(y_{i,t-1} - y_{i,t-2}) + (\mathbf{X'}_{i,t-1} - \mathbf{X'}_{i,t-2})\boldsymbol{\beta} + (\mu_{it} - \mu_{i,t-1}) \quad \ldots\ldots (4)$$

In equation (iv), all the variables are now written as deviation from period means which is done in order to control for period dummy variables. For period t=3, this model uses yi,t=1 as an instrument for (yi,t=2 – yi.t=1) and so on. The critical assumptions that must be met for this estimator to be consistent and efficient are that the X'i,t-k's must be predetermined by at least one period (E(X'i,tμik) = 0 for all k>t) and the error term cannot be serially correlated (E(μi μi,t-k) = 0 and k ≥ 1).

Table 2: Estimates Using Different Estimation Techniques

Estimation Methods	Fixed Effects (1)	Random Effects (2)	Generalized Method of Moment (3)
Inequality	0.0086436 (0.0033525)	0.00764798 (0.0034697)	0.008377415 (0.00251895)
Income	-0.0159431 (0.0038448)	0.01728863 (0.00605093)	-0.0182816 (0.00306905)

Male Education	-0.020206 (0.0449529)	0.02174515 (0.00692520)	-0.00262920 (0.00705867)
Female Education	0.0285119 (0.01130927)	-0.0874779 (0.0358328)	0.0292518 (0.07114215)
PPPI	-0.00076 (0.00026312)	-0.00087 (0.00021456)	-0.00194924 (0.00014994)
R^2	0.71428	0.66421	NA
Adjusted R^2	0.48871	0.51426	NA
Countries	6	6	6
Observations	36	36	36
Period	1980-2015	1980-2015	1980-2015

Table 2 contains the estimates of our model using fixed effects, random effects, and generalized method of moments. Even if the estimates are statistically significant, a test of validity of assumptions must be conducted for each method. First, a Hausman test is conducted to compare the fixed effects estimates of column 1 and random effects estimates of column 2. The Hausman test rejects the fixed effects estimates with $\chi2(5) = 10.76$ with p-value of 0.057. However, due to presence of lagged income variable, these both methods are inconsistent. Another test, which is a matrix singularity test, rejects the exogeneity of the explanatory variables with a reciprocal conditional number very close to zero. Hence, Chamberlain's π-matrix cannot be used for estimates. Although there are not any formal means of checking the first assumption of our model, the regression of inequality on lagged growth in our model suggests that the X_i, t-s's are predetermined by at least one period. For our second assumption, a second-order serial correlation test and Sargan's test of over identifying restriction are both satisfied with p-value of 0.039. Hence, although there is a possibility of endogeneity between inequality and growth undermines the requirement that $E(X'_i,t\mu_{ik}) = 0$ for all k>t. Thus, it is suggested by numerous evidence that GMM estimator is both consistent and efficient in our case.

The reports in column 3 do not only agree with literature that derives a positive relationship between income inequality and growth, but most are highly significant. The results show that the coefficient of initial income is negative and significant. Although not significant, the effect of male education in economic growth is negative but female education has a significant positive impact on growth. Agreeing with the existing literature, the coefficient of market distortions is negative and highly significant. No matter which estimation technique is utilized, the coefficient of income inequality is always positive at significant at the 5-percent level. Even though this is not a surprising, the magnitude of coefficient is. A ten-point increment in income inequality of a country is correlated with a 0.8 percent increment in average annual growth rate over the coming six years period. Although unlikely, this shows the scale of trade-off between promoting equity and growth in a country.

VI. CONCLUSION

The results of this paper both challenges and complements literature on the relationship between economic growth and inequality in South Asia. Although the results of fixed effect estimates and random effects estimates are statistically significant, they are not as consistent and efficient as the Generalized Method of Moments technique used in this paper.

One interesting aspect of the results of this paper is that no matter which estimation technique is used to estimate our panel model, the relationship between inequality and economic growth is always positive and highly statistically significant. This implies that in South Asia, inequality does promote economic growth with one caveat that this paper only focuses on the short-term and medium-term relationship. The lagged endogenous term has been taken into consideration and the use of GMM estimation technique also takes persisting endogeneity into account. Although not statistically significant, the impact of male education seems to negatively affect the economic growth rate which is a similar result across various literature.

An important policy implication of this study is that there exists a trade-off between promoting equity and efficiency. When policymakers implement pro-equity policy, they should also keep in mind its negative effects on growth and efficiency.

Even if the paper reassesses the relationship between economic growth and inequality, it does not identify the channel through which inequality affects economic growth. A further body of literature that theorizes the channels and paths through which inequality affects economic growth is very important in order to shed more light on this issue.

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Role of Migrants' Remittances on Economic Growth: Evidence from Nepal

Ram Narayan Shrestha [*]

Abstract

This paper study the impact of remittances on the economic growth of Nepal. Using time-series econometric techniques (Long-run structural modeling, Vector error correction model, Granger causality test, Generalized impulse response functions, Persistence profile and Variance decomposition analysis) for annual data from 1981-2017, we explore the dynamic impacts of remittances on the economic growth of Nepal. Our econometric specification is based on the augmented neoclassical growth model (Mankiw et al. 1992, Rao 2010). Our analysis shows a long-run relationship between remittances and economic growth and the causality runs bidirectional. This means that the increase in remittances helps in the economic development in long-run. At the same time, the economic growth increases the remittances inflow. But, in short-run, there is no relationship between these two variables and there is no direct causality between these variables. Our analysis also showed that any (negative) shock in the remittance inflow has a negative impact on the economic growth for some period of time. Our results confirm that the remittances also affect the dynamics of other variables like investment, financial development and human capital investment which indirectly affect the economic performance of the economy through these variables. Our findings are consistent with some of the previous studies which show small but positive effects of remittances on the economic growth (Cazachevici et al. 2020). Our analysis suggests that remittance inflow can promote economic growth. Hence, to enhance the growth impact of the remittance conducive environment for investment should be created. Our findings also indicate that remittances could promote financial development in short-run. Hence, policies promoting remittance flow through formal channels and financial literacy could be effective tools for channelizing remittances for economic development. Our study also shows the possibility of (negative) shocks in remittances flow having a permanent negative effect on education. Hence, government should prioritize education sectors to prevent dropout of the students from schools when the households' are hit negatively due to remittance shocks.

Key Words: Remittance, Economic Development, Time-series Analysis

JEL Classification: F24, F43, C22

I. INTRODUCTION

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Remittances have emerged as one of the most important financial flows and source of development financing towards low and middle income countries in last few decades (World Bank 2019, Ratha 2003). Accordingly, there has been surge in studies to understand the role of remittances in economic development. Despite huge literature on the linkages between remittances and development, the findings are not conclusive both theoretically and empirically at aggregate level (Clemens & McKenzie 2018, Gapen et al. 2009, Chami et al. 2008, Kireyev 2006). Several studies have found heterogeneous impacts across different set of countries and over time and the effects are contingent on other intervening factors like financial development, institutional quality, etc. of the receiving country.[1] Among others, the impact of remittances depends on structural characteristics of the receiving country, absorptive capacity of economy to absorb large financial inflows and other country-specific mechanisms and also on the "broader institutional and political environment, the quality of institutions and their development level" of the receiving country (Adams et al. 2009). Moreover, studies based on cross-sectional and panel data can-not address the issues due to significant 'parameter heterogeneity' and much of these studies estimate reduced-form partial correlations only (Durlauf et al. 2004). Hence, the case-study of individual country context in shaping the effects of remittance and economic growth is important.

In this paper, we focus on the role of remittances in economic growth of Nepal. Nepal serves as the interesting case-study given the tremendously increase in remittance flow during the study period and its socio-economic impacts in the country. Nepal is one of the highest remittances-receiving countries in the world in terms of share of the GDP. In 2017, Nepal received US $6.92 billion dollars which is equivalent to 27.8 % of gross domestic product (GDP) of Nepal. Remittance flow is the single most important source of foreign exchange earnings exceeding other sources like export, foreign direct investments and official development assistance. The remittance flow remained more or less stable from 1981 to 2001 and increased drastically there after (see figure 1 (a)). Throughout the study period, the economy grew at the average annual growth rate of 4.4% the remittances grew at the rate of 19% (see figure 1(b)). The remittance flow has helped in reducing poverty and progress in human development (World Bank 2016), maintaining balance of payment and relaxing foreign exchange constraints in Nepal (Pant 2006).

The higher flows of remittances, during the study period, in Nepal is also coincided many socio-economic and political changes in Nepal. Until 1985, Nepal followed state-led inward-looking protectionist economic policies which was followed by the implementation of the structural adjustment programs (SAPs) from 1985 (due to the balance of payment crisis in the first half of 1980s) (Khanal et al. 2005). In 1990, the regime-shift took place by throwing autocratic partyless 'Panchayat system' and restorating the democracy. The restoration of the democracy along with the SAPs of 1980s led Nepal towards liberalization and privatization of the economy. This marks the huge policy departure in Nepal. This also led to increase in work-related migrants in foreign countries accompanied by the higher demand for labor created by the "Oil boom" in the Gulf countries (Shrestha 2008). Shortly after the restoration of the democracy, Nepal entered in a decade long civil conflicts (from 1996-2006) (Bohra-Mishra & Massey 2011) followed by the transitional governance till the Nepal's transition to Federal governance in 2015. During this period, prolonged political instability

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[1] See, for example, Sobiech (2019) and papers cited within for the role of financial development, Chitambara (2019), Catrinescu et al. (2009) on role of institutions on modifying the effects of remittances on economic growth.

remained main feature Nepal. During all these period, especially after 2001, the international labor migration and remittance remained as the important feature of Nepal's economy.[2]

The economic growth in Nepal during the study period remained "low and erratic" with low level of productivity, high subsistence agricultural economic base, stagnation in manufacturing sector and limited absorption capacity of the service sectors (Basnett et al. 2014). In last three decades, the structural transformation took place from agriculture to service sector without major expansion of manufacturing sector lowering overall growth potential of the country (Khan 2020). During this period, foreign labor migration and remittances have remained one of the important life-line for Nepal's economy which has helped to keep Nepal's economy afloat (Sapkota 2013, Shrestha 2008). Despite the poor performance of the economy, there has been significant reduction in poverty and improvement in social indicators of health and education (Wagle & Devkota 2018, Dahal 2014).

While the welfare impacts of the remittances in Nepal has been acknowledged in the literature, the role of remittances in economic growth in Nepal is not conclusively and the number of studies focusing on this are fairly limited (Dahal 2014). So, it is interesting to explore whether remittances have any long-term effects in economic growth of Nepal and exploring the constraining/facilitating factors for economic growth. The systematic analysis of effect of remittances on growth could provide a better insights in formulating development policies as policy measures could be useful to moderating the effects of remittances in the economy. Cosic et al. (2017), for instance, argued that Nepal may stuck into low-growth equilibrium with high migration and high remittances unless the current development practices are drastically changed. This highlights the need for better understanding the role of remittances in economic growth process.

The main objective of this paper is to examine the dynamic relationships between remittances and economic growth in Nepal along with other variables like education and financial development over the period of 1981 to 2017. Our analysis is based on Johanson methodology (Johansen 1988, 1991), Long run structural modeling, Vector Error Correction Model (VECM) and Innovation analysis to find the long run and short run dynamic effects of remittances on economic growth. We found the remittances have small but positive and significant effects on economic growth in long run. However, in short-run, the effects are not significant. There are bi-directional causality between the remittance and real GDP per capita in long run. The dynamic analysis of the relation between remittances and other variables in the system showed that any (negative) shocks in the remittances have negative impacts on economic growth during the forecast horizon (of ten years). Similarly, except for the human capital, remittance response to shocks in other variables in the system in the counter-cyclical. The system is dynamically stable with shocks in the system are established within 5 to 6 years of the shocks. Overall analysis showed that the remittances significant effect on the long-run economic growth and influence the dynamics of other variables in the system.

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[2]   International migration for labor is the regular feature of Nepal's economy which can be traced back to before early 19th century when Nepalis joined the army of a Sikh ruler in Lahore (Seddon et al. 1998). However, in last three decades, the prominence and importance of remittance has increased with the increase in the flow of remittances as well as the change in the migration destinations from traditional destination of India to Gulf and other developed countries.

***Figure 1*: Remittance data for Nepal**
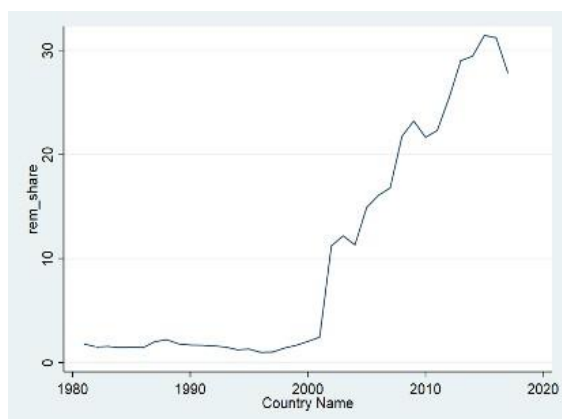
(a)   Remittance share   (b)   Remittance growth
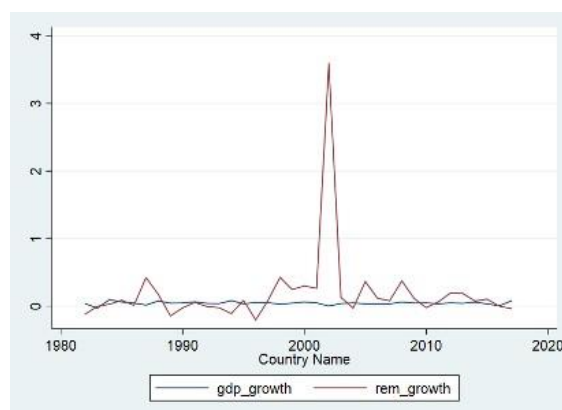
This paper contributes the existing literature in remittances and economic growth in several ways. As Rao (2010) notes, the empirical works based on time-series econometric technique works are often based on ad hoc specification and even those studies claimed to be based on theoretical growth models are ill-informed and conclusion drawn from these studies are often biased and mis-leading. This is true to case of Nepal as well.[3] So, we base our study on "augmented" Solow growth model (Mankiw et al. 1992, Rao 2010), which provides theoretical ground for our study. In addition to remittances, we include human capital and financial development as the control variables to check for the indirect effects of the remittances on economic growth through these variables and to check the robustness of our findings. These variables are most discussed channels through which remittances can have effects on the economic growth. However, non of the studies on Nepal has focused on these aspects. Similarly, there are only few existing papers which look thoroughly in remittance-growth inter-linkage which are often out-dated or empirically not sound (which I have discussed in greater details in review of literature section).

The rest of the paper are organized as follows. In the next session, the overview of the literature is presented. In section three, data and the methodology of the research are presented. In this section, theoretical framework, data and descriptive statistics, preliminary analysis and long and short run relationships are discussed. Section 4 presents Robustness check of the results and the final section presents the discussion and conclusion of the paper. Related data and tables are presented in the Appendix.

II.   REVIEW OF LITERATURE

There are mixed evidences on the effects of remittances on economic growth of the receiving countries. For instance, in a meta-analytical study, Cazachevici et al. (2020) found that about 40 % of the studies reported positive, another 40 % of the studies reported no effects whereas 20 % of the studies reported negative effects with publication bias favoring towards positive results.   Generally, there are two contradictory approaches (optimistic and pessimistic) in studying with the economic implications of remittances in economic development (Brzozowski 2012, de Haas 2010). The optimistic view on the role of remittances on economic growth focuses mainly on the ability of remittances in consumption stabilization, lessening production and investment constraints of the household

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[3]   See, for example, table 1 where I have summarized time-series econometric works on Nepal which are often mis-specified, ad hoc and/or often misleading in their conclusions.

in imperfect market environment thereby creating income-growth linkages (Taylor 1999). The pessimistic views, on the other hand, focus on the 'conspicuous' consumption from the remittances received, import dependency and investment in unproductive sectors like housing and land (Chami et al. 2005).

In the macro-level, remittances may have positive effects on economic growth through its impact on capital accumulation, labor productivity and total factor productivity (Gapen et al. 2009). Remittances help in relieving foreign exchange constraints (Pant 2006), improve credit rating and external debt sustainability which boosts confidence in national economy (Avendano et al. 2011) which helps in economic growth. Increased remittances flow, on the other hand, can have negative impact through real exchange appreciation leading to "Dutch disease" type of phenomenon (Amuedo-Dorantes & Pozo 2004, Acosta et al. 2009). Remittance flow are, generally, counter-cyclical in nature (Frankel 2011). So, it might have growth stabilizing rather than growth enhancing effects. Similarly, remittances are the compensatory transfers paid for the work of the productive member of the household who have migrated. Hence, the net effects on growth may not be positive (Chami et al. 2005). Moral hazard argument, in which the household members reduce labor supply or labor force participation upon receiving remittances, can also have negative impacts on growth (Chami et al. 2005).

The (macro)-empirical literature also shows mixed results on the economic effects of remittances. Ramirez & Sharma (2008), Eggoh et al. (2019), Chitambara (2019), for instance, show the positive effects of remittances on economic growth whereas some other papers find negative effects (Chami et al. 2005, Musibau et al. 2019). Gapen et al. (2009), Rao & Hassan (2011), Ahamada & Coulibaly (2013) on the other hand, find no effects of remittances on economic growth. The effects also vary depending the presence of other factors like institutions (Singh et al. 2010, Williams 2018, Chitambara 2019) or financial sector (Giuliano & Ruiz-Arranz 2009, Sobiech 2019, Bhattacharya et al. 2018). These relationships may also be non-linear among different sets of countries/regions (Eggoh et al. 2019, Feeny et al. 2014).

Now, I discuss some existing literature exploring the relationship between remittances and economic growth in Nepal, where the current study is based. Table 1 shows the summary of the literature on impacts of remittances on Nepal's economic growth. While the studies are relatively less, the existing literature are also not conclusive and with data, theoretical and/or empirical incompetence. For example, out of 10 articles listed in table 1, the estimation of the results in six papers (Srivastava & Chaudhary 2007, Majagaiya 2009, Gaudel 2016, Ojha 2019, Thagunna & Acharya 2013, Gaudel 2006) are based on Ordinary Least Square (OLS) and without proper check for the stationarity of the time-series and with relatively shorter time period. Hence, the findings from these studies are not plausible and prone to spurious regression. Uprety (2017) concludes that there is negative impact on economic growth in short-run while no significant effects in long-run in Nepal. However, the study points out there is at least one cointegrating relation among the variables (indicating long run relationship). This gives considerable space to doubt the findings from the paper. In another paper, Kumar (2011) finds positive impact on economic growth in long-run. However, the diagnostic test reported in the paper shows that the assumption of the serial correlation is not satisfied which may jeopardize the findings from the paper (Asteriou & Hall 2015). Similarly, using ARDL bound approach, Dhungel (2014) finds that one percent remittance in remittances leads to 0.36 percent increase in GDP in long-run. This estimates cast reasonable doubt as the coefficient is extremely high and not plausible (without even considering other methodological doubts). For example, Cazachevici et al. (2020), in the meta-analytical

study, show that the effect of remittance on the growth are positive but small. Similarly, using VECM,Kaphle (2018) also found positive long-term effects between remittances and economic development whereas no statistically significant effects in short-run. The specification of the model is, however, ad hoc and conditioning variables for capital stock is not included in the model specification which bias the findings (Rao 2010).

Several other studies focus on the effects of remittances on other major determinants of growth like financial development, poverty reduction, dutch disease effects, etc. instead of directly focusing of economic growth. Using VECM, Bhatta (2013) explores the impact of remittances on imports and trade balance. Using descriptive analysis for the period 1990/91 to 2005/05, Shrestha (2008) has emphasized the role of remittances in maintaining macro-economic stability, relaxing foreign exchange constraints (despite huge trade deficits) and poverty reduction in Nepal and discussed the potential of remittance in economic development. Dahal (2014) also uses the descriptive analysis to explore the association of remittances with four factors of growth (financial development, productivity, international trade, and human capital accumulation) and found mixed effects on these determinants of growth. Similarly, Sapkota (2013) and Taguchi & Lama (2016) 2016 find on the "Dutch disease" type of effect of remittances in Nepal which leads negative effects on the economic growth.

Overall, the brief overview of the existing literature shows that the effect of remittances on economic growth are so far not conclusive and oftentimes contrasting. The literature on Nepal are even relatively less and the findings are not conclusive. Given the significance and importance of the remittances in the economy of Nepal, better understanding is warranted and further studies should be carried out.

Table 1: Summary of the literature on Remittance and Economic Growth

Author(s)/year	Period	Methodological framework	Variables	Main Finding	Remarks
Kumar (2011)	1975-2010	ARDL	GDP/L, K/L, Credit/GDP, Export/GDP, Telecommunication lines	Positive impact on growth	The diagnostic test of serial correlation is not satisfied.
Srivastava & Chaudhary (2007)	1975/76-2004/05	OLS regression	DV: GDP, GNP and PCI; EV: Rm, GCF, L and Export	Small but positive impact on	Based on OLS; may have problem of spurious regression
Majagaiya (2009)	1991-2005	OLS regression	GDP, FDI , Remit	Positive effects of remittances on growth	Based on OLS; may have problem of spurious regression; too short time period
Gaudel (2016)	1980-2014	OLS regression	DV:GNI, Life expectancy, Mean year of schooling; EV: Remittance	Positive impact on GNI	Based on OLS, ad hoc specification
Dhungel (2014)	1974-2012	OLS regression; VECM	GDPPC, REMPC	Positive impact on growth	Ad hoc specification, OLS based estimates
Kaphle (2018)	1976 -2017	VECM	GDP, Remittance, Trade	Positive impact on growth on both long run and short run	Ad hoc specification; exclusion of the conditioning variables like Capital stock and labor
Gaudel (2006)	1995/96-2004/05	OLS regression	GDP, Rem, Grants, Pensions	Positive impact on growth	Based on OLS; may have problem of spurious regression
Ojha (2019)	1995-2017	OLS regression	DV: GDP,PCI; remittance, money supply, foreign aid, gcf, imports	Positive impact on growth	Based on OLS; may have problem of spurious regression
Thagunna & Acharya (2013)	2002-2010	OLS regression; Granger Causality Test	GDP, Cons, Inve, Savings, import, exports	Positive impact nominal GDP	Based on OLS; may have problem of spurious regression
Uprety (2017)	1976-2013	VECM	GDPPC, ConsPC , In- vPC, RemPC	Negative impact on short run; no effects on long run	Ad hoc specification; exclusion of the conditioning variables like Capital stock

III. DATA AND METHODOLOGY

3.1   Theoretical framework

For analyzing the determinants of the growth, two types of growth models namely exogenous and endogenous growth models are used which have four variants in empirical application based on the nature of data (time-series vs. cross-sectional) (Rao 2010). In the country-specific time-series empirical analysis, both endogenous and exogenous growth models are used. Following Rao (2010), we use empirical model based on exogenous Solow growth model with augmented specifications. The estimated parameters from the model are based long-run Cobb-Duoglas production function rather than long-run growth equation and the estimated coefficients give level effects on the output (economic growth), not growth effects. There are certain advantages of extended Solow framework as discussed by (Rao & Hassan 2011, Rao 2010) which we do not discuss here to avoid the risk of repetition.

Now we present the simple exposition of the theoretical model. The methodology for the analysis is based on the "Augmented" Solow Growth which integrates other output enhancing "shift variables" like remittances and education (Mankiw et al. 1992, Rao 2010). For this, we start with the basic production function with constant returns to scale:

$$Y_t = A_t K^{\alpha t} L^{(1\alpha)t}, \quad 0 < \alpha < 1 \qquad \ldots\ldots\ldots (1)$$

where Y represents output of the economy, A represents the stock of technology, K and L represents capital stock and labor respectively and α and $(1 - \alpha)$ represents capital and labor share respectively. Dividing equation (1) by L, we get:

$$y_t = A_t k^{\alpha t} \qquad \ldots\ldots\ldots (2)$$

In the Solow framework, the long run rate is determined by growth of the total factor productivity. So, we extend the production function by assuming that "shift variable"-remittances-, among others, can influence the stock of technology which is our main variable of interest. These shift variables impact the long run growth through their effects on technological progress. Hence, we assume that the technology A takes the following form:

$$A_t = \phi R^{\delta t} Z^{\rho t} \qquad \ldots\ldots\ldots (3)$$

where R represents remittances, Z represents other factors affecting technology and δ and ρ are elasticity of remittances and Z variables respectively. In our study, we have included human capital proxied by education and financial development proxied by ratio of domestic credit to GDP as Z variables. Substituting equation (3) in (2), we get:

$$y_t = (\phi R^{\delta t} Z^{\rho t}) k^{\alpha t} \qquad \ldots\ldots\ldots (4)$$

Taking log on both sides, equation (4) can be written as:

$$\ln y_t = \ln \phi + \delta \ln R_t + \rho \ln Z_t + \alpha \ln k_t \qquad \ldots\ldots\ldots (5)$$

This model specification forms the basis for our empirical analysis.   We take GDP per capita as the proxy for output and gross capital formation per capita as the proxy for the capital stock.   The variables are expressed in real terms.   We use several time-series econometric techniques to explore the interrelationships between our variables of interest. The schematic diagram of the methods employed is given in figure (2) which is adapted from Zhao & Wang (2015). On the basis of the our analysis starts from unit root testing, checking the cointegrating relation among the variables and testing for long term relationship between the variables in sequential orders. The details of the procedure are discussed below.

Figure 2: **Schematic diagram of the methods employed**
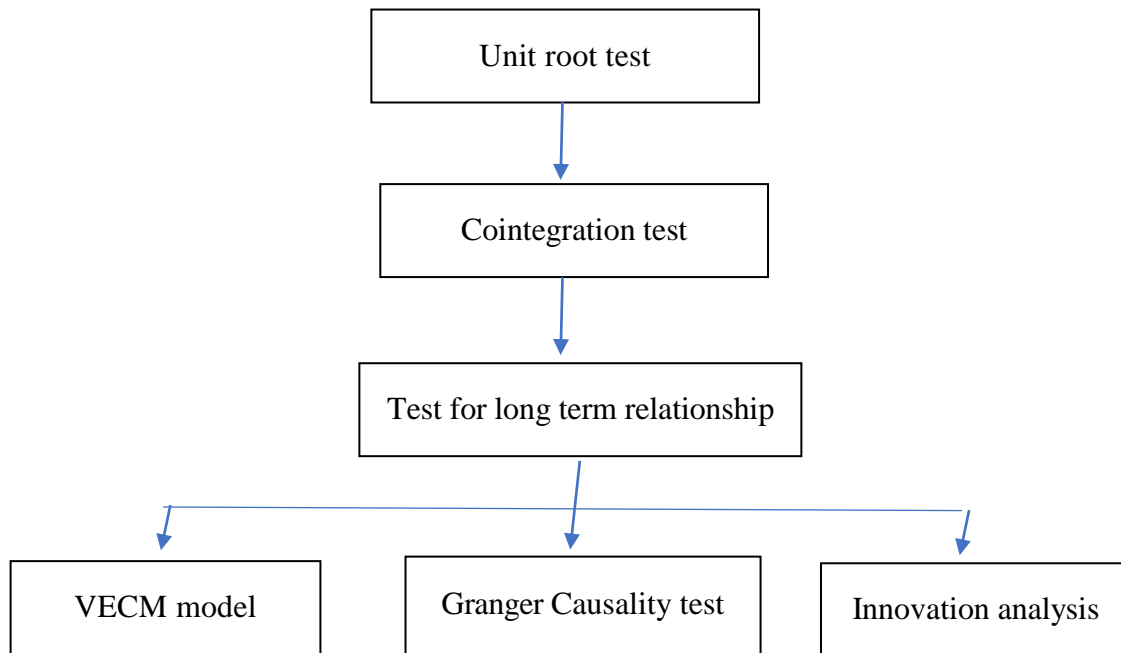
3.2 Data and descriptive statistics

The data for this analysis are taken from World Development Indicators (WDI) database from the World Bank which extends from 1981 to 2017. The variable definitions are presented in table (2). Since the data on remittances in WDI is available form 1993 onward only, we use the data estimated by Giuliano & Ruiz-Arranz (2009) who used the desk-data from IMF to estimate the remittances data from 1975-2002 for 100 countries. The details of the procedure on the collection and the methodology of the data generation in the paper. So to create the longer data frame I used data form Giuliano & Ruiz-Arranz (2009) for 1981 to 1992 and the data from 1993 to 2017 from WDI database. Given the data constraint, this procedure is best-possible way to collect the data on remittance. Similar approach is adopted by Uprety (2017) in his study to create the remittance series for Nepal. Similarly, I have taken secondary school enrollment ratio as the proxy for human capital. However, three data points were missing in the series. Hence, I used interpolation technique (cubic spline) to complete the series. Table (3) provides the summary statistics of the data used for analysis.

Table 2: Variables used in the study

Variable	Variable definition
LNGDP	Logarithmic value of Real Gross Domestic Product per Capita
LNREM	Logarithmic value of Percentage share of Total Remittances Inflow to Gross Domestic Product (GDP)
LNGCF	Logarithmic value of percentage share of Total Gross Fixed Capital Formation to GDP
LNEDU	Logarithmic value of Gross Secondary School Enrollments
LNCREDIT	Logarithmic value of percentage share of Total Domestic Credit to Private Sector to GDP

3.3   Preliminary analysis[4]

Some preliminary analysis like Unit Root Tests, Cointegration test and model fit analysis is carried out (which are presented in the Supplemental Appendix). Three test statistics: Augmented Dicky Fuller (ADF), Phillips-Perron (PP), Kwaiatkoski-Phillips-Schmidt-Shin (KPSS) tests are used check the stationarity of the timeseries. Based on these test statistics, we conclude that all the series under consideration are of I(1). For details refer to Supplemental Appendix.

In the next step, we checked for the possible long-run or cointegrating relationships between the variables using the Johansen methodology (Johansen 1988, 1991). We followed steps sequentially, as outlined by Asteriou & Hall (2015) and Brooks (2014), to carry out cointegration test. The appropriate (VAR) model with optimal lag length is selected using information criteria (AIC and BIC). Several diagnostic tests are also carried out for confirming the lag length (for VAR model). The details of the methodology and statistics are presented in the Supplemental Appendix. Based on the analysis, lag length of 3 was chosen for further analysis.

In the next step, VECM model was estimated to check whether the cointegrating relationships exists between the variables. We used 'Pantula Principle' and 'VEC stability check' and 'roots of characteristic polynomial oc VECM' to select the appropriate intercept/trend specifications for VECM model. See Supplemental Appendix for the details. Based on analysis, VECM model (with intercept (no trends) in CE and intercept (no trends) in VAR) was selected. Based on this model specification, we concluded that the presence of two cointegrating vectors in the model and proceed with this specification for further analysis.

3.4   Long and short run relationships

3.4.1 Long run structural modeling (LRSM) and VECM estimation

Once the cointegrating relation and the rank of the integration is established, we use this information to estimate the VECM model. As rank of integration ($r = 2$), there exists two cointegrating equations/vectors (CVs). These cointegration relations are built into the VECM specification so that it restricts the long-run behavior (β) of the endogenous variables to converge to their cointegrating relationships while allowing for short-run (α) adjustment dynamics. The long-run parameters (β) are uniquely defined based on the eigenvalues which, however, are not useful in making economic interpretation of the estimated coefficients. Hence, to recover economically meaningful coefficients, we use long-run structural modeling by applying just-identifying and over-identifying restriction. First, we impose ($k = r^2 = 4$) just-identifying restrictions on each cointegrating vectors. The restrictions are imposed on LNGDP and LNCREDIT. We choose LNGDP as it is our main variable of interest (dependent variable) while LNCREDIT is chosen as we are interested to see how our main explanatory variables, LNREM, may be related to LNCREDIT. Financial development, proxied by LNCREDIT, is often the most discussed channel through which remittances may have effect on the economy. We impose normalizing restriction of unity on these variables. Table (4) presents the result of long-run co-integrating relationships with just-identifying restrictions.

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[4]   The analysis of this subsection is presented separately in "Supplemental Appendix" to conserve space in the main document.

Table 3: Descriptive statistics

	LNGDP	LNREM	LNEDU	LNGCF	LNCREDIT
Mean	6.105	1.559	3.706	3.234	3.196
Maximum	6.658	3.448	4.305	3.846	4.392
Minimum	5.655	-0.024	2.921	2.842	2.091
Std. Dev.	0.287	1.321	0.347	0.265	0.710

Table 4: Cointegrating vectors with just-identifying restrictions

Cointegrating Eq:	CointEq1	CointEq2
LNGDP(-1)	1.000	0.000
	(none)	(none)
LNCREDIT(-1)	0.000	1.000
	(none)	(none)
LNGCF(-1)	-0.457	0.104
	(0.126)	(0.440)
LNREM(-1)	-0.059	-0.030
	(0.017)	(0.059)
LNEDU(-1)	-0.470	-2.076
	(0.089)	(0.311)
C	-2.785	4.235

Note: Standard errors are reported in the parenthesis.

Table 5: Overidentifying restrictions test

	CointEq1	CointEq2	Chi Square	(p-value) CointEq1
	$\beta=0$		4.798	0.028
LNGCF		$\beta=0$	0.019	0.890
	$\beta=0$	$\beta=0$	6.146	0.046
	$\beta=0$		6.132	0.013
LNREM		$\beta=0$	0.125	0.723
	$\beta=0$	$\beta=0$	7.208	0.027
	$\beta=0$		11.226	0.004
LNEDU		$\beta=0$	7.061	0.008
	$\beta=0$	$\beta=0$	11.226	0.004

Now, we impose the over-identifying restriction of zero on other variables of interest to check the significance of these variables in the cointigrating vectors. We sequentially check the over-identifying restriction of three variables LNREM, LNEDU and LNCREDIT. The results for the over-identifying tests are presented in table (5). The over identifying restriction test shows that the coefficient of LNGCF and LNREM are not rejected at 5 % level of significance both individually and jointly in CV2. Hence, these two variables are excluded in long-run cointegrating relation in CV2. Based on over-identification test, the final cointegrating vectors are identified which is given below. The value of t-statistics are reported in the parenthesis.

$$\text{LNGDP} = 0.461 \times \text{LNGCF} + 0.058 \times \text{LNREM} + 0.470 \times \text{LNEDU} + 2.775 \quad \ldots\ldots\ldots (6)$$
$$(-3.698) \qquad (-3.482) \qquad (-5.327)$$

$$\text{LNCREDIT} = 2.064 \times \text{LNEDU} - 4.480 \quad \ldots\ldots\ldots (7)$$
$$(-15.276)$$

From final cointegrating vectors, we observe that LNGCF, LNREM and LNEDU have positive effects on GDP growth in the long run. Similarly, LNEDU has positive effects on LNCREDIT in the long-run. It is, however, to be noted that the effect of remittances in smaller compared to other variables in the model. One percent increase in remittances-GDP ratio leads to about 0.06 percent increase in real GDP per capita growth in long-run, ceteris paribus. Maysami & Koh (2000) and Chakraborty (2010) state that when there exists more than one cointegrating vectors, the first eigen vector with largest eigen value may be chosen. Hence, following them we also present the long-run cointegrating vector based on first eigen vector (in equation 8). The results are similar both qualitatively and quantitatively as above. The variable LNCREDIT shows negative effects in the long term cointegrating relation, however, is is not statistically significant at 5% level.

$$\text{LNGDP} = 0.452 \times \text{LNGCF} + 0.060 \times \text{LNREM} + 0.574 \times \text{LNEDU} - 0.050 \times \text{LNCREDIT} - 2.574 \quad \ldots\ldots\ldots (8)$$
$$(-2.971) \qquad (-3.466) \qquad (-4.82534) \qquad (-3.466)$$

After estimating cointegrating relations, the short-run adjustment dynamics can be infer from the VECM model. The result of the VECM model and diagnostic tests for the model fit is presented in table (6) which shows that the short-run dynamics of GDP is affected by its own lagged values and (second) lagged value of LNGCF. Other variables like LNREM, LNCREDIT and LNEDU have not statistically significant effect in determining short run fluctuations on LNGDP. We also observe that both lagged error correction terms (ECTs) for LNGDP equation are significant. The first lagged error correction term (ECT 1t-1 = -0.196) corresponding to CV1 indicates that about 20 per cent of the fluctuation in the previous period in long-run equilibrium is corrected by LNGDP equation in present period.

3.4.2 Granger Causality test

Once the cointegrating relations among the variables are establish, we check for the direction for the causality among the variables. One of the important feature of VAR/VECM framework is that it allows for the test of casual relationships among timeseries variables commonly known as "Granger Causality". In simplest term, Granger causality refers whether the effects of past values of an variable X_t has an effect on the current value of another variable Z_t (Enders 2015). When cointegration exists between the variables, short run and long run causality can be inferred from VECM framework (Granger 1988, Chan & Woo 2013). Long run causal relationship can be inferred from lagged error correction term in α from equation (??) which is tested by estimating the LR statistics under zero row restrictions on α (Chan & Woo 2013). The short-run causality can be inferred from the impacts of the sum of the lags of each explanatory variable on the dependent variables which can be detected using the standard Wald test (Chan & Woo 2013).

To infer the long-run relationship, we use weak exogeneity test which enable us to explain the dynamic long run relationship between real GDP and other variables. The test result is re-presented in table (7) which are initially reported in table (6). The table shows that the ECTs (α) is statistically significant for LNGDP and LNREM whereas LNGCF and LNEDU are statistically not significant in CV1. This shows that the LNGDP and LNREM are endogenous whereas LNGCF and LNEDU are exogenous. From this, we infer that the long-run relationship between LNGDP and LNREM and the (Granger) causality may run in either or both direction between the variables. LNGCF and LNEDU, on the other hand, have unidirectional causality running towards LNGDP and/or LNREM which implies that there is no long run feedback from LNGDP and LNREM to these variables. Similarly, in CV2, LNCREDIT is endogenous whereas LNEDU is exogenous. This shows the (Granger) causality is running from LNEDU to LNCREDIT in the long run. The economic interpretation of these results is that the dynamics of the remittances is affected by the growth of the real GDP whereas the dynamics of gross capital formation and education level are not affected by the real GDP in the long run. Similarly, dynamics of the education level is not affected by the financial development in the long run.

Table 6: Results from VECMs and diagnostic tests

Error Correction:	D(LNGDP)	D(LNCREDIT)	D(LNGCF)	D(LNREM)	D(LNEDU)
CointEq1	-0.196	-0.498	-0.273	1.987	0.127
	(0.04)**	(0.266)	(0.304)	(0.702)**	(0.148)
CointEq2	0.038	-0.208	-0.04	0.432	0.069
	(0.013)**	(0.086)*	(0.098)	(0.227)	(0.048)
D(LNGDP(-1))	-0.311	-0.476	0.115	1.796	0.176
	(0.119)*	(0.786)	(0.896)	(2.071)	(0.437)
D(LNGDP(-2))	-0.428	-2.117	-2.41	4.391	0.238
	(0.125)**	(0.827)*	(0.942)*	(2.179)*	(0.459)
D(LNCREDIT(-1))	-0.014	0.205	0.214	-0.678	-0.035
	(0.027)	(0.177)	(0.202)	(0.467)	(0.099)
D(LNCREDIT(-2))	0.001	-0.087	0.546	-0.618	0.076
	(0.029)	(0.194)	(0.221)*	(0.512)	(0.108)
D(LNGCF(-1))	-0.051	0.118	-0.55	0.09	-0.041
	(0.029)	(0.193)	(0.220)*	(0.508)	(0.107)
D(LNGCF(-2))	-0.119	0.184	-0.462	1.45	-0.12
	(0.031)**	(0.204)	(0.232)*	(0.536)*	(0.113)
D(LNREM(-1))	-0.015	0.143	0.014	-0.014	-0.05
	(0.010)	(0.068)*	(0.078)	(0.180)	(0.038)
D(LNREM(-2))	-0.008	-0.087	0.075	-0.003	0.04
	(0.009)	(0.062)	(0.071)	(0.164)	(0.035)
D(LNEDU(-1))	0.018	-0.73	0.325	0.819	0.557
	(0.054)	(0.354)*	(0.404)	(0.934)	(0.197)*
D(LNEDU(-2))	0.015	-0.661	0.433	-0.125	0.095
	(0.062)	(0.407)	(0.464)	(1.073)	(0.226)
C	0.054	0.166	0.027	-0.056	0.002
	(0.007)**	(0.045)**	(0.052)	(0.120)	(0.025)
R-squared	0.702	0.558	0.5	0.602	0.419
S.E. equation	0.013	0.087	0.1	0.23	0.049
Serial correlation LM $\chi^2(2)$	2.882	8.394*	2.312	15.485**	0.919
Normality $\chi^2(2)$	0.186	2.472	2.783	7.967*	3.867
Heteroscedasticity $\chi^2(1)$	0.392	2.282	0.003	27.862**	0.815
ARCH $\chi^2(2)$	2.122	1.031	0.013	0.250	4.499
Functional Form $\chi^2(1)$	0.047	2.211	2.179	9.165	10.009**

Note: * and ** denotes statistical significance at 5% and 1% level respectively.

Table 7: Error correction terms and long-run Granger causality analysis

Error Correction:	D(LNGDP)	D(LNCREDIT)	D(LNGCF)	D(LNREM)	D(LNEDU)
CointEq1	-0.196	-0.498	-0.273	1.987	0.127
	(0.040)**	(0.266)	(0.304)	(0.702)**	(0.040)**
CointEq2	0.038	-0.208	-0.04	0.432	0.069
	(0.013)**	(0.086)*	(0.098)	(0.227)	(0.013)**
CV1	ENDO	-	EXO	ENDO	EXO
CV2	-	ENDO	-	-	EXO

Note: * and ** denotes statistical significance at 5% and 1% level respectively.

To infer the short-run dynamics, Granger cauality/block exogeneity test is carried out. The test results are presented in table (8). The test result shows that bidirectional causality between real GDP and the gross fixed capital formation in short-run. There is no direct impact of remittances on the economy growth. There is unidrectional causality from LNGCF to LNREM and from LNREM to LNCREDIT. Similarly, the short-run dynamics of the LNCREDIT is affected by LNEDU, LNGDP and LNEREM whereas LNCREDIT affects LNGCF. For easier interpretation, the Granger causality test results are presented in the graphical form in graph (3). The arrow head in the graph represents the direction of the causality. Overall, the test results show that remittances have no direct effects on the economic growth. Similarly, other factors which are frequently seen as the determinants of economic growth like education and financial development also have no direct impacts on the real GDP in short-run. These factors have indirect effects on the economic growth through their effects on gross fixed capital formation.

Combining the results from the long-run and short-run causal analysis, we draw the following insights from the results. While in short-run, remittances have no direct effects on the real GDP, in the long-run remittances have effects on the real GDP or vice-versa. Similarly, education also have effects on the real GDP results in the long-run which are not evident from the short-run dynamics. Similarly, in the short-run remittances seems to have effects on the financial development, however, in the long-run remittances have no effects on financial development.

Table 8: Granger Causality/Block exogeneity test

Dependent variable	Wald test statistics				
	D(LNGDP)	D(LNREM)	D(LNEDU)	D(LNCREDIT)	D(LNGCF)
D(LNGDP)	-	2.43	0.22	0.25	14.62**
D(LNREM)	4.38	-	0.83	3.74	8.28*
D(LNEDU)	0.38	2.82	-	0.61	1.07
D(LNCREDIT)	6.78*	6.06*	9.70**	-	1.01
D(LNGCF)	6.85*	1.31	1.79	8.15*	-

3.5 Robustness check

To establish the reliability and validity of the estimate produced by VECM model, we have used several diagnostic tests (for serial autocorrelation, heteroskedasticity and normality) and the dynamic stability tests. Similarly, we carried out Generalized Impulse Response Function (GIRF) and Innovation analysis which are in line of the findings of VECM model establishing the robustness of our analysis. The details of this analysis is presented in the Supplemental Appendix for the brevity of the main document.

The robustness of the analysis may, however, be jeopardized from the "spurious regression" due to non-stationary of the time series (Granger & Newbold 1974). To address this issue, we carried out the unit root tests and Johansen's cointegration test. However, the structural breaks in the time-series, (somehow ad hoc) choices to be made about the prior model specification like choice of the deterministic parts, lag length selection and innovation process distribution may impact our model estimates (Ghouse et al. 2018). Hence, further robustness check was carried out for structural breaks and Gregory-Hansen (G-H) cointegration test (Gregory & Hansen 1996a,b) and Bayer & Hanck (2013) test of non-cointegration test. For details of the tests, refer to Supplemental Appendix.The analysis shows that our VECM specification is robust to structural breaks.

IV. DISCUSSION AND CONCLUSION

In this paper, we analyzed the dynamic effects of remittances in economic growth of Nepal. Remittance is one of the important factor contributing to Nepal's economy. Despite its importance, the studies on the role of remittances in economic growth in Nepal is relatively less and even the existing literature are plagued with data, theoretical and/or empirical incompetency. Hence, this paper tries to address this gap. We applied "augmented" Solow growth model (Mankiw et al. 1992, Rao 2010), which provides theoretical ground for our analysis. We applied cointegration test, long run structural modeling (LRSM), vector error correction model, Granger causality test, generalized impulse response functions, persistence profile and variance decomposition to explore the dynamic relation between remittances and economic growth along with other variables. The cointegration test showed the presence of two cointegration vec-tors (CVs) among the LNGDP, LNREM, LNCREDIT, LNGCF and LNEDU. This implies the existence of statistical significant relationship among these variables, but coefficients of these CVs may not have theoretically meaningful interpretation. So, to uncover the theoretically meaningful relationships from the CVs, we applied LRSM by imposing exactly identifying and over-identifying restrictions. The LRSM shows that there is long-run relationship between remittances and GDP per capita. To discover the short-run dynamics among the variables, we applied VECM which showed remittances do not contribute for the short-run to economic growth in short-run.

Figure 3: **Schematic diagram representing short-run Granger Causually**
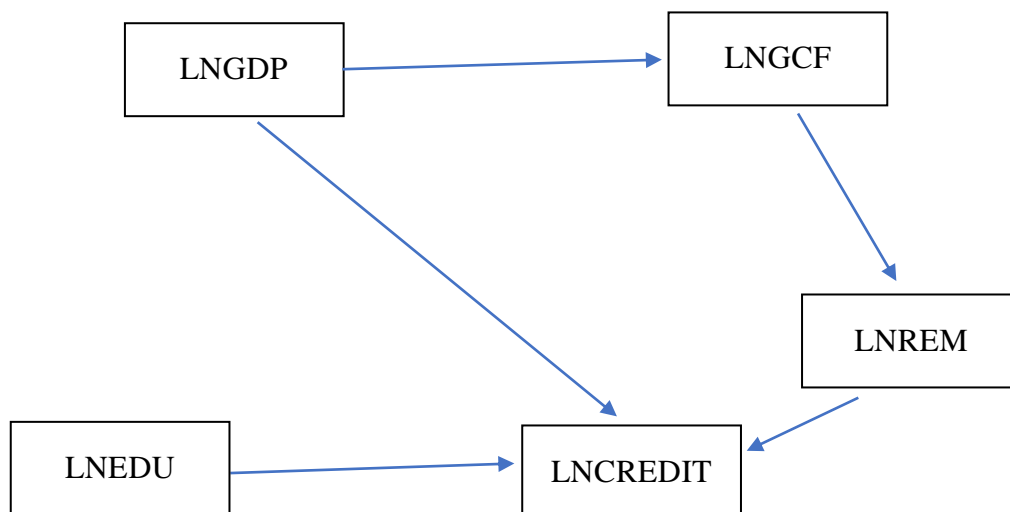
Next, we checked for the direction of causality among the variables for both long-run and short-run relationships. To infer the direction of long-run causality, we used weak exogeneity test. The analysis showed that there is bidirectional causality between the remittances and GDP per capita in long run. LNGCF and LNEDU, on the other hand, have unidirectional causality running to LNGDP and/or LNREM. To check for the short-run causality, we applied Granger causality/block homogeneity test. The result showed that there is bidirectional causality between the GDP and the GCF in short-run. However, there is no direct causality between remittances and the GDP. There is one way causality from LNGCF to LNREM and from LNREM to LNCREDIT in short-run.

Similarly, we used innovation analysis (Generalized impulse response function and Generalized forecast variance decomposition) show dynamic effect of the remittances in the economy and its role in economic development as robustness. The findings are presented in the Supplemental Appendix section of the paper. The results from Generalized impulse response function (GIRF) analysis showed that the shock in the remittance flow have slightly negative impact on real GDP per capita during the forecast horizon (of ten years). Similarly, there instantaneous negative impacts on the dynamics of other variables and take longer time to return to the equilibrium. Similarly, the shocks on other variables (LNGDP, LNGCF and LNCREDIT) have negative impact on the remittance flow for first few and eventually returns to initial equilibrium. This indicates the remittance flow affects the dynamics of other variables and also affected by other variables. The shock in the LNEDU, however, have negative and permanent effects on the remittance inflow. We also check if the dynamic long-run relationships are stable over time by checking role of shocks in cointegrating equations. Our analysis showed that the long-run cointegrating relationship is stable and shocks to remittances as well as the system-wide shocks come to equilibrium with five to six years. By using Generalized Error forecast variance decomposition (EFVD) analysis, we showed that human capital (proxied by LNEDU) and remittance inflows are the most important factors in determine economic growth in Nepal as there are most exogenous (leading) in the system. Our overall analysis show that remittances play important role in the economic growth in Nepal and shaping the dynamics of other variables in the system.

Our findings are in line of existing literature which show remittances have small but positive impact on the economic growth (Cazachevici et al. 2020). In short run, remittances have no effect on the economic growth. These findings are consistent with previous study which echoed that the remittances received by household are mostly spent in consumption purpose and are not invested in productive uses (CBS 2011) which may not direct impact on the economic growth in short-run. However, even in sort-run, remittances may have indirect effects on economic growth via other channels. Our analysis showed that the remittances have causal impact financial development (proxied by GDP share of credit to private sector) which may, in turn, affect the economic growth in short-run. Our analysis also showed that human capital (proxied by Gross enrollment in secondary education) have highest and persistent effect on the economic growth in long-run. Several household-level studies have shown that remittances help in improving the educational attainment in remittance-receiving household (Zhunio et al. 2012, Mansour et al. 2011, Thapa & Acharya 2017). So, remittances can also help in economic growth in long-run through its impact on human capital formation.

The dynamic analysis showed that any (negative) shock in remittances flow could have negative im-pact in economic growth for longer period of time. Similarly, the shock in remittance flow could have negative impact on other variables (LNGCF, LNCREDIT and LNEDU) in the system atleast for first few years of the forecast horizons. Similarly, except for LNEDU, remittances response positively to shocks on other variables in the system

(LNGDP, LNCREDIT and LNGCF) showing counter-cyclical nature of the remittances flow. This finding corroborates with stable (but low (an average growth rate)) economic growth and sustained achievement in human development indicators in Nepal even after prolonged political instability and civil conflicts in Nepal. Overall, remittance inflow have direct and indirect positive impact on the economic growth of Nepal.

While highlighting the positive impact of remittances on economic growth on Nepal, an equally important, if not more, factors to be addressed is the welfare of the migrant workers themselves who are the prime sources of the remittances. Nepali migrant workers are employed mainly as unskilled workers and are often subjected corrosive and exploitative working environment (MoLE 2014). Moreover, other social impacts associated with labor migration and the remittances inflow should also be addressed while emphasizing the positive impact of the remittances. There are several pros and cons of remittance flow but microeconomic as well as aggregate level beyond its impact on economic growth (Amuedo-Dorantes 2014). Hence, better understanding of the impact of the remittances is needed for formulating policy measures.

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Supplemental Appendix:
Role of migrants' remittances on economic growth: Evidence from Nepal

December 31, 2021

1. PRELIMINARY ANALYSIS

1.1 Unit Root Test

Since we are dealing with the macro time-series variables which are normally non-stationary in nature, we have take care of the time series properties of these variables. For example, use of non-stationary data gives rise to the problem of spurious regression. Hence, first step in time series analysis is to check the stationerity of the time series.

We carry out the battery of conventional unit root tests for all the variables used in the paper to find out the order of integration ((non)-stationarity) of the series. The analysis without considering properties of the data i.e. (non)-stationarity of the data may lead to 'spurious' estimates from the analysis. We carry out three types of unit root tests in our analysis namely Augmented Dicky Fuller (ADF), Phillips-Perron

(PP) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests. There are practical considerations to be taken care of while carrying out these tests. For example, the selection of lag-length while carrying out ADF test is crucial as the inference from the test may vary based on the selection of the lag-lengths. Hence, we follow the practical guidelines from Asteriou & Hall (2015) and Rummel (2015). For all the unit root tests considered, the maximum lag lengths was assigned to be 4 and optimal lag length was selected using "general-to-specific sequential t-rule".

The test statistics for the unit root tests are are presented in table (1). Out of three test statistics, ADF and PP tests show that all the series under consideration are integrated of order one, I(1) while KPSS test show that three variables are of I(1) while others three are not. This type of test results are norms rather than exception. Based on all three test statistics, we conclude that the all the series under considerations are of I(1).

1.2 Cointegration testing and testing for model fit

We conclude, from unit root tests, that the variables used in the analysis are all of I(1). So, now we check for the possible long-run or cointegrating relationships between the variables using on the Johansen methodology (Johansen 1988, 1991). Trace and Maximal Eigen value statistics can calculated from the Johansen methodology is used to determining the cointergrating relationship. There are several steps and practical considerations in testing cointegration under Johansen methodology. We follow these steps sequentially to carry out cointegration test following Asteriou & Hall (2015) and Brooks (2014).

Table 1: Unit root test results

	Level		First difference		
Variables	**Const.**	**Const. with trend**	**Const.**	**Const. with trend**	**Inference**
Augmented Dicky fuller (ADF) test					
lnGDP	1.641	-1.693	-1.855	-7.543***	I(1)
lnREM	-0.145	-1.822	-1.990	-5.037***	I(1)
lnEDU	-0.771	-2.830	-4.070***	-3.948**	I(1)
lnGCF	-0.562	-2.273	-7.278***	-7.182***	I(1)
lnCREDIT	0.069	-3.342	-4.958***	-4.854***	I(1)
Phillips-Perron (PP) test					
lnGDP	2.866	-1.637	-6.979***	-8.375***	I(1)
lnREM	-0.360	-2.055	-5.296***	-5.315***	I(1)
lnEDU	-1.689	-3.017	-4.101***	-4.011**	I(1)
lnGCF	-0.106	-2.800	-7.617***	-7.680***	I(1)
lnCREDIT	0.084	-3.054	-5.065***	-5.022***	I(1)
Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test					
lnGDP	0.785***	0.139	0.521**	0.087	I(1)
lnREM	1.330***	0.133	0.200	0.128	I(1)
lnEDU	0.408	0.091	0.165	0.117	I(0)/I(1)
lnGCF	0.405	0.123	0.162	0.071	I(0)/I(1)
lnCREDIT	2.875***	0.062	0.064	0.046	I(1)

Selection of the appropriate (optimal) lag length is essential for the cointegration test. The general procedure to select the optimal lag length is to estimate standard VAR models in level data with maximum lag-length p, and subsequently with (p-1), (p-2) and so on. Among them, the appropriate model with optimal lag length is, then, selected using information criteria (AIC and BIC). The diagnostic tests for autocorrelation and heteroskedasticity is also carried out as the model with optimal lag length should also pass these tests. We estimate standard VAR models starting from maximum lag length of 3. The summary of the information criteria of the estimated models are given in table (2). Using Schwarz information criterion (SIC), we find the optimal lag length for the model to be 1 whereas Akaike information criterion (AIC) selected the lag-length of 3.

The lag length, thus, selected should be free from autocorrelation and heteroskedasticity and normality. Hence, we further carry out these tests for both V AR(1) and V AR(3) models to check model fit. The test results are presented in table (3). Ideally, it would be better to choose the one with shorter lag length given the size of our sample and other consideration. However, VAR(1) model do not satisfy the normality test whereas VAR(3) model satisfy all three diagnostic tests. Hence, we chose lag length of 3 for further analysis.

Table 2: Lag length selection criterion for VAR model

Lag	LogL	LR	FPE	AIC	SC	HQ
1	216.3757	NA	6.39e-12*	-11.59852	-10.46481*	-11.21706*
2	236.4574	27.99277	9.39E-12	-11.30045	-9.033014	-10.5375
3	270.4255	37.05609	7.07E-12	-11.84397*	-8.442817	-10.6996
4	292.3726	17.29163	1.56E-11	-11.65894	-7.124072	-10.1331

Note: * indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 3: Test of model fit (VAR model)

	VAR(1)		VAR(3)	
Test	**Stat**	**p-value**	**Stat**	**p-value**
Joint Normality (Jarque-Bera) test	43.641	0.000	18.005	0.055
Serial correlation LM test	27.133	0.349	24.734	0.477
Heteroskedasticity test (joint)	161.517	0.246	466.715	0.283

Note: The lag-length for serial correlation test are selected as 1 and 3 for VAR(1) and VAR(3) models respectively.

Once the optimal lag length of the model is chosen, next step is to check whether the cointegrating relationships exist between variables. The trace statistics and maximal Eigen value statistics are use for determining r cointegrating vectors. The important consideration while estimating equation VECM is whether intercept and/or trend or both enters in the model in short-run and/or long run. Based on this following five scenarios can be observed;

–   Model 1 : No intercept or trend in CE or V AR
–   Model 2 : Intercept (no trend) in CE, no intercept or trend in V AR
–   Model 3 : Intercept in CE and V AR, no trend in CE and V AR
–   Model 4 : Intercept in CE and V AR, linear trend in CE, no trend in V AR
–   Model 5 : Intercept and quadratic trend in the CE intercept and the linear and linear trend in V AR

So, it is difficult to determine a priori the appropriate restrictions on intercept/trend specification for testing of co-integration. Out of five models, model 1 and model 5 are of little practical significance (Brooks 2014, Asteriou & Hall 2015). We use 'Pantula principle' to select the appropriate intercept/trend specifications (Brooks 2014, Asteriou & Hall 2015). For this, we carry out the Johansen cointegration tests for all alternative models and compare the trace and maximal eigenvalue test statistics to select the appropriate model. The test statistics for cointegration tests of three alternative models are summarize in table (4).

Based on the trace statistics selects model 2 whereas Maximal Eigen-value selects model 3 yielding conflicting results. So, we use additional information from VEC stability condition checks for selecting appropriate deterministic component (i.e. between model 2 vs. model 3). For the stability of the VECM, it requires that the VECM with cointegrating rank r should

have r (modulus of) characteristic roots equals unity and all other roots should be less than unity. Otherwise the system is not stable. For this purpose, first we check for cointegrating rank using model 2 and model 3 as deterministic component separately and check for the stability of the VECM with cointegrating rank r, thus, estimated. Using model 2 as deterministic form, Johansen's cointegration test shows the existence of three (from trace statstics) or two (from maximal eigen value statstics) whereas Johansen's test with model 3 as determistic

term shows the presence of two coingegrating relation (from both trace and eigen value statistics). Now, we check for the roots of characteristic polynomial of VECM for r cointegrating relation. The test results are presented in table (5). The roots of characteristic polynomial (modulus) value of the cointegration test with model 2 as deterministic term is more than one signaling the instability of dynamic model whereas the cointegation test with model 3 as deterministic term has two roots of characteristic polynomial (modulus) with exact unity value and all other roots lying below unity. Hence, we choose cointegration test with model 3 as deterministic term for further analysis.

In the next step, we report the cointegration test for the model selected above i.e. model 3 (intercept (no trend) in CE and test VAR) specification as deterministic component in table (6). Both the trace and maximal eigenvalue statistics confirms the presence of two co-integrating relationships. Hence, we conclude the presence of two cointegrating vectors in the model and proceed with this specification for further analysis.

2. ROBUSTNESS ANALYSIS

2.1 Innovation analysis/accounting

Estimation of VECM often involves estimation of large number of parameters and interpreting and understanding the properties of these coefficients are more difficult (Lütkepohl & Reimers 1992). In this context, Impulse response function (IRF) and Error forecast variance decomposition (EFVD) analysis (collectively called innovation accounting analysis) provides useful way to interpret the coefficients. IRF analysis helps to trace the response of impulse (exogenous shocks) on one variable to some or all other the variables (or/and cointegrating equations) in VECM system and the time path of the variables may give interesting insights into short run and long run interactive relationship which is generally not available from Granger-causality analysis. The IRF is generally sensitive to the ordering of the variables where the shocks need to be orthogonal, so we use generalized impulse response function (GIRF) as it is in-variant of the ordering of the variables (Pesaran & Shin 1998, Pesaran 2015) which is free from ordering dependence. Similarly, error forecast variance decomposition (EF V D) method helps to quantify the proportion of the movements in a timeseries due to its "own" shocks versus shocks to the other variable in the system (Enders 2015). We use generalized version EF V D given by Lanne & Nyberg (2016) which is based on GIRF as EFVD is sensitive to ordering due to Cholesky decomposition similar in IRF.

Table 4: Pantula Principle

Hypothesis		Trace Statistic					
		Model 2		Model 3		Model 4	
Null	Alternative	Statistic	Critical value	Statistic	Critical value	Statistic	Critical value
r=0	r=1	55.9071	34.4	34.6121	33.64	40.0554	37.86
r≤1	r=2	31.6303	28.27	28.9231	27.42	33.0134	31.79
r≤2	r=3	19.2173*	22.04	18.4967	21.12	26.2776	25.42
r≤3	r=4	11.2056	15.87	10.0449	14.88	15.6254	19.22
r≤4	r=5	7.6321	9.16	0.040916	8.07	9.8586	12.39
				Maximal Eigen value statistics			
r=0	r≥1	125.5924	75.98	92.1177	70.49	124.8303	87.17
r≤1	r≥2	69.6853	53.48	57.5056	48.88	84.7749	63.00
r≤2	r≥3	38.055	34.87	28.5825*	31.54	51.7615	42.34
r≤3	r≥4	18.8377	20.18	10.0858	17.86	25.484	25.77
r≤4	r=5	7.6321	9.16	0.040916	8.07	9.8586	12.39

Note: Critical value is given for 5% significance level. * Denotes the first time when the null hypothesis is not rejected for the 5% significance level.

Table 5: VEC stability condition check

Roots of Characteristic Polynomial (modulus)		
Model 2, r=2	Model 2, r=3	Model 3, r=2
1.002	1.011	1.000
1.000	1.000	1.000
1.000	1.000	0.962
1.000	0.907	0.927
0.896	0.907	0.927
0.896	0.893	0.907
0.779	0.893	0.907
0.779	0.571	0.569
0.602	0.571	0.569
0.602	0.558	0.564
0.597	0.553	0.546
0.487	0.551	0.546
0.431	0.551	0.523
0.369	0.443	0.430
0.369	0.443	0.430

Table 6: Cointegrration test

Hypothesized No. of CE(s)	Eigenvalue	Statistic	Critical Value (0.05)	Prob.**
Unrestricted Cointegration Rank Test (Trace)				
None *	0.712	104.549	69.819	0.000
At most 1 *	0.654	63.515	47.856	0.001
At most 2	0.448	28.454	29.797	0.071
At most 3	0.228	8.837	15.495	0.381
At most 4	0.009	0.307	3.841	0.580
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
None *	0.712	41.033	33.877	0.006
At most 1 *	0.654	35.061	27.584	0.005
At most 2	0.448	19.617	21.132	0.080
At most 3	0.228	8.530	14.265	0.327
At most 4	0.009	0.307	3.841	0.580

*   denotes rejection of the hypothesis at the 0.05 level
**   MacKinnon-Haug-Michelis (1999) p-values

The figure 1 shows the results of GIRF for one standard deviation shock on the equation for LNREM on itself and the other variables in the system over the horizon of 10 years. The confidence interval are reported at 95% level and estimated using bootstrapping technique with 1000 repetitions. Figure 1 shows that the remittance shocks have larger and more persistent effect on remittance itself followed by LNGCF, LNCREDIT, LNEDU and LNGDP. The effect of shock ranges to 0.5% to 5% from the equilibrium during the forecast horizon. Overall, the shock in remittance have negative impact on LNGDP throughout the forecast horizon. For other variables (LNGCF, LNCREDIT, LNEDU), the shocks have negative impact instantaneously and returns to the equilibrium during the forecast horizons. The shocks in LNREM is responsive to itself reaches to higher level of equilibrium in the consecutive years onward. The overall result shows that the shock in the remittances have negative effects on other variables instantaneously and returns to equilibrium (except for LNGDP) during forecast horizons. For LNGDP, the effect of shock seems permanent and last for longer period of time.

Figure 2 shows results of generalized impulse response for one standard deviation shocks on the equation for LNGDP, LNCREDIT, LNGCF and LNEDU on LNREM. As above, the confidence interval are reported at 95% level and estimated using bootstrapping technique with 1000 repetitions. The results from GIRF shows shocks on LNGDP, LNCREDIT and LNGCF have positive impact on LNREM while shock to LNEDU have negative impact on LNREM. Comparing with figure 1, the impacts of shock on other variables on remittances are higher compared to impact on other variables due to the shock in remittances.

We explore the results from figure 2 in more details. Figure 2(a) shows the effect of impulse response of LNGDP on remittances which shows that the effect is slightly positive after first year and decrease slightly thereafter till fourth year and increases again during the forecast horizon. Figure 2(b) shows the response of LNREM to one S.E. shock on the equation for LNCREDIT. The shock in LNCREDIT has overall positive effect on LNREM during the forecast horizon. Similarly, the impulse response of LNGCF has positive effect on LNREM.

Lastly, the shock in LNEDU have negative effect on the LNREM during the forecast horizon. These results show that LNREM responses positively to the shocks in other variables (except LNEDU). This shows the pro-cyclical nature of the remittance flow in Nepal.

We also consider how the shocks in the variables or system-wide shocks on the cointegrating vector(s) rather than individual variable(s) in the model. This analysis helps to estimate the time profile of the effect of shock which contains the useful information on the speed with which the economy returns to equilibrium once the economy receives shock (Pesaran & Shin 1996, Pesaran 2015). This helps to analyze the long-run adjustment mechanism of the system.

Figure 3(a) shows the effect of one S.E. shock on LNREM on the cointegrating vectors. As expected, the time profile of shocks on both cointgrating vectors die out over time implying the stability of cointgreating vectors. It shows that it takes six years for CV1 to returns to equilibrium once one S.E. shock in induced in LNREM while it takes even longer time for CV2 to returns to equilibrium. Similarly, figure 3(b) shows the effect of system-wide shocks on cointegrating vectors also knowm as "persistence profile". The persistence profile shows that it takes five year for CV1 to return to equilibrium to one S.E. system-wide shock while it takes about nine years for CV2 to return to equilibrium. These results show that the remittances have deeper effects on the cointegrating relation and the in overall system. This highlights that remittance is integrated to Nepal's economy and any shocks in the remittance flow could take longer time for the economy to return to equilibrium.

Figure 1: Generalized impulse response(s) on other variables in the system to one S.E. shocks to the equation of LNREM

(a) Response of LNGDP to one S.E. shock on equation for LNREM
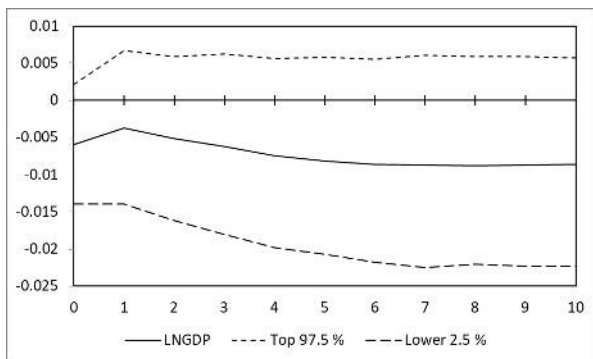
(b) Response of LNCREDIT to one S.E. shock on equation for LNREM
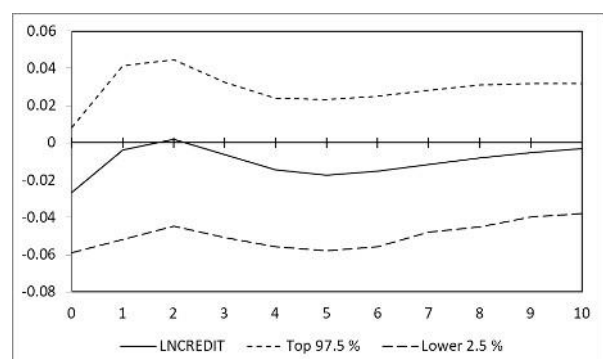
(c) Response of LNGCF to one S.E. shock on equation for LNREM
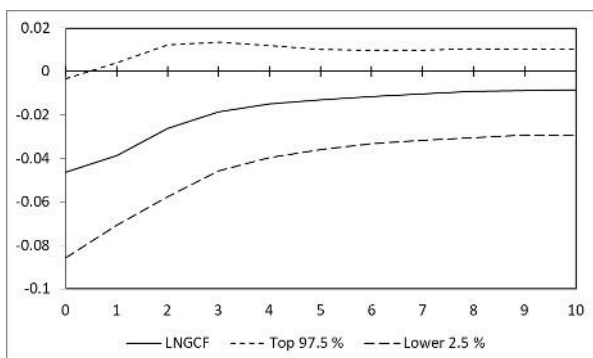
(d) Response of LNREM to one S.E. shock on equation for LNREM

(e) Response of LNGCF to one S.E. shock on
equation for LNREM

LNEDU   ---- Top 97.5 %   ―――Lower 2.5 %
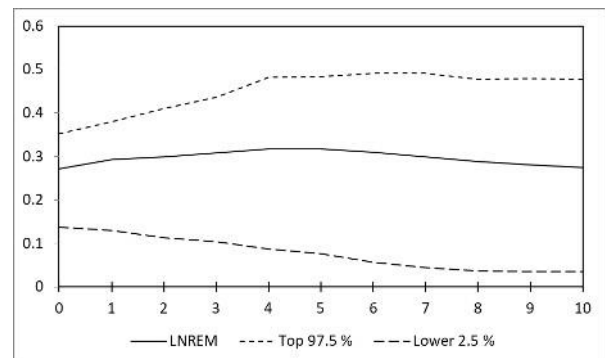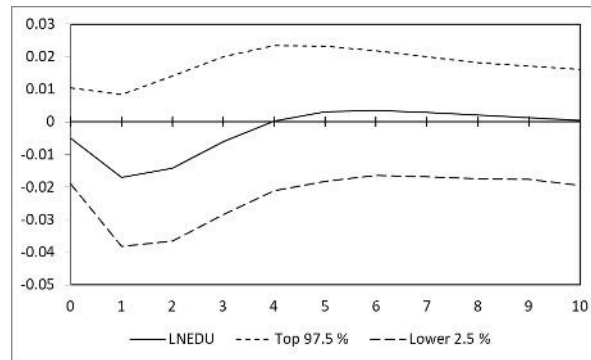
Next, we apply the generalized forecast error variance decomposition (GFEVD) to the system five variables. The results for four different forecast horizons (1, 2, 5 and 10 years) are presented in table 7. In GFEVD the total amount of all variance for each variable is not summed up to one as the covariance between the original shocks is non-zero, thus we apply weight to normalize all the variances to one when added the row values. Approximately 64% of the forecast error variance of LNGDP is accounted by its own innovations in first period and decreased over forecast horizon and reached to about 48% in 10th year. LNGCF explains the highest proportion of the variance in LNGDP followed by LNCREDIT, LNREM and LNEDU. LNREM explains about 5% of the total variance of LNGDP over forecast horizon. The importance of these variables increase over time to explain the variance. This shows that other variables in the system are important in determining the dynamics of the LNGDP over forecast horizon.

Figure 2: Generalized impulse response(s) of LNREM to one S.E. shocks to equation of other variables in the system

(a) Response of LNREM to one S.E. shock on equation for LNGDP

(b) Response of LNREM to one S.E. shock on equation for LNCREDIT

LNGDP   ---- Top 97.5 %   ―――Lower 2.5 %

LNCREDIT   ---- Top 97.5 %   ―――Lower 2.5 %
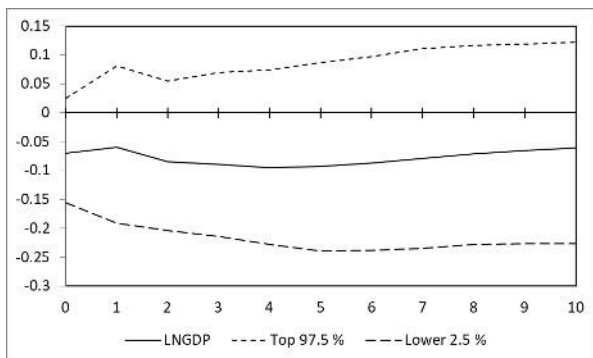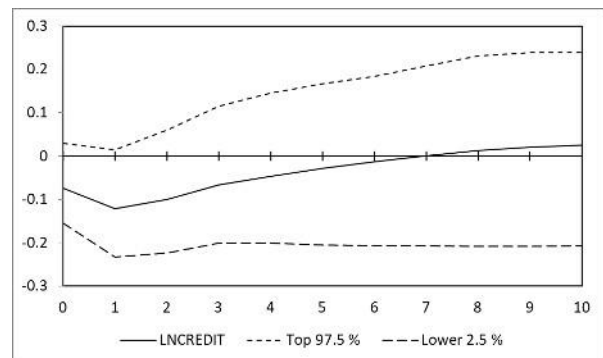
(c) Response of LNREM to one S.E. shock on   (d) Response of LNREM to one S.E. shock
      equation for LNGCF   on equation for LNEDU
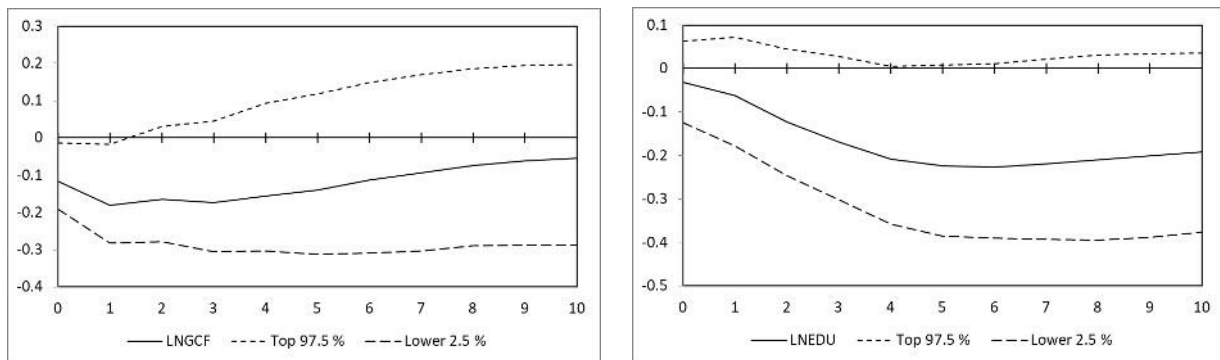
**Figure 3: Generalized impulse response(s) of cointegrating vectors (CV)s to
one S.E. shocks to equation LNREM and system-wide shocks to CV(s)**

(a) Response of CV(s) to one S.E. shock in   (b) Persistence profile of the effect of a
      LNREM   system-wide shocks to CV(s)
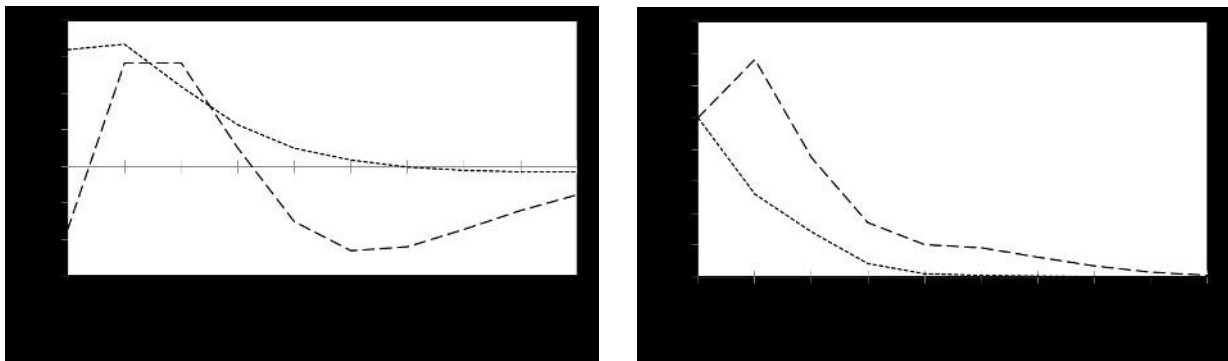
In LNCREDIT, approximately 90% of the variance is explained by its own innovations in first year of the forecast horizon which decreases over period and approximately 57% in 10th year of the forecast horizon. About 3% of the total variance in LNCREDIT is explained by LNREM during the forecast horizon. This shows that other factors are important in explaining the dynamics of LNCREDIT. Similarly, about 58% of the variance in LNGCF is explained by its own innovations and remain more or less stable over time and reaches to about 56% in 10th year of the horizon. About 12% of the variance in LNGCF is explained by LNREM during the forecast horizon. In case of LNEDU, 83% of the variance is explained by its own innovations in the first year of the forecast horizon and slowly decreases over time and reaches to approximately 70% in 10th year of the forecast horizon. This shows that not much of influence of other variables in determining the dynamics of education. Remittances contributes about 4% of the total variances in LNEDU over forecast horizon.

Now, we focus on the contributions of other variables in determining the variance on remittances. About 67% of the variance is explained by its own innovations in the first period. Apart from this, LNGCF and LNEDU explains the significant proportion (approximately 15%) of the variance of LNREM. The role of LNGCF is more and stable during forecast horizon whereas the role of education increases steeply. LNGDP and LNCREDIT explains about 5% of variances in LNREM. This shows that dynamics of remittance is highly interdependent on dynamics of other variables in the system.

Similarly, about 83% of the variance in explained by its own innovations in the first

period.   Apart from this, LNGDP and LNREM explains the significant proportion of the variation in LNEDU. Compared to other variables, the dynamics of other LNEDU is less interdependent on dynamics of other variables in the system.

The numbers in the bold font in table 7 show the forecast error variance explained by its own shocks in the fifth and tenth years for each variable respectively. The higher values for LNEDU compared to LNGDP shows that LNEDU is more exogenous (leading) than LNGDP implying that change in education level significantly affects economic growth in Nepal. After LNEDU, LNREM and LNCREDIT are more exogenous than LNGDP which implies that the deviation in these variables significantly affects the economic growth.   These findings are in line with our findings from VECM and Granger causality estimates.

3.   ROBUSTNESS CHECK

To establish the reliability and validity of the estimate produced by VECM model, we have used several diagnostic tests (for serial autocorrelation, heteroskedasticity and normality) and the dynamic stability tests. These tests (reported in section 3) show that our estimates are technically sound. Similarly, we carried out GIRF and Innovation analysis which are in line of the findings of VECM model establishing the robustness of our analysis.

The robustness of the analysis may, however, be jeopardized from the "spurious regression" due to non-stationary of the time series (Granger & Newbold 1974). To address this issue, we carried out the unit root tests and Johansen's cointegration test. However, the structural breaks in the time-series, (somehow ad hoc) choices to be made about the prior model specification like choice of the deterministic parts, lag length selection and innovation process distribution may impact our model estimates (Ghouse et al. 2018). Hence, to check if the structural breaks in the time-series may hamper our findings, we carry out four unit root tests for structural breaks (one or two breaks). The results of the unit root tests are reported in table 8 in appendix. Unfortunately these tests produce contradictory findings and inclusive about the (presence or absence of) structural breaks. So, to check if structural break(s), in fact, affect the cointegration results, we carry out Gregory-Hansen (G-H) cointegration test (Gregory & Hansen 1996a,b). The null hypothesis of the test is no cointegration against the alternative of cointegration with a single shift (in level, trend, regime or regime and trend). The test statistics for G-H test (table 9) do not lend support to the existence of cointegration with shift. This test result shows that the structural break(s) in the series should not affecting cointegration among the series.

Table 7: Generalized error forecast variance decomposition

	Horizon	LNGDP	LNCREDIT	LNGCF	LNREM	LNEDU
LNGDP	1	0.642	0.045	0.244	0.036	0.032
	2	0.615	0.057	0.260	0.036	0.032
	5	0.523	0.071	0.316	0.045	0.045
	10	0.477	0.075	0.329	0.054	0.065
LNCREDIT	1	0.029	0.897	0.036	0.036	0.002
	2	0.035	0.895	0.037	0.028	0.005
	5	0.063	0.715	0.051	0.028	0.143
	10	0.074	0.575	0.037	0.024	0.290
LNGCF	1	0.169	0.068	0.583	0.140	0.040
	2	0.181	0.070	0.579	0.133	0.038
	5	0.213	0.061	0.566	0.124	0.036
	10	0.246	0.051	0.559	0.113	0.030
LNREM	1	0.035	0.085	0.193	0.667	0.020
	2	0.040	0.079	0.189	0.641	0.052
	5	0.045	0.041	0.161	0.597	0.155
	10	0.042	0.024	0.112	0.598	0.224
LNEDU	1	0.081	0.019	0.019	0.051	0.830
	2	0.082	0.041	0.013	0.055	0.810
	5	0.075	0.071	0.044	0.042	0.769
	10	0.069	0.125	0.065	0.034	0.707

Table 8: Unit root tests with structural break

Variable	test	break	breakdate	test statistics	p-value
LNGDP	ZA	intercept	2011	-3.609	*
LNGDP	ZA	trend	2008	-6.115	**
LNGDP	ZA	both	2006	-6.029	*
LNGDP	Perron	intercept	2011	-4.296	
LNGDP	Perron	trend	2008	-6.124	**
LNGDP	Perron	both	2005	-5.992	*
LNGDP	LS	one (crash)	1999	-1.666	
LNGDP	LS	two(crash)	1997/2007	-1.614	
LNGDP	ClemAO1	one break	2009	-1.845	
LNGDP	ClemAO2	two break	1995/2007	-2.287	
LNGDP	ClemIO1	one break	2006	-1.194	
LNGDP	ClemIO2	two break	1992/2006	-1.18	

Variable	test	break	breakdate	test statistics	p-value
LNREM	ZA	intercept	2002	-6.878	**
LNREM	ZA	trend	1993	-1.958	
LNREM	ZA	both	2002	-6.230	**
LNREM	Perron	intercept	2001	-6.970	**
LNREM	Perron	trend	2011	-1.775	
LNREM	Perron	both	2001	-7.119	**
LNREM	LS	one (crash)	2005	-2.445	
LNREM	LS	two(crash)	2003/2005	-2.716	
LNREM	ClemAO1	one break	2003	-5.037	*
LNREM	ClemAO2	two break	1999/2003	-1.115	
LNREM	ClemIO1	one break	2000	-7.099	*
LNREM	ClemIO2	two break	2000/2007	-7.677	*
LNGCF	ZA	intercept	2009	-3.845	*
LNGCF	ZA	trend	2004	-4.197	*
LNGCF	ZA	both	1999	-4.902	**
LNGCF	Perron	intercept	1998	-3.936	
LNGCF	Perron	trend	2005	-3.697	
LNGCF	Perron	both	1998	-4.479	
LNGCF	LS	one (crash)	1996	-3.461	
LNGCF	LS	two(crash)	1998/2009	-3.779	
LNGCF	ClemAO1	one break	2006	-3.600	*
LNGCF	ClemAO2	two break	1992/2007	-4.783	
LNGCF	ClemIO1	one break	2002	-2.661	
LNGCF	ClemIO2	two break	1991/2006	-3.612	
LNEDU	ZA	intercept	1998	-6.090	**
LNEDU	ZA	trend	2007	-3.166	*
LNEDU	ZA	both	1997	-6.073	**
LNEDU	Perron	intercept	1997	-6.045	**
LNEDU	Perron	trend	2010	-3.244	
LNEDU	Perron	both	1997	-6.589	
LNEDU	LS	one (crash)	2008	-2.427	
LNEDU	LS	two(crash)	2002/2008	-2.561	
LNEDU	ClemAO1	one break	2008	-2.882	
LNEDU	ClemAO2	two break	1993/2007	-3.106	
LNEDU	ClemIO1	one break	2006	-3.936	
LNEDU	ClemIO2	two break	1998/2006	-4.978	
LNCREDIT	ZA	intercept	2002	-4.467	**
LNCREDIT	ZA	trend	NA	NA	NA
LNCREDIT	ZA	both	2002	-4.327	**
LNCREDIT	Perron	intercept	2001	-4.411	
LNCREDIT	Perron	trend	1997	-3.222	
LNCREDIT	Perron	both	2001	-4.337	
LNCREDIT	LS	one (crash)	1999	-3.640	*
LNCREDIT	LS	two(crash)	1993/2007	-3.739	*
LNCREDIT	ClemAO1	one break	2010	-1.695	
LNCREDIT	ClemAO2	two break	1994/2006	-2.78	
LNCREDIT	ClemIO1	one break	2004	-1.28	
LNCREDIT	ClemIO2	two break	1992/2005	-3.333	

Note: * and ** represents statistical significance at 5% and 1% level respectively. NA shows that the test statistics is not available.

- ZA stands for Zivot & Andrews (2002) Unit root test
- Perron stands for Perron (1997) Unit root test
- LS stands for Lee & Strazicich (2003, 2004) Unit root tests
- ClemAO1 and ClemAO2 stands for Clemente et al. (1998) unit root test for additive outliers for one break and two breaks respectively
- ClemIO1 and ClemIO2 stands for Clemente et al. (1998) unit root tests for innovative outliers for one break and two breaks respectively.

Table 9: Gragory-Hanson Cointegration test

Test	Statistic	Breakpoint	Date	Crtical value (5%)	Conclusion
ADF	-5.12	level	2011	-5.56	
Zt	-5.19	level	2011	-5.56	No cointegration
Za	-32.98	level	2011	-59.4	
ADF	-3.80	trend	2011	-5.83	
Zt	-5.89	trend	2011	-5.83	No cointegration
Za	-36.13	trend	2011	-65.44	
ADF	-4.79	regime-shift	1997	-6.41	
Zt	-6.05	regime-shift	2008	-6.41	No cointegration
Za	-37.30	regime-shift	2008	-78.52	
ADF	-5.27	regime-shift with trend	2009	-6.84	
Zt	-6.75	regime-shift with trend	2005	-6.84	No cointegration
Za	-40.30	regime-shift with trend	2005	-88.47	

Table 10: Bayer-Hanck Cointegration test

Test	Test statistics	Critical value (5%)	Conclusion
EG-J:	56.168099	10.576	Cointgrated
EG-J-Ba-Bo:	166.69218	20.143	Cointgrated

Gregory-Hanson test, on the other hand, shows the another possibility that the cointegration may not exists at all (supports null hypothesis of no cointegration). So, to confirm the existence of the cointegration in the model, we carry out Bayer & Hanck (2013) test of non-cointegration. Bayer-Hanck cointegration test combines the elements from other cointegration tests and provides summary statistics of the test. The test statistics (table 10) clearly lends supports in favor of the existence of the cointegration. These discussions show that our estimates could not affected by structural breaks.

One alternative to our analysis could be estimation of the model using ARDL and bound testing approach due to Pesaran et al. (2001) which is seen as appropriate to small sample size and useful when the series are integrated of different order (I(0) or/and I(1)). One important limitation of ARDL model is that it assumes existence of only one cointegration relation among the variables and provides inconsistent estimates when order of integration is more than one(Dergiades & Tsoulfidis 2011). As our VECM estimate shows that there are two cointegrating relationships in the model, ARDL model may not be appropriate. Hence, we do not rely on ARDL model for robustness check.

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Impact of COVID-19 on Nepal Stock Exchange (NEPSE): An Event Study Approach

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Abstract

The article aims to analyze the impact of COVID-19 pandemic announcement date of March 11, 2020 on sectoral returns of Nepal Stock Exchange (NEPSE) and semi-strong market efficiency of NEPSE according to Efficient Market Hypothesis (EMH). For this, the study samples the abnormal returns of sectoral indices of financial sectors that dominate the NEPSE. Similarly, the use of market model under event study methodology deduces the significant abnormal returns around the event day of pandemic announcement by World Health Organization (WHO) (March 11, 2020), seven days before and after the announcement. The result contradicts with some literature as the paper implies not much significant impact of pandemic announcement, with negative impact on different financial sectors at NEPSE. Furthermore, the market pre-reacts to the publicly available information, thereby not aligning with the semi-strong efficient market. This shows the possibility for the investors to work on the public information for achieving above normal returns during the crises as COVID-19 that may occur in future. Similarly, for future studies, researches can also look into other factors like vaccine penetration, daily COVID cases and deaths and different waves of COVID-19 and investigate their impact on NEPSE to reliably establish the notion of COVID-19's impact on the market.

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I. BACKGROUND OF THE STUDY

Fama (1970) introduced the concept of efficient market to describe the market that fully reflect all the available information. Furthermore, he classified the market into three levels on the basis of information: weak form efficiency – the stock prices reflect all the historical information of past prices and returns, semi-strong form efficiency – prices reflect all available public information and strong form efficiency – the market prices reflect all information including privately held information known to market participants.

Usually, the stock markets behave in the efficient way with the auto-correlation between returns close to zero, but the crisis like Corona Virus Disease -19 (COVID-19) come with exception as shown by the Lyocsa and Molnar (2020) with the use of autoregressive model on the S&P 500 data from November 2019 to May 2020 where they show the increased uncertainity and fear to mean the market with high autocorrelation in its returns. Similarly, the study of the various COVID-19 affected markets around the world show the contagian effect of the virus on the stock markets which show the significant increase in the conditional correlation between the market returns of the stocks (Akhtaruzzaman, Boubaker, & Sensoy , 2020, Okorie & Lin, 2021). This implies the necessity for the analysis of market efficiency during the times of high uncertainty and fear.

The outbreak and spread of corona virus disease (COVID-19) has been one of the catastrophic events in the history in the human history with more than 5 million deaths and 250 million cases as of 8 November 2021 according to the World Health Organization (WHO). With the symptoms like fever, cough, tiredness, loss of taste or smell and intensity depending upon the age and the underlying medical conditions like cardiovascular disease, diabetes, chronic respiratory disease, WHO declared it as global pandemic on 11 March, 2020. Not only as a health crisis, COVID-19 has been an economic crisis, creating recessions across nations due to reduction in aggregate demand and supply chain disruptions due to the disease and the subsequent lockdown measure to control it.

As a part of globalized world community, Nepal could not refrain herself from this pandemic as well. From the first recorded case of 23 January 2020 and the first death in 14 May 2020, there has already been more than 11,000 deaths and 815,000 cases till November 8 2021 as per the data of Ministry of health and population.

The study of relationship between the confirmed COVID-19 cases and deaths with the stock market returns across different markets showed negative relationship; the market returns decrease as the cases increase whereas there is weak relationship between the number of deaths and returns. Similarly, the markets respond quickly to the COVID-19 with varying response over time depending on the severity of the outbreak (Ashraf 2020).

There has been unprecedented movement in the financial markets around the globe due to this pandemic; the great uncertainty of the pandemic and its associated economic losses has created volatility and unpredictability in the stock market returns of markets like US, Italy, China and many other developed markets resulting in the negative returns and this event is greater in its significant impact compared to the health emergencies of 1918-1919, 1957-1958 and 1968 (Sharif, Aloui, & Yarovaya, 2020; Baker , et al., 2020; Zhang, Hu, & Ji, 2020).

Similarly, Mazur, Dang and Vega (2021) have also shown the stock market crash of March 2020 studying the different sectors like gas, food, healthcare, petroleum, real estate, entertainment and hospitality sectors. They also established significant negative relationship between the COVID-19 confirmed cases, deaths and the stock market returns across different companies in Hang Seng Index and Shanghai Exchange Composite Index over the period from January 10 to March 16, 2020 (Al-Awadhi, et al. 2020). This shows the COVID-19

pandemic as the publicly available information with the capacity to cause the stock return differentials.

As a sequel to Fama (1970), Fama (1991) proposed the changes twenty years later to the categories of market efficiency:

- Using *tests for return predictability* instead of weak form tests so as to see the extent of past returns' predictability of future returns.

- Using *event studies* instead of semi-strong tests of adjustment of prices to public announcements to see how well the prices reflect such information.

- Using *test for private information* instead of strong-form tests of whether specific investors have privately information to check if investors have information that is not fully reflected in stock prices.

Thus, this article focuses on the semi-strong efficiency of the Nepal Stock Exchange with the pandemic announcement by WHO as the event. So, the primary emphasis will be on how well the NEPSE was able to reflect this information through the study of abnormal returns of the indices.

1.1 Objectives

This study, primarily has two objectives – one is to examine the impact of COVID-19 pandemic announcement by WHO across sectors in Nepal Stock Exchange; while the other is to test the semi-strong efficiency level of the Nepal Stock Exchange during the COVID-19 pandemic.

The organization of the paper has been done in the following order. Section II is about the literature review considering the empirical evidences; similarly, section III delineates the research methodology and the design of the research project. Furthermore, section IV presents the data presentation and its findings. Finally, section V explores the discussion of the findings along with the concluding remarks on the study with the prospects for future implications of this study.

II. LITERATURE REVIEW

The literature is inundated with the evidence of effect of the pandemic on the stock markets around the globe. The study of fifty two listed air transportation firms in market representing each continents with event study approach with three events characterizing the pandemic – the first case reported outside China, Italy outbreak and WHO declaration of COVID-19 as the global pandemic showed the varying result with the market overreacting to the third event whereas under reacting to the first; airlines stocks in Australia, Canada, the UK and the US were the worst performers in the post event period in the third event (Maneenop & Kotcharin, 2020). This showed the negative impact of the pandemic on the overall airlines industry.

Similarly, the lockdown event in Greece as a proxy for the pandemic showed the significant effect on the returns of the eleven randomly selected energy sector stocks; however, as the event subsides, the negative effect also dissipates as suggested by the efficient market hypothesis (Polemis & Soursou, 2020). The impact study of the pandemic on different industries on china showed interesting results. While the traditional industries like transportation, mining, electric and heating and environmental industries were adversely affected, the stock prices of manufacturing, information technology, and education, and health industries responded to the pandemic in the positive fashion (He, Sun & Zhang, 2020). Interestingly, this showed the potential of the pandemic to have positive impact on some of the sectors which might enjoy the pandemic.

Alam, Wei and Wahid (2020) emphasize on the necessity to analyze the pandemic effects according to the particular nature of industries as pandemic outbreak had varying impact across sectors in Australia as food, pharmaceuticals and healthcare exhibited impressive positive abnormal returns, while energy fared the poorest with transportation, real-estate and energy following the negative effects. This approach has its fair similarity with He, Sun and Zhang (2020) regarding their approach towards sectoral analysis of indices.

Continuing with the pandemic positivity to the market, COVID-19 had the positive impact on the returns of the banking stocks in Nigeria, despite the expectation of potential operational, market, credit and liquidity risks during the pandemic (Chinedu, 2021). This suggests the possibility for the overall market to have positivity even during the pandemic.

Herwany, Febrian, Anwar and Gunardi (2021) studied COVID-19 effects on the different sectors and overall index of Indonesian Stock Exchange and depicted the abnormal returns of financial sectors to be highly negative and significant with respect to other sectors like infrastructure, utilities, real estate, construction, trade and services. Similarly, the overall index is also affected as evidenced by the significant abnormal returns around the event.

Furthermore, Liu, Manzoor, Wang, Zhang and Manzoor (2020) after their study of pandemic effects on twenty one leading stock markets of the world, surmised the negative effect of the disease outbreak on their respective markets with Asian markets facing the higher toll in terms of more negative abnormal returns as the outbreak induced the investors' pessimistic sentiment on the future returns and fears of uncertainties. AlAli (2020) also iterates this result associating the global pandemic announcement with negative returns on the stock market returns of the five major Asian stock markets.

The analysis of stock market returns of Bombay Stock Exchange prior and after the lockdown showed the different result; the prior lockdown abnormal returns were negative whereas the market reacted positively to the lockdown announcement by the government (Alam, Alam & Chavali, 2020). The market seems to have taken lockdown as the good protective measure, creating the optimistic sentiment to its participants.

The country specific first death announcement had significant negative impact on the stock returns of European and US based markets; this use of event study methodology showed the COVID-19 impact across various cross-sections (Heyden & Heyden, 2021). This establishes that the death case might affect market more than, mere the increasing cases of COVID-19.

Similarly, according to Panyagometh (2020), the pandemic along with the policy measures of social distancing, quarantine and temporary market shutdown created the market volatility; so, comparison with the pre pandemic levels show the negative abnormal returns in the stock returns. This effect is particularly visible in the banking, finance and securities stocks as they have significant negative returns to the pandemic announcement by WHO.

Phuong (2021) also demonstrated the negative impact of the pandemic, with reference to national lockdown as the pandemic proxy, on the banking returns in the case of listed banking stocks in Vietnam.

The financial sector stocks showed the negative average abnormal returns and cumulative average abnormal returns in Pakistan; the returns were negative around the lockdown announcement date whereas the adjustment of the price to the information showed the existence of informational efficiency of the market in the semi-strong form (Tao, et al., 2021). This shows how the developing markets can also swiftly reflect the public information.

Kacperska and Kraciuk (2021) showed the effects of pandemic on the stock returns of agri-food companies in Poland through the use of event study methodology where they find that

the uncertainty around the pandemic creates the circumstance for the investors to manage their risks so as to beat the uncertainty and reduce their losses; thus, there seems to be negative returns associated with the pandemic. Furthermore, their study seems to be aligned with the semi-strong form efficiency as the stock prices discount all the existing public information including the pandemic, its effect, number of cases and death tolls.

The impact of COVID-19 on financial and banking sector holds particular importance to the Nepali context. So, the cases presented by the aforementioned authors show the enough evidence to hypothesize that the pandemic can significant negative returns to the financial sector; Herwany, Febrian, Anwar and Gunardi (2021), Tao, Su, Yaqoob and Hammal (2021), Phuong (2021) and Panyagometh (2020) all imply towards this conclusion with Chinedu (2021) as the only exception who showed the significant positive impact of the pandemic on the banking returns.

Furthermore, the pandemic on overall has negative impact on the stock market returns as evidenced by Liu, Manzoor, Wang, Zhang and Manzoor (2020), from their analysis on the major world markets; in further addition results by AlAli (2020), Alam, Alam and Chavali (2020) also show the reflection of same effects on major Asian markets including that of India, although the post-lockdown period looked promising in the Indian case.

Moreover, Tao, Su, Yaqoob and Hammal (2021) discovered the alignment of market efficiency theory by Fama (1970), establishing the semi-strong efficient market in the case of Pakistan in terms of pandemic as the publicly available information; Similar to it, Polemis and Soursou (2020) also prove the efficiency Greek energy market.

Dangol (2016) found an extent of consistency of semi-strong form efficiency differing from his conclusion of Dangol (2009) where he had rejected the market efficiency in the case of Nepal with respect to dividend announcement as the publicly available information. Similarly, the Nepali market seems to be in semi-strong level of efficiency with respect to the earthquake as the information (Karki, 2020).

Nevertheless, the literature lacks the perspective of pandemic and its impact on Nepalese stock and subsequent analysis of market efficiency hypothesis. So, the article indulges with this research gap as it holds importance in the contemporary scenario of the global phenomena of COVID-19 pandemic.

III. RESEARCH METHODS

3.1 Study Design, Population & Sample

Although the first case of local transmission happened in 4 April 2020, the announcement of COVID-19 as global pandemic can be seen as a triggering event in the March 2020 fall of the stock market around the globe. Similarly, the government announced the first lockdown as the protective measure against COVID-19 on from March 24 to July 21. With the lockdown and the inefficient online trading infrastructure, Nepal Stock Exchange closed almost for two months. Thus, the article uses the WHO announcement of global pandemic on March 11,2020 as the event date for the study.

The NEPSE index is dominated by banking and finance sectors (Kiran 2009).Thus, author uses sample of following six financial indices to understand the sectoral impact of the pandemic announcement decision. This sectoral analysis aligns with the objectives set by He, Sun and Zhang, (2020) and Alam, Wei and Wahid (2020) where they explore the COVID-19 impact on the different sectors based in Chinese and Australian Stock exchanges respectively.

So, this study uses the Nepal Stock Exchange as its sample based on the indices of life insurance, non-life insurance, banks, development banks, finance companies and microfinance institutions:

Table 1: Depiction of the sampled indices for the study

Sector	Nepali market and index name
Market Index	NEPSE index
Life-Insurance	Life-Insurance Index
Non-Life Insurance	Non-Life Insurance Index
Commercial Bank	Banking Index
Development Bank	Development Bank Index
Finance	Finance Index
Microfinance	Microfinance Index

The study is based on the secondary data derived from the official website of NEPSE (neweb.nepalstock.com.np) between May 16, 2019 to February 6,2020 for the period of 180 trading days as estimation window and 26 February, 2020 to 12 May, 2020 for the period of 15 trading days for the event window. The derived data is analyzed through the use of following design on Microsoft Excel to understand the state of the market during the time of pandemic.

3.2   Research Design

Bosch and Hirschey (1989), Hovav and Arcy (2003) have famously studied the corporate decisions and events that impact the returns of the stock returns. With the use of market model, they analyzed the effects of specific events like corporate name changes and the virtual attacks to the computer network on the valuation and returns of the stock. Similarly, Mackinley (1997) emphasize on the essence and necessity of event study on ascertaining the effects of corporate events on returns with relative ease.

Apart from the corporate events, Papadakis (2006) used the event study to analyze the differing patterns in the returns due to the supply chain disruptions due to the earthquake. Similarly, Liu, Manzoor, Wang, Zhang and Manzoor (2020), Al-Awadhi, Alsaifi, Al-Awadhi and Alhammadi (2020), Zhang, Hu and Ji (2020) have also used the event study methodology in the contemporary emergency situation of COVID-19 pandemic.

Furthermore, the use of this methodology in the case of Nepal to study the unanticipated catastrophic event in the form of earthquake by Karki (2020) and cash and stock dividend announcement to the stock market returns by Dangol (2009) show the applicability of the methodology in the case of Nepal, further substantiating the author's methodological choice of event study, market model.

The article derives the methodological basis from Dangol (2009) as the environment that the author is working on is similar to his. This provides author to use the proven methodology in the case of different instance of event.

$$R_{it} = \alpha_i + \beta_i R_{mt} + e_{it} \qquad \qquad \text{.......... (1)}$$

Where, R_{it} = the return of index i on day t = [Index value$_{it}$ – Index value$_{it-1}$]/ Index Value$_{it-1}$

   R_{mt} = the market index returns on day t, the average of returns of all firms included in the market index.

   e_{it} = a random error term for index i on day t.

   α_i and β_i = firm independent coefficients to be estimated.

Dangol (2009) used the market model to estimate the returns of particular stocks; nevertheless, this article uses an approach by Alam, Wei and Wahid (2020) where they have used this model for the estimation of the index returns as well.

The market model is used for the estimate of each index using the 180 daily returns and the period starts 200 days before the pandemic announcement date of 11th March, 2020 and ends 21 days before the announcement date (t = -200 to t = -21). The estimation window follows the time period according to the studies of Bosch and Hirchey (1989), Hovav and Arcy (2003), Dasilas (2007) and Dangol (2016). The estimated parameters (αi and βi) and the realized returns of the particular indices are used to predict the normal returns during the event period.

Alam, Wei and Wahid (2020) have used 21 days as the event window with t = 0 as the pandemic announcement as the event. However, the NEPSE remain closed from March 23,2020 after the first lockdown announcement, only to open on May 12. So, this impeded authors to take the event window of 10 days after the announcement date. So, as a remedy, the article takes on the daily index returns for the seven days before and after the event date (t = -7 to t = +7); this event window is consistent with Ryandono, Muafi and Guritno (2021). The coefficient estimates from regression equation (1) are used to predict normal returns for the six events periods: (-7, -1), (-7, +7), (-3, +3), (-1, +1), (0, +1) and (+2, +7). Prediction errors during the event periods, i.e. deviations of realization return from normal returns, are estimates of abnormal returns (AR). Thus, the market model is used to calculate abnormal return for the index i on event day t, as under:

$$AR_{it} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{mt}) \qquad \dots\dots\dots (2)$$

The null hypothesis to be tested is that the average abnormal returns and cumulative abnormal return are equal to zero for any given event period. More formally, for a sample of N indices, the mean abnormal returns on any given day t is:

$$\overline{AR}_t = \frac{1}{N} \sum_{i=1}^{N} AR_{it} \qquad \dots\dots\dots (3)$$

To measure abnormal returns over a specific time interval or holding period, the sample mean abnormal returns are summed to derive the sample mean cumulative abnormal returns as under:

$$\overline{CAR}_t = \sum_{t=T_1}^{T_2} \overline{AR}_t \qquad \dots\dots\dots (4)$$

Where, T1 and T2 identify beginning and ending days of sample-specific event periods within the overall 15 days t = -7 to t = +7 event period. The test t-statistic for the significance of $\overline{AR}_t$ is calculated as under:

$$t - \text{statistic (for AR)} = \frac{\overline{AR}_t}{\hat{S}(\overline{AR}_t)} \qquad \dots\dots\dots (5)$$

Where,

$$\hat{S}(\overline{AR}_t) = \sqrt{\sum_{t=-200}^{t=-21} \frac{(\overline{AR}_t - \overline{\overline{AR}}_t)^2}{179}} \qquad \dots\dots\dots (6)$$

$$\overline{\overline{AR}} = \frac{1}{180} \sum_{t=-200}^{t=-21} \overline{AR}_t \qquad \ldots\ldots\ldots (7)$$

Where, t = -200 to t = -21 is the 180 days estimation period. The interval test statistic for each sample and each holding period of T days in length is assumed to be approximately unit-normal and can be written as under and follows a t-statistic distribution:

$$t - statistic \ (for \ CAR) \quad = \frac{\overline{CAR}_t}{\hat{S}(\overline{AR}_t)\sqrt{T_2 - T_1 + 1}} \qquad \ldots\ldots\ldots (8)$$

3.3 Study Limitations

- The NEPSE halted its trading during the first lockdown period for around two months. As a result, this impeded in analysis of the exact impact of the COVID-19 pandemic announcement or the subsequent lockdown on the indices.

- The limited number of stocks in non-financial sectors apart from banking and insurance industries limited the comprehension of true COVID-19 impact on the stock market.

- Small number of listed companies compelled the author to study the index returns instead of sampling the stock from the exchange and their returns as a sample for the overall market returns.

IV. RESULTS AND FINDINGS

4.1 Data Presentation and analysis

Table 2 presents the respective abnormal returns of the indices in the event window (t = -7 to t = +7 days). The abnormal returns for commercial banks show the significant positive result at t = -7 days at 1% level. However, the other abnormal returns for the banks are not significant enough to conclude the pandemic announcement effect.

Similarly, development bank index abnormal returns show two significant impact around t = -2 (5% significance level) and t = 6 days (10% significance level). The former is positive whereas the latter is negative in significance. Compared to banks, finance companies have been affected much as shown by the significant abnormal returns in t = -7 (5% level), t = -6 (5% level) and t = -5 (10% level). However, only significance at t = -7 is negative. The microfinance sector, too has two significant abnormal returns, t = -7 (5% level) and t = -4 (1% level); in this case, both significance show negative effect of the pandemic announcement.

Compared to banking institutions, insurance companies are affected less as depicted by significance of the abnormal returns only seven days both (life insurance and non-life insurance) index returns show just one significant negative abnormal returns around t = -7 days at 1% significance level.

None of the index returns demonstrate significant returns around the event, although finance companies are affected much around the event. On Contrast, banking and microfinance have positive returns, nevertheless with no significance. Even though the significant test shows weak effect, Figure 1 highlights almost negative impact of the pandemic announcement on the sectoral, barring the finance index returns which show positive effect for three days after the initial negativity on the event day.

Furthermore, amongst all, microfinance and finance companies have shown clear effects of the event window as finance index returns have moved from negative returns to positive

returns within the period of 15 days whereas microfinance returns have drastic negativity within the same period as seen from Figure 1.

Similarly, Table 3 and 4 show the significant average abnormal returns of the selected indices. The t = -7 and +3 days are significant negative abnormal returns whereas returns for t = +2 days is positively significant. Accordingly, the abnormal returns of the event day do not pass the t-test suggesting the lack of effect of WHO pandemic announcement on the market. Also, Table 4 depicts how the abnormal returns in the event window are; Cumulative Average Abnormal Returns also imply the same conclusion as no period have significance.

The analysis from Table 3 and 4 give to the conclusion that, although the event had scant significant before the events, there was no sustaining significant abnormal returns within the overlapped periods of the event window. However, the announcement effect is pronounced in t = -7 days as negative, in t = +2 as positive and in t= +4 days as negative. This combination of positive and negative significance nullified the overall significance in periods. Nonetheless, the overall event period – (-7,7) show high level of negativity (although not significant), directing towards a picture that the overall pandemic announcement had negative effect on the stock exchange; but then, lack of its significance might curtail generalizing the result and establishing the negativity.

On overall, Figure 2, 3 and 4 depict the negative impact of the pandemic announcement on the abnormal returns of the market. Particularly, Figure 3 and 4 substantiate the idea that the pandemic announcement had negative effect on the market returns as the cumulative average abnormal returns of the sampled indices are negative and rapidly decreasing after the announcement date.

Table 2: Summary of Abnormal Returns (%) for the following indices

Day	Commercial Banks	Development Banks	Finance Companies	Microfinance	Life Insurance	Non-Life Insurance
-7	4.23***	0.16	-2.88**	-3.72*	-4.53***	-6.16***
-6	0.41	-0.07	2.40**	-1.38	-1.83	-0.68
-5	-1.56	-0.09	2.13*	-0.51	-0.01	1.47
-4	0.91	0.24	0.36	-5.33**	0.95	1.12
-3	-0.64	-0.39	1.31	-2.71	0.36	0.62
-2	-0.77	1.34***	1.37	2.42	1.35	0.16
-1	-1.41	-0.39	1.52	0.11	-1.68	3.10
0	1.12	-0.03	-1.04	1.18	-0.15	-0.59
1	-0.45	-0.14	0.15	-1.41	1.03	-0.24
2	-0.70	-0.02	0.16	-0.65	-2.15	-0.04
3	-0.10	0.20	0.33	0.90	0.29	0.59
4	-0.29	-0.80	-1.12	-2.06	-2.17	-1.57
5	0.04	0.49	0.59	0.39	0.02	0.34
6	0.33	-1.06*	-1.85	0.19	0.68	-0.10
7	-1.20	0.60	0.97	0.21	0.18	2.11

Note: *, ** and *** indicate Significant at 10% level (two-tail test), 5% level (two-tail test), and 1% level (two-tail test) respectively

The study primarily had two objectives – studying the returns of major financial indices that dominate the NEPSE and deduce the informational efficiency of the market during the pandemic announcement period. With respect to these objectives, the article surmises following findings:

There was significant negative returns few days before the event whereas with no significant effect on the event day. However, the pandemic announcement affected the life insurance and microfinance sectors with not much significant impact to the commercial banking and development banking sectors.

Figure 1: **Cumulative Abnormal Returns of Indices**
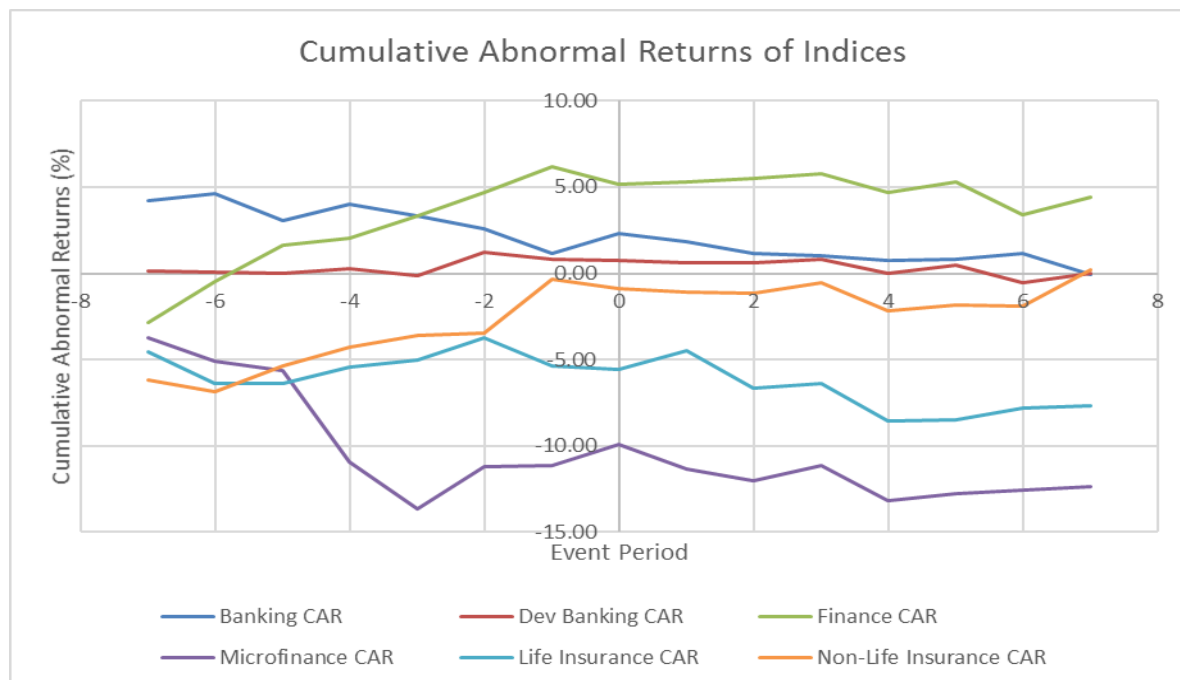
The NEPSE market is not semi-strong efficient as the market returns reflected the WHO pandemic announcement decision, even before the announcement as shown by significant abnormal returns as much as up to seven days before the event date.

Table 3: Average Abnormal Returns (%) of the sampled indices

Day	Average Abnormal Returns	*t*-statistic for Average Abnormal Returns
-7	-2.15	-4.94***
-6	-0.19	-0.44
-5	0.24	0.55
-4	-0.29	-0.67
-3	-0.24	-0.56
-2	0.98	2.25**
-1	0.21	0.48
0	0.09	0.22
1	-0.18	-0.40
2	-0.57	-1.30
3	0.37	0.84
4	-1.34	-3.07***
5	0.31	0.72
6	-0.30	-0.69
7	0.48	1.10

Note: *, ** and *** indicate Significant at 10% level (two-tail test), 5% level (two-tail test), and 1% level (two-tail test) respectively

Table 4: Cumulative Average Abnormal Returns of the sampled indices

Period	Cumulative Average Abnormal Returns	t-statistic for Cumulative Average Abnormal Returns
(-7,-1)	-1.45	-0.86
(0,+1)	-0.08	-0.05
(+2,+7)	-1.05	-0.62
(-7,+7)	-2.58	-1.53
(-3,+3)	0.66	0.39
(-1,+1)	0.13	0.08

Note: *, ** and *** indicate Significant at 10% level (two-tail test), 5% level (two-tail test), and 1% level (two-tail test) respectively

Figure 2: **Average Abnormal Returns of sampled indices around the event.**
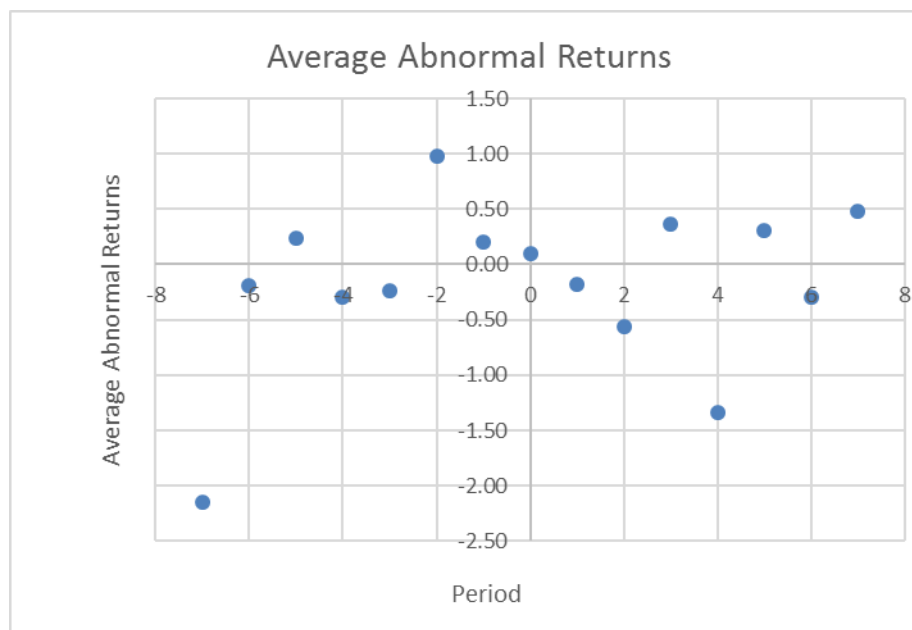
V. DISCUSSION, CONCLUSION AND IMPLICATIONS

5.1 Discussion

The empirical results show interesting results; although, the cursory glance of the publicly available charts and graph show the significant negative effects of the pandemic announcement, the results suggest otherwise. There is high negativity around the market, on majority, around the date of February 27,2020 which falls on seven days before the event. However, all other significant abnormal returns are mixture of negative and positive returns with majority of it as negative returns. This result is in agreement with Herwany, Febrian, Anwar and Gunardi (2021), Tao, Su, Yaqoob and Hammal (2021), Phuong (2021) and Panyagometh (2020), thereby contradicting Chinedu (2021), who evidenced the positivity of the pandemic.

Similarly, the overall NEPSE abnormal returns are also baffling. Liu, Manzoor, Wang, Zhang and Manzoor (2020), Sharif, Aloui and Yarovaya, 2020, Baker, et al. (2020) all imply the negativity around the COVID-19 through the significant negative abnormal returns of stocks, however the article implies the not much effect of pandemic with WHO announcement date as sample event. There is mixture of significant negative and positive returns within the event window but with no sustenance of the significant for considerable period, thus, showing weak

effect of the event. This does not fully agree with Maneenop and Kotcharin (2020) and AlAli (2020), where researchers have established the significant negativity of the pandemic announcement on the market, whereas the case of this paper shows scant effect.

Nevertheless, the empirical result does not align with the results of Dangol (2016) and Karki (2020) who had shown the semi-strong efficiency of Nepalese market to the dividend announcement and earthquake as publicly available information respectively; in this case, the result does not accept the NEPSE as semi-strong efficient as per Fama (1970) with the methodological use of Fama (1991). However, the case can be made as the there were other information like death counts, daily cases and contagion effects of the pandemic to have disrupted the market efficiency than just the pandemic announcement by WHO.

A conjecture can be made about the results. There was increasing fear and uncertainty around the 15 days of the event. The COVID-19 was rapidly trasmitting around the world, with the high level of cases around neighboring nations; this created the contagion effect, with the market pre-reacting to the announcement as it can be seen that market anticipated some worldwide catastrophe, even before WHO had announced it.

Figure 3: Cumulative Average Abnormal Returns of sampled indices of the pandemic announcement event from t = -7 to t = 7 days
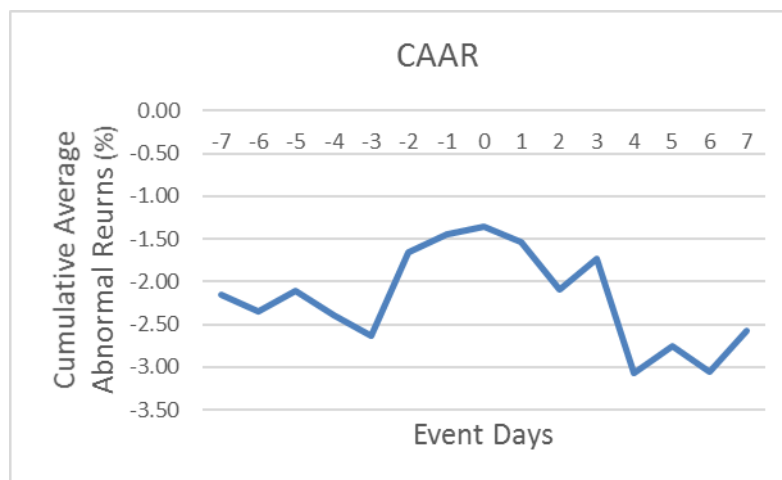
5.2   Conclusion

As a contemporary issue, the article attempted to study the impact of COVID-19 on the sectoral returns of the NEPSE with the WHO pandemic announcement of March 11, 2020 as the sample event representing the pandemic. The study focused on the indices of commercial banking, development banking, finance, microfinance, life insurance and non-life insurance as these financial sectors dominate the NEPSE index. The result was aligned with the majority of existing literature as the article found pandemic announcement to have significant negative impact on the returns. Similarly, the pre-reaction and post reaction even after few days of this announcement implied the existence of the semi-strong inefficiency level of the market as per the level of information reflection by the sampled indices in the market.

5.3   Implication

This research opens up whole lot of avenues for future researches that can evidence and document the pandemic effects on the market. Although the pandemic announcement had weak effect, post the open of NEPSE after two months showed promising market behavior. Similarly, the second lockdown also brought enthusiasm to the market fueling the price and index inflation. So, analysis of COVID-19 with respect to events like pandemic announcement and lockdowns as events will bring holistic picture of the pandemic. This

paper is a stepping stone for understanding and documenting the pandemic effect, whereas future researchers can integrate these events to understand it better.

Similarly, the observational analysis show that the Nepali market is highly affected by the level of money supply, Balance of Payment and liquidity levels; So, not only as events, but also, regression of these economic fundamentals to the returns, along with the event study might paint a clear picture for gathering useful implications for policy formulators and even to the investors.

Furthermore, the market closed within few weeks of pandemic announcement and the results show the significant negative returns even after four days of announcement; this has a huge implication of how our market reflects the information. There might already be the news of closing down of the market, even before the actual closing, suggesting the possible information leaks, insider news and very weak in information disclosure. This kind of dissemination of private information to market participants was further seen in lockdowns as evidenced by the rapid price inflation of companies with weak fundamentals against the strong ones and blatant cornering and publicity of cornered stocks.

So, this research also implies the need for capacity building and re-structuring of the regulatory bodies to meet the present scenario of technological change where investors can easily manipulate wider audience without any reprimand or negative consequences for their behaviors. Thus, policy formulators need to develop strong technological and human resource infrastructure which will prevent and detect the information leakage; this helps to increase the informational efficiency of the market and establishing the fairness in the stock market.

Similarly, the NEPSE market does not properly adjust the public information like pandemic, earthquake or any other information; so, investors can utilize this research for formulating their trading strategies- buying the dip or selling the top as the situation demands, thus optimizing their overall returns.

Besides WHO announcement, other events like death counts, increasing cases, vaccine development and penetration, fiscal and monetary policies during the pandemic are some of the significant factors which needs to be studied before forming a clear picture of the pandemic effects. So, researchers can also deal with this factors for forming the comprehension of this pandemic.

Figure 4: Cumulative Average Abnormal Returns of sampled indices of pandemic announcement event from the announcement day (t= 0) to t=7 days
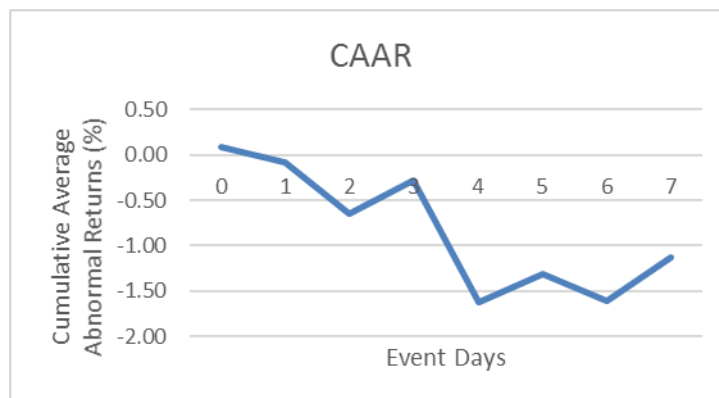
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ANNEXURES

Annex I: NEPSE Indices of Sampled and market index in Estimation Window

Date	NEPSE Index	Life Insurance Index	Non-Life Insurance Index	Banking Index	Dev Banking Index	Finance Index	Microfinance Index
9-Feb	1319.99	7424.30	5897.52	1141.42	1812.07	665.26	2196.73
6	1333.69	7500.16	6029.03	1153.81	1831.21	670.78	2166.94
5	1342.36	7476.28	6117.50	1162.39	1843.14	671.50	2187.63
4	1337.04	7438.02	6091.02	1158.62	1845.37	666.10	2205.09
3	1349.13	7514.64	6062.24	1172.60	1840.36	665.47	2199.07
2	1346.64	7557.44	6002.97	1175.96	1809.78	666.26	2221.95
30-Jan	1325.38	7558.53	5901.45	1148.92	1781.46	662.08	2229.70
29	1305.88	7389.90	5676.81	1130.67	1765.03	655.72	2207.57
28	1306.15	7422.77	5579.62	1138.62	1770.26	657.93	2188.96
27	1300.62	7263.49	5438.29	1139.74	1770.15	657.36	2098.01
26	1276.68	7089.45	5288.53	1121.73	1726.34	654.50	2055.44
23	1297.47	7214.45	5440.27	1140.19	1747.65	665.17	1989.01
22	1313.42	7173.56	5506.89	1161.41	1766.93	672.42	2015.82
21	1320.47	7010.82	5529.94	1170.03	1784.65	674.37	2030.81
20	1317.11	6949.35	5448.77	1165.36	1794.92	677.84	2041.17
19	1343.65	7104.01	5565.08	1181.25	1847.79	700.17	2043.56
16	1310.23	6700.76	5228.06	1163.30	1781.26	665.01	2101.45
15	1284.23	6458.18	5098.53	1142.45	1734.96	637.19	2069.38
14	1263.38	6377.12	5078.72	1116.76	1704.00	618.33	1992.01
13	1270.86	6428.78	5127.52	1127.12	1703.31	609.90	1966.00
12	1255.72	6376.71	5088.50	1112.31	1690.77	599.02	1974.73
9	1213.11	5967.44	4704.29	1085.01	1647.44	585.10	1988.61
8	1209.60	5948.33	4608.89	1086.43	1640.66	585.44	1866.41
7	1216.92	5959.44	4670.82	1097.64	1649.28	579.84	1803.41
6	1200.69	5958.39	4584.26	1078.62	1623.10	574.82	1788.95
5	1182.31	5946.26	4583.47	1052.75	1609.93	573.33	1756.05
2	1166.21	5862.58	4524.18	1036.01	1590.57	569.47	1719.72
1-Jan	1169.50	5911.42	4540.40	1038.22	1591.76	570.60	1679.48
31-Dec	1166.03	5993.78	4568.22	1034.84	1585.28	571.50	1663.92
30	1167.95	5998.58	4581.97	1032.80	1580.40	575.70	1638.23
29	1162.43	5742.05	4520.07	1035.01	1581.75	578.06	1619.26
26	1167.41	5661.34	4530.55	1043.66	1588.23	576.08	1615.51
25	1168.03	5644.78	4555.22	1042.97	1585.94	577.33	1624.33
24	1166.21	5575.08	4538.99	1042.55	1584.74	578.33	1625.06
23	1168.58	5615.42	4598.54	1041.70	1593.74	578.32	1631.04
22	1150.81	5444.54	4439.74	1038.38	1577.30	566.78	1641.95
19-Dec	1149.64	5488.31	4463.94	1039.30	1573.81	569.84	1611.21
18	1152.07	5530.31	4500.16	1041.24	1581.51	564.74	1609.76

17	1155.37	5552.68	4537.89	1042.98	1579.46	566.04	1614.83
16	1154.11	5506.10	4499.14	1044.57	1574.43	566.30	1623.01
15	1167.86	5642.63	4671.23	1051.79	1584.55	569.96	1613.13
12	1172.64	5794.55	4704.76	1048.98	1589.02	572.28	1627.17
11	1161.47	5515.86	4372.72	1046.15	1586.30	570.88	1663.45
10	1151.36	5436.57	4259.59	1041.89	1569.50	564.64	1671.67
9	1148.89	5427.43	4262.54	1034.80	1567.58	564.17	1614.59
8	1135.37	5366.45	4106.20	1026.89	1539.43	557.17	1612.71
5	1131.92	5378.10	4140.50	1026.41	1533.84	558.97	1562.28
4	1124.47	5224.89	4068.51	1024.30	1527.31	557.39	1545.19
3	1115.74	5081.98	3966.86	1021.34	1516.76	555.38	1520.65
2	1111.99	5018.19	3947.22	1019.05	1517.07	556.64	1487.61
1-Dec	1112.85	5082.20	3950.92	1017.92	1520.90	557.24	1472.97
28-Nov	1112.79	4952.84	3970.30	1021.21	1529.82	554.30	1474.01
27	1117.46	4934.72	3998.88	1025.45	1537.54	556.42	1480.83
26	1109.16	4874.53	3972.20	1020.52	1523.53	551.02	1484.06
25	1110.08	4883.00	3985.52	1019.69	1524.01	553.14	1469.13
24	1110.08	4907.16	4004.44	1020.72	1525.22	551.74	1471.13
21	1120.60	4955.24	4061.59	1031.19	1535.61	557.15	1467.33
20	1128.34	4975.83	4086.75	1040.61	1542.95	558.17	1473.67
19	1129.99	5006.20	4111.00	1040.04	1545.33	558.95	1485.20
18	1131.12	5031.30	4150.71	1041.66	1543.32	561.83	1488.64
17	1131.36	5002.03	4132.21	1041.56	1543.25	559.45	1489.51
14	1135.95	5015.19	4158.85	1042.03	1544.45	565.22	1488.98
13	1135.16	5001.60	4150.09	1040.65	1545.81	561.19	1492.74
12	1139.96	5042.24	4155.23	1045.91	1548.53	560.09	1503.32
11	1145.57	5047.49	4211.12	1051.22	1561.71	563.77	1514.31
10	1131.80	4968.47	4143.59	1038.91	1548.40	561.70	1483.56
7	1131.97	5007.84	4140.76	1039.18	1562.02	561.01	1479.29
6	1138.02	5047.95	4128.62	1045.84	1555.07	564.27	1479.71
5	1139.45	5026.57	4133.00	1045.87	1562.02	566.90	1475.24
4	1140.26	5041.54	4161.33	1045.47	1562.54	570.47	1471.59
3	1139.26	5038.51	4146.95	1046.39	1563.36	571.47	1465.99
31-Oct	1146.17	5064.58	4179.20	1053.17	1564.94	573.97	1469.00
24	1149.34	5093.04	4219.18	1056.66	1562.97	576.30	1474.16
23	1142.60	5071.53	4227.32	1050.03	1557.17	570.23	1467.78
22	1134.79	5023.25	4217.55	1043.43	1549.53	567.23	1458.90
21	1132.40	5004.19	4235.25	1038.98	1547.92	567.53	1457.49
20	1133.71	4981.69	4226.66	1040.86	1554.13	569.83	1456.97
17	1137.75	5005.06	4243.39	1044.79	1556.79	570.17	1459.52
16	1137.03	4991.99	4206.53	1044.03	1566.92	567.73	1457.35
15	1142.04	5002.80	4217.41	1049.01	1559.48	568.70	1465.27
14	1136.96	4971.64	4213.96	1044.49	1551.28	567.43	1459.94

10	1149.01	5008.74	4263.49	1057.94	1562.71	573.72	1473.79
3	1149.40	5053.87	4256.07	1056.54	1560.60	570.83	1476.20
2	1140.71	5004.36	4216.27	1050.39	1547.56	574.11	1461.96
1-Oct	1145.69	5058.36	4265.09	1054.95	1553.90	574.90	1464.35
30-Sep	1135.56	5041.75	4215.97	1042.14	1550.06	565.22	1453.06
29	1125.14	4969.89	4149.47	1032.33	1540.17	562.05	1443.06
26	1129.80	4992.43	4213.44	1036.77	1538.71	562.96	1449.12
25	1131.53	4986.16	4227.07	1038.52	1543.41	562.98	1453.85
24	1134.56	4989.24	4249.51	1043.35	1546.70	566.46	1453.05
23	1140.98	5054.11	4282.03	1047.53	1551.48	568.32	1460.91
22	1139.25	5037.51	4273.67	1047.09	1548.81	568.49	1457.12
19	1155.30	5118.39	4397.96	1058.42	1567.00	573.00	1487.44
18	1172.15	5232.68	4501.61	1071.85	1576.13	572.67	1496.65
17	1150.74	5052.09	4360.19	1054.50	1568.52	571.46	1467.49
16	1123.83	4949.15	4271.62	1033.43	1541.75	563.00	1437.29
15	1140.01	5080.77	4349.05	1046.50	1549.51	565.09	1448.52
12	1157.88	5146.85	4407.31	1066.19	1564.81	569.98	1467.98
11	1163.21	5180.71	4441.56	1068.97	1567.50	571.08	1474.40
10	1166.67	5212.18	4490.59	1070.73	1572.28	571.39	1480.21
9	1168.91	5238.39	4467.77	1072.47	1570.22	574.40	1484.33
8	1178.46	5302.99	4533.85	1079.28	1573.26	576.88	1498.09
5	1191.07	5388.43	4636.14	1090.24	1589.08	577.17	1505.59
4	1194.77	5406.50	4636.02	1093.27	1592.43	579.09	1508.96
3	1190.90	5398.12	4610.82	1087.18	1589.27	582.69	1506.15
2	1170.34	5252.62	4487.29	1068.19	1567.68	576.12	1472.72
1-Sep	1184.78	5348.30	4558.55	1080.78	1580.58	582.16	1497.70
29-Aug	1196.41	5491.79	4638.62	1087.92	1583.90	580.68	1510.74
28	1197.75	5542.03	4649.34	1087.06	1581.00	582.37	1512.58
27	1208.00	5599.15	4686.62	1096.64	1587.22	584.15	1521.83
26	1203.13	5583.85	4699.49	1091.44	1582.68	578.99	1511.88
25	1209.62	5651.89	4727.85	1096.29	1586.76	581.47	1512.69
22	1213.06	5702.96	4759.17	1097.95	1588.97	582.07	1516.89
21	1214.05	5696.66	4801.18	1098.65	1594.13	585.82	1515.72
20	1213.63	5703.44	4807.08	1098.70	1593.68	585.72	1516.96
19	1222.06	5759.60	4832.68	1105.53	1600.72	587.77	1530.08
18	1214.83	5715.28	4862.45	1098.20	1587.30	586.70	1508.57
15	1224.03	5802.69	4894.03	1102.45	1592.73	623.28	1517.15
14	1225.90	5783.27	4876.71	1104.78	1588.23	621.49	1521.16
13	1231.07	5805.33	4887.07	1111.28	1588.75	622.58	1521.02
12	1233.85	5824.72	4891.58	1112.58	1596.00	624.93	1522.44
11	1233.71	5805.11	4925.90	1113.00	1590.78	622.02	1517.39
8	1238.56	5842.77	4964.78	1117.43	1594.19	621.26	1522.01
7	1248.48	5869.33	5033.52	1123.57	1603.22	625.74	1544.31

6	1245.73	5843.30	5011.49	1120.61	1604.55	623.69	1521.76
5	1255.09	5849.41	5052.46	1129.97	1609.76	628.46	1542.85
4	1259.64	5871.24	5048.97	1132.80	1613.20	631.98	1569.88
1-Aug	1263.84	5894.31	5073.53	1136.29	1616.90	630.96	1569.65
31-Jul	1265.57	5873.44	5069.98	1139.99	1617.97	630.96	1554.01
20	1259.37	5826.94	5016.02	1137.94	1618.81	628.74	1501.57
29	1255.98	5834.15	4993.20	1135.09	1611.49	628.08	1486.85
28	1252.80	5849.94	4991.85	1132.50	1607.71	622.90	1463.45
25	1269.92	5956.83	5091.52	1148.42	1623.20	624.73	1491.15
24	1284.07	6010.37	5175.88	1160.97	1641.97	628.56	1510.83
23	1277.17	6002.16	5107.44	1154.74	1633.47	629.56	1495.85
22	1271.23	5996.97	5069.38	1147.77	1629.30	629.13	1467.85
21	1268.74	6003.37	5091.21	1145.43	1627.60	628.27	1460.38
18	1272.49	6040.71	5104.26	1148.38	1636.86	627.42	1460.48
17	1274.86	6068.37	5125.27	1149.73	1641.22	624.39	1460.30
16	1259.01	6018.68	5070.25	1133.04	1613.87	626.02	1434.32
15	1254.56	6016.96	5059.79	1128.91	1607.88	620.87	1428.81
14	1249.49	5996.41	5044.13	1126.15	1604.18	617.93	1424.11
11	1248.53	5963.89	5044.26	1126.76	1595.33	619.54	1424.26
10	1249.15	5988.29	5047.25	1124.87	1598.85	620.15	1429.79
9	1250.27	5986.84	5064.00	1123.09	1601.61	621.13	1426.27
8	1247.35	5962.73	5101.06	1119.22	1596.80	616.19	1426.68
7	1256.04	6026.81	5164.27	1128.71	1603.51	618.88	1433.18
4	1260.47	6077.05	5125.96	1135.41	1600.36	616.18	1441.66
3	1268.68	6131.02	5188.40	1142.00	1605.17	619.54	1448.08
2	1253.06	6036.09	5094.99	1128.24	1590.78	616.59	1422.06
1-Jul	1241.61	5951.55	4982.91	1116.72	1578.77	615.75	1406.53
30	1244.89	5945.71	4990.73	1120.36	1579.09	617.89	1408.89
27	1257.15	6004.00	5050.71	1132.21	1591.78	620.79	1424.28
26	1258.29	6026.74	5152.05	1131.49	1594.45	616.61	1425.91
25	1261.07	6037.92	5156.96	1134.72	1595.39	617.91	1429.77
24	1260.10	6037.62	5151.64	1133.33	1595.91	618.61	1427.25
23	1254.35	6038.02	5153.87	1128.99	1598.46	617.51	1409.87
20	1264.36	6111.90	5239.14	1135.91	1596.95	617.47	1424.92
19	1258.46	6108.32	5246.80	1129.02	1591.94	617.86	1411.24
18	1258.66	6094.08	5277.08	1130.08	1586.52	615.00	1412.89
17	1260.90	6144.50	5305.43	1129.64	1585.06	617.13	1408.04
16	1258.27	6163.34	5268.16	1127.94	1587.81	615.06	1411.23
13	1269.55	6198.79	5379.19	1135.07	1598.77	621.77	1440.72
12	1272.49	6213.51	5402.99	1137.16	1601.85	626.90	1443.57
11	1275.99	6240.85	5464.33	1140.19	1606.49	628.33	1451.14
10	1275.82	6241.95	5512.64	1137.72	1603.31	629.64	1447.56
6	1284.59	6304.38	5637.02	1143.34	1598.84	637.12	1459.04

4	1289.28	6989.62	5648.33	1148.95	1595.38	618.57	1464.11
3	1292.84	6415.57	5703.35	1151.82	1592.89	618.17	1476.50
2-Jun	1305.68	6470.30	5771.00	1162.89	1606.47	623.44	1489.02
30-May	1319.47	6529.67	5813.83	1176.66	1607.75	625.92	1507.10
29	1313.88	6520.13	5820.62	1165.71	1612.19	626.01	1508.88
28	1305.49	6580.37	5809.79	1158.64	1604.60	618.10	1501.43
27	1302.96	6583.65	5843.26	1156.86	1586.84	614.76	1502.11
26	1302.61	6612.27	5859.15	1157.81	1585.03	613.49	1501.31
23	1341.55	6650.28	5894.23	1167.42	1599.68	618.87	1506.46
22-May	1319.63	6694.81	5890.52	1168.36	1608.88	625.91	1504.76
21	1312.44	6651.22	5879.58	1165.78	1602.85	621.88	1497.55
20	1307.71	6609.22	5851.52	1165.70	1600.40	611.37	1500.61
19	1316.84	6694.66	5970.77	1172.97	1620.75	631.32	1517.42
16-May	1318.71	6754.39	6029.80	1177.19	1611.93	625.96	1525.92
15-May	1321.00	6766.79	6002.52	1185.43	1590.68	623.12	1531.15

Annex II: NEPSE Indices of Sampled and market index in Event Window

Day	NEPSE Index	Life Insurance Index	Non-Life Insurance Index	Banking Index	Dev Banking Index	Finance Index	Microfinance Index
26-Feb	1596.13	9905.94	7568.55	1356.86	2025.05	721.18	2803.65
27	1632.17	9741.31	7355.16	1440.15	2063.70	712.66	2747.30
1-Mar	1591.36	9266.69	7032.80	1414.91	2025.36	716.91	2657.04
2	1495.30	8576.39	6508.07	1319.51	1934.06	700.59	2521.40
3-Mar	1509.67	8765.69	6673.25	1342.14	1954.01	708.37	2405.27
4	1441.20	8308.73	6266.30	1281.18	1881.87	694.28	2257.02
5-Mar	1435.70	8386.57	6240.68	1266.93	1903.14	702.09	2305.05
10	1349.31	7623.65	5878.49	1183.57	1811.81	681.93	2202.09
11-Mar	1423.09	8134.63	6324.14	1252.03	1886.25	702.54	2319.37
12	1377.18	7897.32	6007.14	1211.61	1839.65	687.17	2229.74
15-Mar	1313.04	7275.44	5590.41	1154.61	1776.79	664.97	2136.32
16	1316.39	7324.22	5644.24	1155.71	1785.04	668.65	2159.54
17-Mar	1277.06	6897.74	5305.91	1122.55	1732.36	646.68	2065.87
18	1255.80	6760.68	5193.17	1106.74	1720.65	642.83	2047.65
19-Mar	1269.30	6901.18	5270.49	1120.39	1717.38	636.30	2068.24
22-Mar	1251.45	6797.20	5271.76	1093.26	1711.02	636.13	2050.30
12-May	1226.15	6639.42	5199.42	1067.15	1695.65	632.86	2032.25

Glass Ceiling and Women Career Development in the Banking Sector: A Case of Birgunj

Som Raj Nepali[*]

Abstract

The study examines the relationship of glass ceiling with women career progression in banking sector in Birgunj city of Nepal. The study has used primary source of data in order to assess the opinions of women bankers of twenty-five commercial banks and central bank's branch regarding study variables. The study has adopted simple random sampling technique and employed structured questionnaire with the 5-points Likert scale items. The study has undertaken the descriptive and causal-experimental research design. The findings show that individual factors, cultural factors and family factors are negatively related to the women career development. The regression results reveal that cultural factors andindividual factors have negative influence on the career progression. The most dominant factor that influences the women career development is individual factors followed by cultural factors. The major conclusion of the study is that glass ceiling slows down the women banker's career development. Therefore, this study provides theoretical induction and practical implications to formulate the policies that builds-up self-confidence, unleash gender stereotyping, and promote equitable growth opportunities for the women empowerment and their career development.

Key Words: Work force diversity, glass ceiling, career development, organizational factors, and individual factors

JEL Classification: M12, O15

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I. INTRODUCTION

Women empowerment has been the major issue in the world's geo-politics. Women represent themselves in major economic and political opportunities. An access to education, equitable training & development opportunities and persistence self-efforts to gain necessary qualifications are supporting women to aspire for the senior management jobs. As a result, women are progressively grabbing professions, occupations and managerial jobs, which were believed to be reserved for men (International Labor Organization [ILO], 2004). However, women are still rare on the top level of the businesses (Meyerson & Fletcher, 2000).

One of the reasons of not having women in higher positions is believed to be linked to unseen barriers termed as a glass ceiling. Hymowitz and Schellhardt (1986) coined the term glass ceiling in corporate women report published in a 1986 Wall Street Journal. The concept of the glass ceiling describes the invisible as well as artificial hurdles that have kept women being promoted to upper management level and other higher leadership positions in the world of business (Maume, 2004).

Glass ceiling is an off-used metaphor for the relative disadvantages related to women's career opportunities along with the growing difficulties for women in moving up to the career ladder (Cotter et al., 2001). According to Tiwari et al. (2019), women are efficient at every position either in superior or mid-level positions. However, they are perceived as an inefficient employee who is burdened with lot of responsibilities other than workplace. Sometimes, the hindering obstacles may be self-created perception and beliefs or generated by the organizational system or grown by the contemporary social structure.

1.1 Women labor force participation in Nepalese context

Globally, women hold just 34 percent of managerial positions across the countries. On the other hand, women hold less than 7 percent managerial positions in the four worst performing countries viz. Egypt, Saudi Arabia, Yemen and Pakistan. Nepal ranks on 106th position out of 156 countries with the global gender gap score of 0.683 for 2021 (World Economic Forum [WEF], 2021). This rank was 105 with the score of 0.671 in 2018 where 1 represents the parity and 0 represents imparity. The rise in several spots is due to narrowing its gender gap in labor force participation as well as greater representation of women in parliament (WEF, 2018).

Table 1: Score card of Nepal in global context

Variables	Rank	Score	Average	Female	Male	Female/Male
Economic participation and opportunity	107	0.63	0.583			
Labor force participation rate, percent	5	0.991	0.655	85.3	86.1	0.99
Wage equality for similar work 1-7 (best)	89	0.627	0.628			4.39
Estimated earned income, Int'l $1000	25	0.741	0.494	2.7	3.6	0.74
Legislators, senior officials and managers, percent	142	0.152	0.349	13.2	86.8	0.15
Professionals and technical workers, percent	134	0.429	0.755	30	70	0.43

Source: The Global Gender Gap Report, 2021, WEF.

1.00 score = Gender parity; 0.00 score = Gender imparity

The above table (see Table 1) reveals about the Nepal's score card on the various gender-based factors with respect to other 156 countries in the world in March 2021. In Nepal, over 85 percent of women participate in the labor force. Similarly, income earned by a woman is 74 percent of that of a man, which shows gap lower than 50 percent.

Similarly, the following table (see Table 2) shows the status of female in economic leadership factors in Nepal.

**Table 2: Status of Nepalese female in economic leadership**

Economic leadership	Female	Male	F/M value
Advancement of women to leadership roles, 1-7 (Best)			4.12
Firms with female majority ownership, percent firms	21.8	78.2	0.28
Firms with female top managers, percent firms	17.2	82.8	0.21

Source: The Global Gender Gap Report, 2021, WEF.

1= Gender parity; 0= Gender imparity

As shown in figure (see Figure 1) below, the data says that there is gender disparities as national Labor Force Participation Rate (LFPR) and Employment to Population Ratio (EPR) were higher than those for females respectively. The LFPR is 53.8 percent for males compared to 26.3 percent for the females.

Figure 1: **Key labor market indicators by sex and locality**
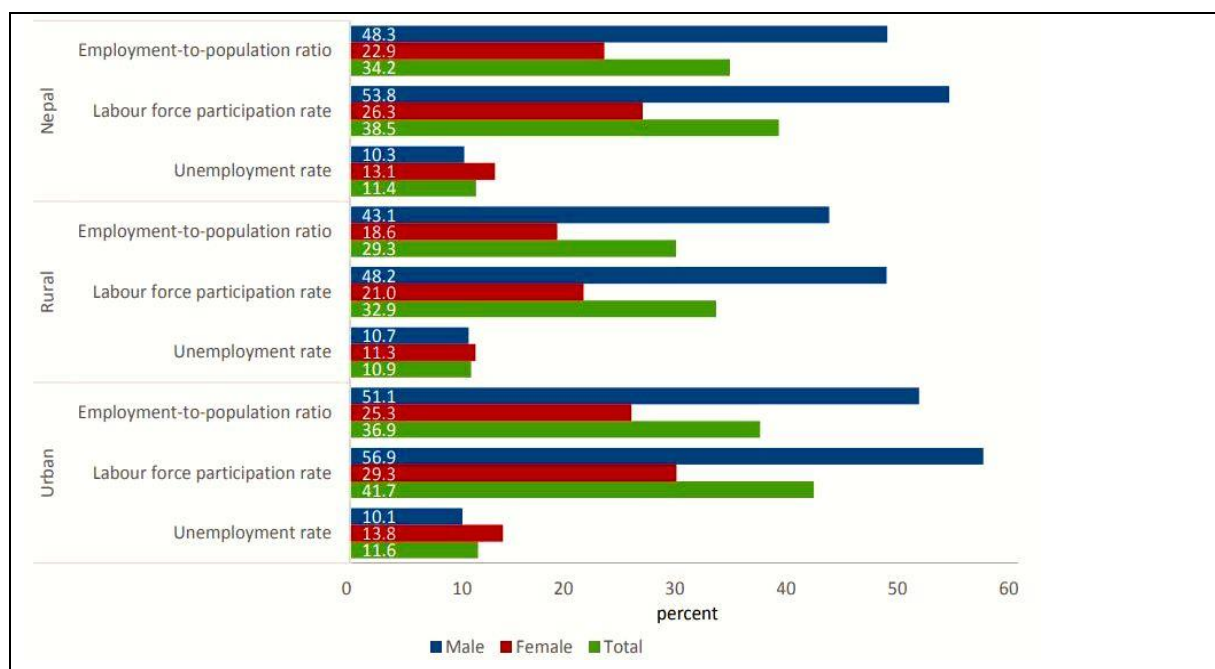
Source: Nepal Labor Force Survey-2017/18, CBS.

Another dimension of the scale of gender inequalities in the Nepalese labor market is the number of females per 100 males in each labor market category which is shown in the below figure (see Figure 2).

Figure 2: **Number of females per hundred males in the working-age population**
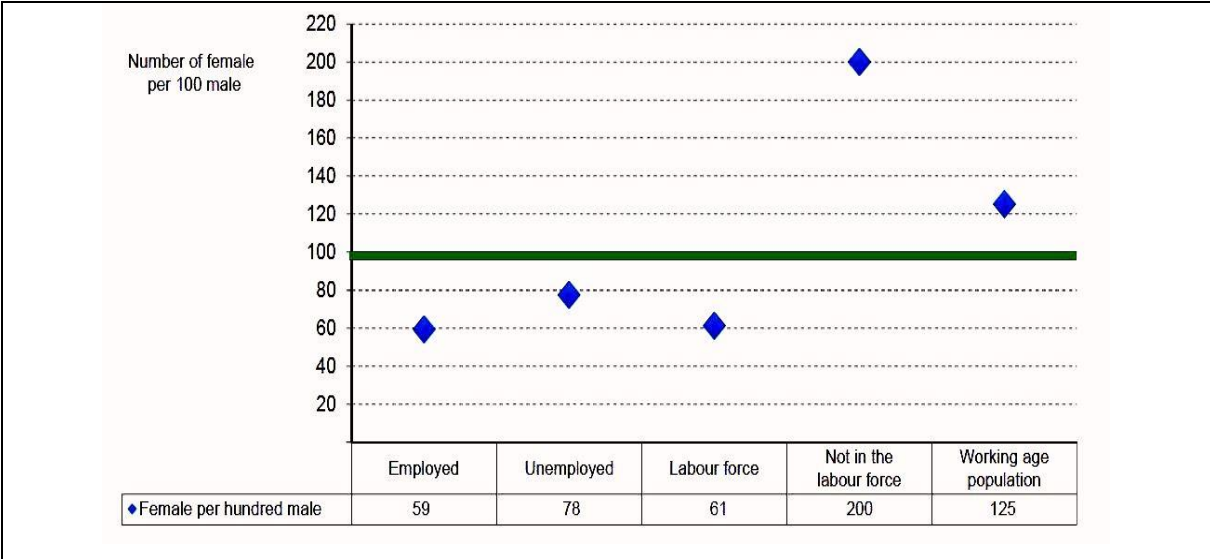
Source: Nepal Labor Force Survey-2017/18, CBS.

The data showed that there were 125 females for every 100 males in the working-age population. However, there were only 59 employed females for every 100 employed males when it came to employment. Gender disparities also existed among the unemployed and those who were not in the labor force (Central Bureau of Statistics [CBS], 2017/18).

Nepalese banks have been employing human resources and attempting to make gender diversity as much as possible in the work place. According to CBS (2017/18), at the managers level only 13.2 percent are female managers and rest, 86.8 percent, are the male managers. Financial and insurance activities have provided employment to the 63 thousand of male and 55 thousand of female. Nepalese banking sector has just witnessed Mrs. Anupama Khunjeli, the first ever women Chief Executive Officer, taking charge of Mega Bank Limited on 12th April 2018.

This study therefore helps to understand the present scenario of glass ceiling in women banker's career development in the context of Birgunj city of Nepal. It serves as the base for finding the relationship of glass ceiling and its effect on women career development in Nepal. This study is important for future researchers, jobholders and aspirants as it provides more knowledge on glass ceiling and career development and lastly, recommendations for overcoming their effects in Nepalese banking sector.

Further, the organization of the study is as follows: section two summarizes the literature review, section three explains methodology, section four describes the results and discussion, section five elaborates the summary and conclusion, section six yields recommendations of the study and the final section, section seven, sketches the future scope of the study.

II. LITERATURE REVIEW

World has witnessed a significant increased participation of women in labor force in last few decades. However, there is also an argument that this increment is primarily on the proportion of women at entry level, in lower and midlevel positions. Similarly, the proportion of women advancing to senior and top positions remains relatively low (ILO, 2002). According to Bal et al. (2013), career advancement means achieving a top position for a particular company through a series of stages. In other words, it is attaining experience in several professional fields to be able to develop their personal career.

Studer and Daisley (2014) revealed that about 55 percent of almost 800 professional women in the world from the financial services sector agree that, "It is harder for women to reach senior leadership roles in financial services than it is for men." There could possibly be many factors responsible for the glass ceiling. According to Fapohunda (2018), there is a moderately negative relationship between the glass ceiling and women career advancement. The study also concluded that personal dynamics, organizational dynamics and cultural dynamics significantly influence women career advancement. Similarly, there is a unique challenge posed by the family responsibilities for those who want to advance in career.

De and Chatterjee (2017) revealed that there exists negative relationship between the glass ceiling and women career development. The study also showed that individual factors, cultural factors and organizational factors have a significant effect on women career development. The study also concluded that of education and skills are the major elements in affecting women's participation in the workforce in India. Similarly, Tharenou (2005) showed that individual factors (e.g. education, work experiences, personality) social factors (e.g. support and encouragement) and organizational factors (e.g. organizational level) have important stake in women's advancement.

According to Bombuwela and De Alwis (2013), glass ceiling and women career development are negatively related among the female executive level employees working in Sri Lankan private sector organizations. Similarly, there is a weak negative correlation between family factors and women career development. In contrary, Wolfinger et al. (2008) revealed that family obligations and reproductive roles are the two potential barriers identified for women's lack of career development and academic achievements.

Family responsibilities are the main challenge for female executives' career advancement. Moreover, family responsibilities are related to other challenges, such as physical mobility, professional experience, educational attainment, and informal networks (Jauregui and Olivos, 2018). Victor and Shamila (2018) revealed that glass-ceiling barriers created by the individual, family and cultural factors have significant impact on women career development. However, organizational factors do not have significant impact on career development of executive level women of financial sector in Sri Lanka.

Ganiyu et al.(2018) concluded that because of factors that are rooted in cultural, societal, organizational, individual and psychological factors, women are not making it to the very top of their career. The study further concluded that cultural prejudice, religion convictions, family related issues, and individual and organizational influences have induced to an insignificant presence of women compared to men in managerial positions.

According to Thapar and Sharma (2017), banks' top-level management somewhere manipulated the things according to their convenience. The study also concluded that there is traditional working style, hierarchical patterns and conservative leadership styles because of which top positions are for men, in almost every sector, especially in public banks. Likewise, Helm (2006) argued that the glass ceiling is nourished by the organizational culture, policies and strategies rather than the women's own inadequacies. Glass ceiling is real, not myth, in the context of retail banks in South Africa.

According to Bhattarai (2001), there is lack of self-confidence among the women on their own capacity to compete Public Service Commission (PSC) examination. In addition, family members also have no confidence on their daughter, sister to compete and think that PSC examination as a very difficult to succeed in Nepal. According to Mathema (2010), salient culture, information ignorance, and economic dependency of the Nepalese women are the dominant factors that have made them indifferent about their participation in gainful employment and subsequent career development.

Therefore, above research findings lack consistency in their results and findings in different contexts including Nepal. The study attempts to fill the literature gap in the field of human resource management and its strategic HR planning in the context of Nepalese banking.

2.1 Statement of problem

Right activists, policy makers and researchers have been focusing on mitigating the gender differences in career development in every economic sector for years. An accusation to the male chauvinist society is that there prevails a prejudice and gender stereotyping about women, restricting them to be promoted to upper level than men. According to Keenawinna and Sajeevanie (2015), corporate practices, stereotypes about women and family commitment have negative relationship with women career development. The study further revealed that glass ceiling has negative impact on career development of women bank-branch managers.

However, Rai and Srivastava (2008) concluded that the glass ceiling is a relative term. They argued that it does not exist in real. It is because women worked for lesser time, engaged in low-risk jobs and disrupted career, which leads to lower salaries. In addition, Jones (2014) found that confidence problem after securing leadership position is one of the major experiences of women employees.

Based on the review of all above literatures related to glass ceiling and women career development, there still exists research problem that which factors; either organizational, individual, family and/or cultural factors have greater influence on the career development of women working in the banks and financial institutions. Therefore, this study deals with the following issues in the context of banking sector in Birgunj, Nepal:

   a. What is the demographic profile, status and patterns of women working in banks in Birgunj city?

   b. Is there any relationship among glass ceiling factors; organizational, individual, family and cultural factors and women career development in banking sector?

   c. Do organizational, individual, family and cultural factors affect women career development in banking sector? And to what extent?

2.2 Objective of the study

The major objective of the study is to examine the impact of glass ceiling on women career development in banking sector in Birgunj, Nepal. Besides, the specific objectives of the study are to answer all of the problem statements subsequently.

2.3 Conceptual framework

Based on the literatures reviewed above, the study develops following conceptual framework, which explains the systematic explanation of the relationship among the dependent and independent variables. The schematic conceptual framework (see Figure 3) shows that the organizational, individual, family and cultural factors are the independent variables, which affect women career development, a dependent variable.

Figure 3: Conceptual Framework
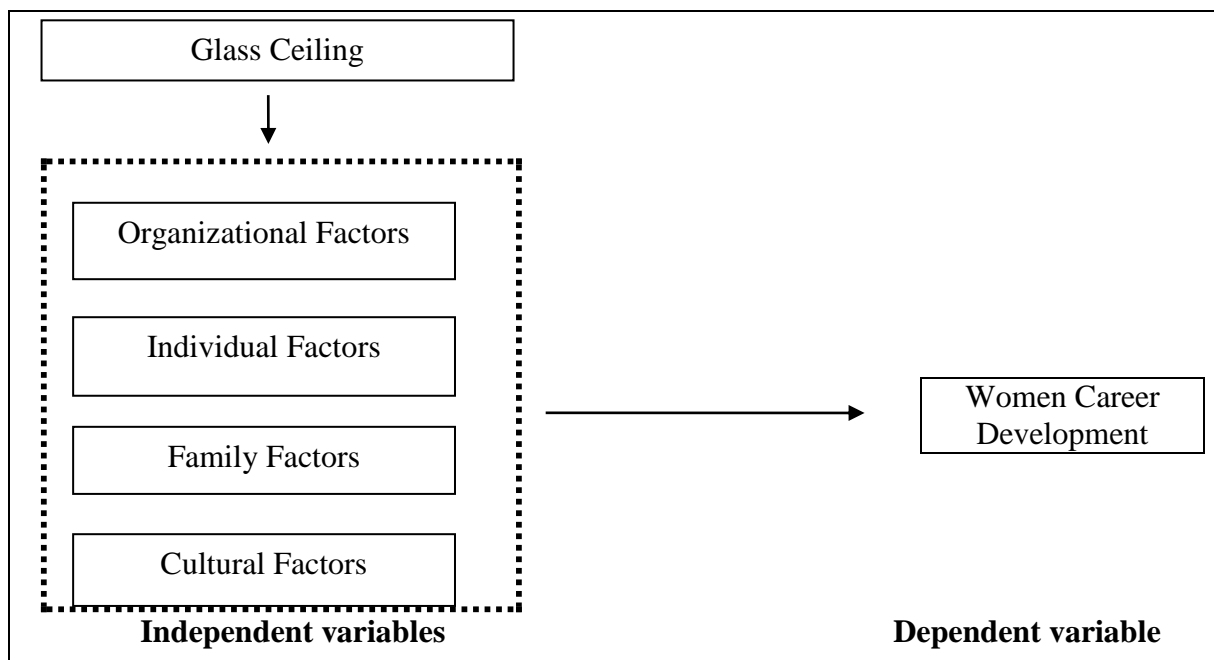
Source: Developed by researcher

2.4 Hypothesis of the study

Based on the above research findings and discussions in global contexts and Nepalese context, the study develops following hypotheses:

H_1: *There is a significant effect of organizational factors and women career development.*

H_2: *There is a significant effect of individual factors and women career development.*

H_3: *There is a significant effect of family factors and women career development.*

H_4: *There is a significant effect of cultural factors and women career development.*

III. METHODOLOGY

3.1 Research design

The study undertakes the combination of descriptive and causal-experimental research design. The descriptive research design helps to observe and describe variables in their respective natural environment. The study also employs causal-comparative research design which tests the level of significance and impact of independent variables such as organizational, individual, family, and cultural factors on the women career development.

3.2 Sample and sampling measures

The study has collected the primary data via questionnaire method, distributing questionnaires to the women employees working in the banks in Birgunj. The study has adopted simple random sampling technique to take sample of respondents. Self-administered structured questionnaire are used to assess the opinions of women employees' regarding the glass ceiling and its effect on their career development. The questionnaire employed in the study comprises of six sections; section (1) addresses the demographic profile of the respondents and section (2) measures the career development factors, which is a dependent variable. Similarly, section (3), section (4), Section (5) and section (6) measure the organizational factors, individual factors, family factors and cultural factors of glass ceiling respectively, which are the

independent variables of the study. Each section consists of the six items. The study has used 5-point Likert scale items to indicate the extent to which respondents agree or disagree with the statements ranging from 1 = Strongly disagree, 2 = Disagree, 3 = No opinion, 4 = Agree to 5 = Strongly agree respectively. The data collected is analyzed using IBM SPSS 23.0 software program.

3.3 Variables of the study

3.3.1 Dependent variable

Women Career Development - WCD refers to the amount of career focus, job satisfaction, increased self- confidence, growth opportunities and attitudes towards organization of an employee for advancing their career.

3.3.2 Independent variables

An independent variable of the study is a glass ceiling, which is taken as a composite index of organizational, individual, family and cultural factors. The independent variables of the study, inferred from the study of Bombuwela & De Alwis (2013), are defined and explained below:

a. **Organizational factors** - It refers to the extent to which the employees see the organization as being responsible for their lack of performance. Similarly, it explains the extent to which organizational structure and practices, including organizational policy and management style influence the employee development.

b. **Individual factors** - It means the extents to which individual's lack of confidence, self-belief, personal traits and inability to sell them, which are the barriers coming from themselves influence their career development.

c. **Family factors** - It depicts the extent to which relationships; family responsibilities and housework issues affect to the performance of employee.

d. **Cultural factors** - It measures the extent to which the beliefs, traditions, and stereotyping influence the employee development.

3.4 The model

The model of the study has estimated that the women career development depends on glass ceiling variables. The empirical investigation employs one Ordinary Least Square (OLS) regression approach to give in-depth analysis. The study therefore estimates the following model:

Women career development = f (Glass ceiling)

WCD = f (GC)

WCD = f (OF, IF, FF, and CF)

WCD= $\alpha + \beta_1 OF + \beta_2 IF + \beta_3 FF + \beta_4 CF + \varepsilon_1$

Where,

WCD = Women Career Development, GC = Glass Ceiling, OF = Organizational Factors, IF = Individual Factors, FF= Family Factors, CF = Cultural Factors, α is the constant term and β_1, β_2, β_3, and β_4 are the beta coefficients of variables, and ε_1= Error term

3.5 Reliability of data

The questionnaire's reliability is tested by using statistical tool Cronbach Alpha (CA), which is an estimate of how much variation in scores of different variables is attributable to chance

or random errors. As a rule of thumb, a coefficient greater than or equal to 0.70 is acceptable and is a good indication of construct reliability.

IV.   RESULTS AND DISCUSSION

4.1   Response rate

The following table (see Table 3) shows the response rate of the questionnaire.

Table 3: Response rate

S.N.	Response	Frequency	Percent
1.	Returned	100	83.33%
2.	Unreturned	20	16.67%
	Total	120	100%

Source: Researcher's calculation

One hundred and twenty questionnaires are distributed among the women employees working in the banks to avoid receiving less than required minimum number. Finally, the respondents return 100 questionnaires (83.33%).

4.2   Reliability Analysis

The following table (see Table 4) represents the result of the reliability analysis:

Table 4: Reliability Analysis

S.N.	Variables	Cronbach Alpha	Number of items
1	Career development	0.70	6
2	Organizational factors	0.76	6
3	Individual factors	0.73	6
4	Family factors	0.71	6
5	Cultural factors	0.80	6

Source: SPSS 23.0

4.3   Descriptive statistics

Table (see Table 5) below shows the demographic profile of the respondents of the study.

Table 5: Demographic profile of the respondents

Demographic variable	Particulars	Frequency	Percent
Age	18 – 30 years	79	79
	30 – 39 years	20	20
	40 – 49 years	1	1
	50– 59 years	0	0
	Total	**100**	**100**
Marital Status	Single	56	56
	Married	43	43
	Divorcee/Separated	1	1
	Widow	0	0
	Total	**100**	**100**

Education	School level	2	2
	Intermediate	1	1
	Bachelors	33	33
	Masters	64	64
	Doctorate and above	0	0
	Total	**100**	**100**
Experience	0-5 years	81	81
	5-10 years	15	15
	10-15 years	2	2
	15-20 years	1	1
	20-30 years	1	1
	Total	**100**	**100**
Department	Front desk/CSD	26	26
	Cash Counter	29	29
	Credit and relationship management	9	9
	Operations and administrations	21	21
	ATM & IT support	0	0
	Legal and Compliance	0	0
	Remittance	8	8
	Trade finance	2	2
	Others	5	5
	Total	**100**	**100**
Income level (per month)	<Rs.10000	1	1
	Rs.10000-20000	12	12
	Rs.20000-30000	49	49
	Rs.30000-50000	30	30
	> Rs.50000	8	8
	Total	**100**	**100**
Class or category of banks and financial institutions	A	96	96
	B	0	0
	C	0	0
	D	0	0
	Central bank	4	4
	Total	**100**	**100**

Source: SPSS 23.0

According to Table 5, majority (79 percent) of the women respondents have age within 18 to 30 years, followed by 20 percent of respondents have age within 30 to 39 years and only 1 percent of respondents have age within the range of 40-49 years. Likewise, 56 percent of the respondents are single whereas 43 percent of the respondents are married. 1 percent of the respondents are divorced or separated during the study.

The table further reveals that majority (64 percent) of the respondents have academic qualification of Master's Degree followed by 33 percent of bachelor's degree, 2 percent of school level and 1 percent of intermediate level. Similarly, 81 percent of the respondents have working experience up to 5 years. Likewise, 15 percent, 2 percent and 1 percent of the respondents have work experience of 5 to 10 years, 1 to 15 years, 15 to 20 years and 20 to 30 years respectively.

As shown in Table 5, majority (29 percent) of the respondents work in cash counter. 26 percent of respondents work in front desk/CSD and 21 percent of the respondents work in operation and administration department. Similarly, 49 percent of the respondents earn Rs. 20,000 to 30,000 monthly and 30 percent of the respondents earn Rs 30,000 to 50,000 per month. Only 1 percent of the respondent of the study earn below Rs. 10,000 per month. Likewise, majorities (96 percent) of the respondents work in a commercial bank and 4 percent of the respondents work in central bank located in the Birgunj.

4.4 Correlation analysis

Pearson's correlation coefficients are computed and the results are presented in the table (see Table 6) below:

Table 6: Pearson's correlation coefficients matrix

	Mean	SD	WCD	OF	IF	FF	CF
WCD	3.877	0.501	1				
OF	3.112	0.567	0.033	1			
IF	3.115	0.643	-0.367**	0.478**	1		
FF	2.923	0.600	-0.182	0.397**	0.456**	1	
CF	3.653	0.743	-0.315**	0.489**	0.606**	0.249*	1

Note: The asterisk signs (**) and (*) indicate that coefficients are significant at 1 percent and 5 percent level of significance.

Source: SPSS 23.0

Table 6 shows that mean value of career development is 3.877 which reveal that majority of the respondents agree that their career in the banking sector has developed. Similarly, organizational factors and individual factors have mean value of 3.112 and 3.115 respectively indicating that they have moderate level of stake in the career development of the women employees. However, family factors have mean value of 2.923 which is below moderate level. The mean value of cultural factors is 3.653 which imply that respondents agree on that cultural factors have stake in women career development.

The bi-variate analysis, in Table 6, also shows that there is weak and insignificant relationship between organizational factors and women career development. However, individual factors have negative and significant relationship with women career development having the correlation coefficient of 0.367 significant at 1 percent level of significance. It reveals that women's individual factors are blocking them to reach the top positions.

Similarly, family factors are negatively related to the women career development with the correlation coefficient of 0.182. However, the result is not significant at the 1percent level of significance. Likewise, there exits negative association between cultural factors and women career development having the correlation coefficient of 0.315 significant at 1 percent level of significance. It shows that fewer the cultural factors, which create the barriers, lower would be the women's career development in the banking sector in Birgunj.

Having shown the relationship between individual independent variables and dependent variables, following table (see Table 7) represents the relationship between glass ceiling, combined variable of four independent variables, and women career development.

Table 7: Pearson's correlation coefficients matrix

Variables	WCD	GC
WCD	1	-0.286**
GC	-0.286**	1

Note: The asterisk signs (**) and (*) indicate that coefficients are significant at 1 percent and 5 percent level of significance.

Source: SPSS 23.0

Table 7 shows that the glass ceiling is negatively related to women career development. It indicates that decrease in glass ceiling factors leads to accelerate the career development of the women working in the banks and financial institutions. There is moderate negative relationship between glass ceiling and career development since the correlation coefficient is 0.286 significant at the 1 percent level of significance.

4.5 Regression analysis

Table below (see Table 8) shows the regression results of organizational factors, individual factors, family factors and cultural factors on women career development.

Table 8: Estimated regression of OF, IF, FF and CF on WCD

Dependent Variable: Women Career Development
Method: Least squares
Number of respondents: 100

Variables	Coefficient	Std. Error	t-statistic	Prob.
(Constant)	4.598	0.303	15.155	0.000**
Organizational factors	0.322	0.097	3.313	0.001**
Individual Factors	-0.256	0.097	-2.650	0.009**
Family Factors	-0.092	0.087	-1.059	0.292
Cultural Factors	-0.180	0.0798	-2.253	0.027*
R-squared	0.237	**F-statistic**		7.361
Adjusted R-squared	0.204	**Prob. (F-statistic)**		0.000**

Note: The asterisk signs (**) and (*) indicate that coefficients are significant at 1 percent and 5 percent level of significance respectively.

Source: SPSS 23.0

Table 8 shows that the beta coefficient is positive for organizational factors. It reveals that organizational factors have positive impact on the women's career development. However, the beta coefficient is negative for individual factors. It means that individual factors have negative effect on the women career development indicating that weaker the individual factors higher would be the women career development. The result is significant at the 1 percent level of significance. This finding is consistent with the findings of the Victor and Shamila (2018) and Kulkarni (2002).

Similarly, the beta coefficient is negative for the family factors indicating that family factors have negative impact on the women career development. It also shows that decrease family related barriers uplifts women to have higher career growth in the banking however the result

is not significant at the 1 percent level of significance. This finding is similar to the findings of Jauregui and Olivos (2018). Likewise, there is negative impact of cultural factors on the women career development since the beta coefficient for cultural factor is negative with the career development. The result is significant at 5 percent level of significance. It also reveals that decrease in toughness in cultural factors leads to career development of women in the banking. This result is consistent with the findings of Bombuwela and De Alwis (2013).

The regression model shows F-value of 7.361 with the probability value of 0.000 and it is statistically significant at 1 percent level of significance. According to the R2 value the 23.70 percent of total variation in the women career development is explained by the above independent variables.

Following table (see Table 9) presents the regression analysis between glass ceiling as combined variable of above mentioned four independent variables and women career development.

Table 9: Estimated regression of GC on WCD

Dependent Variable: Women Career Development
Method: Least squares
Number of respondents: 100

Variable	Coefficient	Std. Error	t-statistic	Prob.
(Constant)	4.815	0.321	14.999	0.000**
Glass Ceiling	-0.293	0.099	-2.956	0.004**
R-squared	0.081	**F-statistic**		8.738
Adjusted R-squared	0.073	**Prob. (F-statistic)**		0.004**

Note: The asterisk signs (**) that coefficients are significant at 1 percent level of significance.

Source: SPSS 23.0

Table 9 regression analysis presents F-value of 8.738 with the probability value of 0.000. It is statistically significant at 1 percent level of significance as the probability value is less than 0.01. This implies that glass ceiling has significant impact on the women career development. The coefficient of determination is measured with the R2 and it is 0.081 which reveals that 8.1 percent of the variation in the women career development is determined by the glass ceiling while 91.9 percent is explained by other factors.

The regression result shows that beta coefficient is negative for glass ceiling with the women career development. It means the negative effect of glass ceiling on the women career development. In other words, lowering or breaking the glass ceiling contributes to the higher career growth of women working in the banking sector in Birgunj and vice-versa. This finding is consistent with the findings that glass ceiling has negative influence of women career development (Keenawinna and Sajeevanie, 2015; De and Chatterjee, 2017; Fapohunda, 2018; and Victor and Shamila, 2018).

4.6   Test of hypotheses

Under the test of hypotheses, if the p-value, of respective independent variable with the dependent, is equal or less than 0.05, then the null hypothesis is rejected, otherwise accepted. Table (see Table 10) below shows summary of the accepted or rejected hypotheses of the study.

Table 10: Summary of hypothesis testing

Hypotheses	Accepted	Rejected	Remarks
H_1			It is based on p-values of individual correlation and regression coefficients at 5 percent level of significance.
H_2			
H_3			
H_4			

Source: Constructed by the researcher

V.   SUMMARY AND CONCLUSION

This study attempts to analyze the glass ceiling and its effect on women career development in banking sector in Birgunj. The results show that individual factors, family factors and cultural factors have negative relationship with the career development. The study reveals significant negative effect of individual factors on career development showing that individual factors like; lack of confidence, lack of technical skills, unbalanced work life etc. are hindering women reaching to top position. Similarly, cultural factors have significant negative impact on women career development. It means that cultural factors like; traditions, beliefs, and stereotyping about women have negative impression regarding women career development. Social support and cultural positive changes help to increase participation of women in top position in the banks.

Likewise, the study shows that the family factors have negative but insignificant effect on the women career development. It also reveals that increase in family relationships, responsibilities, and household issues have contributed women not concentrating on career development. However, there is positive association between organizational factors and career development indicating that organizational factors are supportive to the women career development. The human resource policies are equal to employees irrespective of gender, location since it is always guided by the central office, and the study shows positive HR policies and practices for the women career development.

As a combined result of all four glass-ceiling factors, the study concludes that there is significant and negative relationship between glass ceiling and women career development. It implies that increase in glass ceiling leads to slow down or restrict the career development of women in banking sector.

VI.   RECOMMENDATIONS

The study shows that individual factors, among other glass ceiling factors, are the most influencing factors on the women career development. Hence, female bankers are recommended to work on developing their capabilities, enhancing their managerial as well as technical skills, increasing self-confidence, working on self-development and so on. Likewise, families are responsible for helping women bankers by sharing household works among themselves and having balanced work family life. However, organizational factors have positive impact on the women career development. Women find organizational policies and practices are favorable and supportive to their career development and banks are recommended to ensure the fairness, equality, impartiality, and equity in matter related to women career development.

VII. FUTURE SCOPE

Future studies can be guided towards banking sector as a whole, not only limited in particular city of Nepal. It can also increase the sample size by taking consideration of employees of development banks, finance companies, micro-finances and co-operatives as well. Similarly, researchers can further analyze other dimensions viz. regulatory requirements, labor policies, international HR practices, etc. and their effect on the women career development.

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Assessment of Gender Diversity on Banking Performance in Nepal: Evidence from Binary Logit Estimation

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Sushma Adhikari **

Abstract

The relationship between gender diversity and firm performance has been the subject of research request for more than three decades now. Evidences shows, status of the women is not that encouraging in Nepal. Factors relating to gender diversity are hypothesized so as to increase the banking performance. The objective of this paper was to assess the role of gender diversity on banking performance in Kathmandu valley. The study adopted descriptive approach. Respondents were sampled from employees of a commercial banks in Kathmandu valley. Simple random sampling techniques was used to select 300 employees. The questionnaire was used for data collection. Descriptive statistics, correlation, regression, pre-estimation, post-estimation techniques within Binary Logistic Model were used for data analysis. The study found that gender diversity has positive significant influence on enhancing banking performance. Gender diverse teams could help organization enhance creativity in its practice and increase its performance level. This study concluded that gender diversity has been one of the important issue in the world and enhancing it could result higher productivity and higher performance of an organization. Hence, the paper recommends that there should be inclusive climate in the workplace and policies supporting work-life balance should be forwarded.

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I. INTRODUCTION

The connection between gender diversity and firm performance has been the subject of exploration for over three decades now (Joshi, 2017). Gender diversity achieves more broad perspectives, various types of information and contemplations inside an affiliation and results in unparalleled basic reasoning and essential initiative (Richard, Kirby, & Chadwick, 2013). With respect to encouraging gender diversity as a feature of their working environment procedure, private area firms are regularly left to depend on past experiences, speculations and recounted assertions(Joshi, 2017). Worldwide, women have less entryways for monetary investment than men, less admittance to key and high level training, more vital prosperity and dangers, and less political portrayal (Estes and Hosseini, 1988). Women's don't take an interest in the worldwide economy similarly as men do (Kochhar & Jain-chandra, 2017). As per McKinsey overall foundation also gauges that a situation where women achieved total gender equality with men could yield worldwide by more than one-quarter comparative with a the same old situation (Joshi, 2017). Exploration on gender and business morals recommends that women's are more moral than men in attitudes and practices (Putnam, 1979). Associations in which number of female heads are more in number, perform better regarding corporate administration and monetary execution (Omri & Boukattaya, 2018).

Gender diversity is seen as abusing reasonable remarkable credits just as capacities among male and female which could be of acceptable upper hand to the firm (Hassan, 2018). Moreover pioneers of gender diversity, proposes that gender diverse firms will in general acquire the bit of leeway, for example, lessening cost through lower speeds of turnover and non-appearance when contrasted with firm with less gender diverse teams. The public authority should establish an amiable climate for making a strong work market for women's and they should be advanced through a few data campaigns (ILO, 2005). Next could be encouraging an atmosphere of consideration in the working environment for which firm ought to have formal projects and quantifiable targets and actualize viable variety the board strategies (US Department of Commerce, 2000). Moreover extending the proof base on gender diversity across all hierarchical levels could be other arrangement where firms should screen and assess measurements to keep tabs on women development from section to administration, just as information identifying with the status of women representatives in a few positions relating to variety the board and incorporation, is to be gathered in an occasional premise and made accessible for straightforward analyses(Noland, Moran, & Kotschwar, 2016).

Thus, gender diversity is a source of intangible and socially complex resources that helps a firm to gain sustained competitive advantage in the market (Ali, Kulik, & Metz, 2011). Such intangible and socially complex resources as obtained from gender diversity are market insight, creativity and innovation, and improved problem-solving that employees will be equipped with (Ali, Kulik, & Metz, 2009). Furthermore, a gender-diverse team can surely produce high quality decisions because male and female bring different ideas and perspectives leading to varied alternatives (Salas, 1995). The negative effects of diversity might also continue to unfavorably influence workers even intensify. The increment minority representation (e.g. women) may be seen as a power threat by the majority (e.g. men). Thus, increased competition and struggle would strengthen in-group out-group dynamics further bringing the performance down (Ali, Kulik, & Metz, 2009). Gender diversity has been a center of research among many researcher as it's a burning issue prevailing in any nation that could impact a firm's performance in both positive and negative manner (Nakagawa, 2015). Despite having several social organizations to protect and ensure gender equality among the nations, still we can find women in the world are back in social, economic and political spheres (Baral, 2017).

As per the several studies conducted, several gender diversity related issues and findings has been appeared to existence. Gender diversity offers ascend to relational clash. Gender, similar to age and race, is an impermeable attribute and hard to change. Contrasts in impermeable attributes for the most part lead to more grounded in-gathering/out-bunch inclinations advancing sentiments of hatred, outrage, and disappointment and eventually relational clash (Mellahi & Johnson, 2000). Women don't approach administration. Women's are regularly prohibited from managerial places of power and initiative because of generalizations, which have been built by watching 'non-managerial' populations at large(Estes & Hosseini, 1988). As we have been already aware with the fact that women still are so backward in the sectors of development as compared to men (European Commission, 2018). Though there has been some improvements regarding the participation of women in several affairs of developmental sector, still it's not up to the mark. So for this, women at the very first needs to be empowered through several means, they should be well recognized by the nation and should be given equal rights and opportunities as men. Companies in order to help ensure equality among male and female, should promote company as a diversity friendly and acknowledge the benefits both male and female could together contribute so as to improve firm's performance(International Finance Corporation, 2016).

Looking towards the Nepalese context, status of the women is not encouraging especially in rural areas(Paper, 1999). Rural areas are still backward in the gender issue where people don't simply want to agree with the modern thought of creating gender equality and equity particularly for the freedom of the women in every spheres of their life equally as male members (Bhadra & Shah, 2007). Despite Nepalese women participation in service sectors, still in some areas they are suffering from double discrimination of social backwardness as well as gender inequality (Asian Development Bank, 2016). Out of total working-age women, only 8.5 million are in labor force who are either employed or are in search of employment, and only 2.6 million from the total women labor force are employed, according to the report (CBS, 2009). This shows only 22.5 percent of working age women are employed in Nepal according to the National Labor Force Survey 2017-18. Therefore the role of women in the local developmental contexts, in several areas of country is particularly down and out in light of the fact that the word gender isn't seen fittingly in our general public (Baral, 2017). Thus, this study tries to gain insight regarding gender diversity on banking performance in Kathmandu valley exploring what role gender diversity has on banking performance, present status of gender diversity on banking performance in valley, factors that led to affect gender diversity on banking performance in Kathmandu valley.

Second section of this study includes literature review, followed by methods used in third section. Fourth section discusses results and finally fifth section concludes the study.

II. LITERATURE REVIEW

Among economically active population, 56.63% are male and 43.37% are female (Ongena, 2003). Compared to female, male working population is at a highest number in banking sector. Banking sector is however influenced by gender discrimination. In banking sector, there are no female officers at a higher position. Women's participation is found to be much lower than that of men and it's because of their lower educational attainments and slow rise in literacy rate. Women's position is very much undermined in both education and employment because every decision making positions are being controlled and also dominated by male (Pant, 2016). However, today's business stated that they focus on diverse workforce as they possess varied skills and competencies as they are the source of creativity and innovation. However the basic leadership attributes of males and females in a 'non-administrative' population in which most of people have not experienced formal management education are

stood out from an 'managerial' population of potential and real managers who have embraced such education (Johnson & Powell, 1994).

Gender diversity can be a positive resource for organizations, taking into consideration the utilization of progressively assorted information and human ranges of abilities (Bénavidès et al., 1984; Johnson & Powell, 1994). Numerous investigations have shown that there are striking contrasts between the male and female work force, some have in the opposite demonstrated that there are no differences in their efficiency. Feminine gender is progressively turning into the "motor of financial development". When contrasted with men, women in the western nations have a superior possibility of succeeding and exceeding expectations in organizations because of their better execution (Egbuwe & Nwinee, 2019). On an expert level, women supervisors who have arrived at top administration positions can execute the same number of men administrators as far as the usage of clear and feasible destinations. Females surpassed males in scores on giving data, advancing glad relations, being responsive to thoughts, empowering exertion, appearing - concern, and being mindful. Males outperformed females on scores of predominance, coordinating discussions, and hostility (Alpha & Vincent, 2011). The latest data show that only 560 out of 2500 employees are female in Nepal bank limited. Similarly, 190 out of 1373 in Nepal Rastra Bank, 506 out of 2019 in Rastriya Banijaya Bank, 60 out of 256 in Everest Bank, 21 out of 100 in Lumbini Bank are female employees (Tulaadhar & Yadav, 2018). The Banking and monetary associations have extended in various portions of Nepal and number of taught females are expanding significantly. In spite of having increment number of female on the banking and financial organization, the number is more yet negligible than male. So it is important to direct an exploration to learn about the status of female workers on banking and financial sector of Nepal (Paper, 1999).

Both male and female officially instructed administrators can contribute similarly to the authoritative choice procedure. Future research ought to react all the more completely to difficulties that measures customarily utilized in gender look into reflect male-determined measures. More noteworthy consideration ought to be given to the improvement of measures that suitably speak to the two circles of gender (Carter, Williams, & Reynolds, 1997; Johnson & Powell, 1994). Planned change approach ought to be utilized to systematically oversee diversity, by creating and executing and planned change-corporate decent variety technique. Organizations ought to execute their social reengineering endeavors to move people and the hierarchical culture along the diversity continuum from the conditions of recognizing and esteeming diversity to the ideal condition of overseeing diversity (Nasir & Morgan, 2017). Furthermore, this examination ought to be stretched out to incorporate other visible aspects of cultural diversity, for example, race and age. At long last, diversity was analyzed distinctly at the management group level. Future research should address this issue in regards to surveying diversity independently into three levels of management. Comparative center ought to be set at firm wide and industry levels of examination (Dwyer et al., 2003).

III.   RESEARCH METHODOLOGY

3.1   Theoretical and Conceptual Debate

In today's scenario there is a demand for a diverse people that may be in terms of gender, race, ethnicity etc. Male and female together could help organization gain a better way for its development because they possess different traits and attributes and thus they need to be equal politically, economically and socially. For this study, several scholar have attempted to link their opinion. The very first theory is Theory of Representative Bureaucracy holds that "aloof portrayal", or how much an organization utilizes people of varying measurement establishments, will prompt dynamic portrayal, or the mission for approaches reflecting the

interests and needs of those individuals (Bradbury & Kellough, 2008). The consequent theory is Feminist theory that has dependably been associated with review the social world to such an extent that lights up the powers that make and bolster lopsidedness, abuse, and wretchedness, and in doing everything considered, impels the voyage for correspondence and worth. Feminism is a theory that male and female should be proportionate strategically, fiscally and socially. Symbolic interaction theory handles that people make their social reality by means of day by day connections, in this way, they consider gender to be a segment of individual execution. Gender assumes a job so as to shape all relationship of individuals in everyday life (Aksan, Kisac, Aydin, & Demirbuken, 2009). Next comes Contingency theory which prescribe that gender diversity impacts at the organization level is reliant upon, that is, facilitated by, the alliance's irreplaceable bearing, the different leveled culture where it stays, and furthermore the multivariate correspondence among two or three factor (Dwyer et al., 2003). Petrocelli et al. (2003) presents a conflict theory that says, a society is a battle for power among social gatherings (like women versus men) that go after exceptional assets and it is difficult for female to transcend male, as transcendent gain the standards for ground and opportunity in the all-inclusive community eyes.

The study assumes that its essence to understand the factors influencing gender diversity on banking performances. Gender diversity goes about as a driver of innovations at firm level. Innovation that reveals new ways to development will just spring from high-performing, sexual orientation various groups that boost the intensity of various sentiments, viewpoints and social references. Gender diversity cultivates inventiveness and produces increasingly proficient arrangements (Teruel & Agustí, 2017). Gender diversity in a business cultivates imagination by giving required aptitudes, information in the activity of business and remembering both male and female for the undertakings of business guarantees uniformity by and by and prompts progressively skillful business. Both men and women of a different race, culture and age should be given equal open entryways for their improvement. There is an unquestionable necessity to have a gender diversity in any business to make a productive business(David & Ely, 2005). The essential persuasion that unfurls the "diversity – performance" connection sways between the point of view of social order (perceivable properties, for example, age, sex and racioethnicity) versus enlightening/practical diversity (character, information, values) points of view (Knippenberg, 2013). Whereas the last point of view stresses diversity of surface (age, sex, ethnicity) and practical (residency, instructive foundation, aptitude) characteristics expands execution, the previous social order point of view fights that diversity builds the expense of gathering the executives because of the insider/outside elements of social gatherings (Tajfel, 1978). Put gruffly, different groups may hamper execution due to expanded expenses of coordination and arrangement between profoundly various individuals, while heterogeneous groups beat their increasingly homogeneous counterparts because of the more fluctuated assets and better quality basic leadership accessible (Knippenberg, 2013).

Gender diversity leads to short term and long term consequences. The short term consequences are classified as effective, cognitive and symbolic. Effective includes factors like, role conflict, role ambiguity and perceived discrimination, whereas cognitive includes factors such as, innovation, number and quality of ideas and range of perspective. Similarly symbolic includes, behavior of low level employees. The long term consequences are classified as Individual, group and organizational. The factors on an individual level includes abseenteism, turnover and performance whereas in a group level, the factors are turnover and performance. Similary in an organizational level, the factors includes performance and strategic changes. Here, the dependent variable is banking performance and independent variable is gender diversity which consists of several factors under it such as age, marital

status, education, training and development, workplace, competencies and so on. These all factors has a great impact on banking performance that will either positively or negatively impact it's overall operational performances. These days diversity isn't just a human issue yet has become a hierarchical issue both inside and outside organization. Those organizations who have figured out how to oversee gender diversity have received rewards from it as far as maintenance of gifted workforce, improved gathering execution, better reaction to changing commercial center and diminish turnover cost(Barbosa &Cabral-Cardoso, 2010). Additionally, female on the top brings educational and social advantages, enhances conduct showed by supervisors and inspires women in the center administration (Dezso& Ross, 2012).

3.2 Empirical Framework

For empirical analysis of the study, binary logistic model was selected to identify the significant variables that determine the role of gender diversity and banking performances. The model is given as $Pr(Y = C/Xi) = F(Xi\beta)$. Where, Y is the response generated as outcome for attitude level of community that is coded as $0 =$ less aware, $1=$ Moderate aware and $2 =$ High aware; F is the standard logistic cumulative function; X is the set of independent variables.

$$P\, Yi > j = \frac{exp\,(x_i\,\beta - k_j)}{1 + [exp\,(x_i\,\beta - k_j)]} \quad , j = 1, 2\ldots M\text{-}1, \text{ which implies}$$

$$P(Y_i = 1) = 1 - \frac{exp\,(x_i\,\beta - k_j)}{1 + [exp\,(x_i\,\beta - k_j)]}$$

$$P(Y_i = j) = \frac{exp\,(x_i\,\beta - k_{j-1})}{1 + [exp\,(x_i\,\beta - k_{j-1})]} - \frac{exp\,(x_i\,\beta - k_j)}{1 + [exp\,(x_i\,\beta - k_j)]} \quad , j = 2, \ldots.. M\text{-}1, \text{implying}$$

$$P(Y_i = M) = \frac{exp\,(x_i\,\beta - k_{m-1})}{1 + [exp\,(x_i\,\beta - k_{m-1})]}$$

In the case of M=2, these equations simplify to

$$P(Y = 0) = \frac{1}{1 + [exp\,(Z_i - k_i)]}$$

$$P(Y = 1) = \frac{1}{1 + [exp\,(Z_i - k_2)]} - \frac{1}{1 + [exp\,(Z_i - k_1)]}$$

Hence, Williams (2016) stated that utilizing the estimation of Z and the assumed logistic distribution of the aggravation term, the ordered logit model can be utilized to assess the likelihood that the unobserved variable Y* falls inside the different edge limits. The empirical specification can be seen as below:

$$Y = \alpha + \beta1X1 + \beta2X2 + \beta3X3 + \beta4X4 + \beta5X5 + \beta6X6 + \beta7X7 + \beta8X8 + \beta9X9 + e$$

Where Y = dependent variable, X_1-X_9 = independent variables and e refers error term.

The performance measurement used in this study are age, marital status, training and development, education, workplace, motivation of employees, satisfaction level of employees, competency level and it is believed to give positive relationship with gender diversity as depicted in table 1.

Table 1: Variables and Expected Sign of Variables

Variable	Description	Value	Expected sign
Dependent Variable			
Banking performance		1=yes 0= otherwise	±
Independent Variable			
Age	Age of respondent	in years	±
Sex	Sex of the respondents	1= Male, 0 = Otherwise	±
Marital_ status	Marital status of respondent	1= Married 0= otherwise	±
Training _and_ development	Training and development program received by respondent	1= yes 0= otherwise	+
Work_ experience	Total employee experience year	In category	+
Motivation	Motivation level of respondent	1= yes 0= otherwise	+
Satisfaction	Satisfaction level of respondent	1= yes 0= otherwise	+

3.3 Study Area

Kathmandu valley of Nepal is chosen for the study area. Nepal has 77 districts, and from the 77 district, 3 districts include in Kathmandu valley (Kathmandu, Bhaktapur and Lalitpur) situated in province 3 were taken for the study area of this research. The geographic coordinates of Kathmandu valley are: latitudes 27°32"13" and 27°49"10"north. and longitudes 85°11"31" and 85°31"38" E (Paudel et al, 2020). The total population of Kathmandu is 1,442,271which has the largest population than other district. This study was emerging issue of most of the banking sector of Nepal because there are both male and female working in a particular organization which would surely impact the banking performance to a great extent. There are many financial institutions but we select only 27 commercial banks of Nepal. The Kathmandu valley was suitable area for research because it has a largest population of Nepal.

Figure 1: Study Area
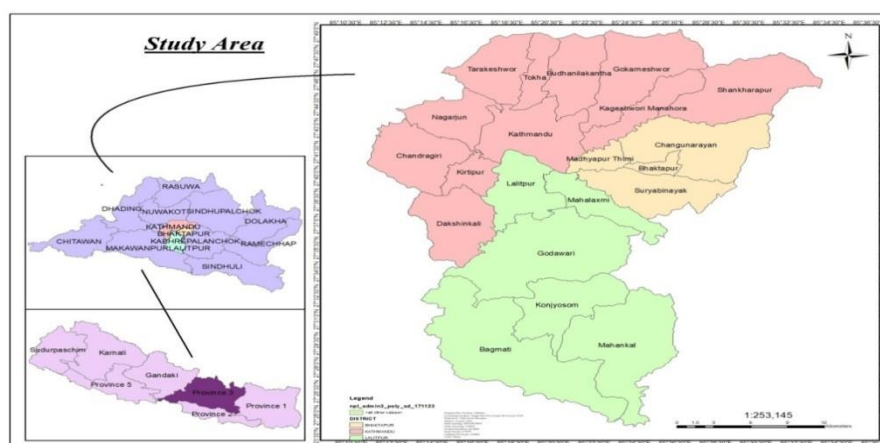
3.4 Study Population and Sample Size Determination

As highlighted before the study was conducted in Kathmandu valley of Nepal. The target populations were banking employees who are responsible for the overall performance of

bank. A probability sampling was used for the survey and within that simple random sampling was used to collect data. The sampling unit in the study was the bank's employees. To work out the sample size $n0 = z2$ pq/e 2 (Micky Olutende, Wisiuba Bukhala, & Wesonga, 2018; Bhandari et al., 2021)has been used.

Where, N0 = sample size required for study, Standard tabulated for level of significance (z) = 1.96, p = prevalence or proportion of an event% = 0.50(More et. al, 2012). So, P = 0.5 and q = 1-p, = 0.5. Allowable error that can be tolerated (e) = 6%. So, total population for the study = (1.96)2×0.5×0.5/ (0.06)2 = 266.78, Non-response error 6%, i.e. 266.78*6/100 = 16.00. Thus, sample size taken for study was (266.78+16.00) = 282.78(≈283).

3.5 Research Instrument

In this study, Questionnaire and observation were used as research instruments. In order to get quantitative data from individual customers, the banks customers' survey was conducted. Structured questionnaire was used for this study. However the questionnaire was maintained using Kobo toolbox. After the preparation of the questionnaire, 5% of the total sample size determination was taken as pre- test. For the analysis of data, descriptive, banking performance index and inferential method were carried out which were presented with the help of charts, tables and figures.

IV. RESULT

4.1 Socio- demographic Analysis

300 respondents were interviewed in each of the three districts; Kathmandu, Lalitpur and Bhaktapur. There were altogether 49.50 percent male and 50.50 percent female respondents which indicates that there are equal number of male and female employees in banks of Kathmandu valley which can be said as there is gender equality in terms of hiring employees in banks. Most (65.67%) of the respondents hold masters' degree among which 38.67% are male and 27% are female. Similarly majority of respondents belongs to age group below 30 i.e. 64.78% and majority (37%) of the employers of the banks holds work experience of more than 3 years.

4.2 Banking Performance Index based on Gender

Banking performance index is presented in this section which shows performance of an organization. While analyzing performance of banking organization it was revealed out of total respondents, 11.67 percent were less performing employees, 85 percent were moderately performing and only 3.33 percent were high performing employees.

*Figure 2***: Performance of Organization Based on Sex**
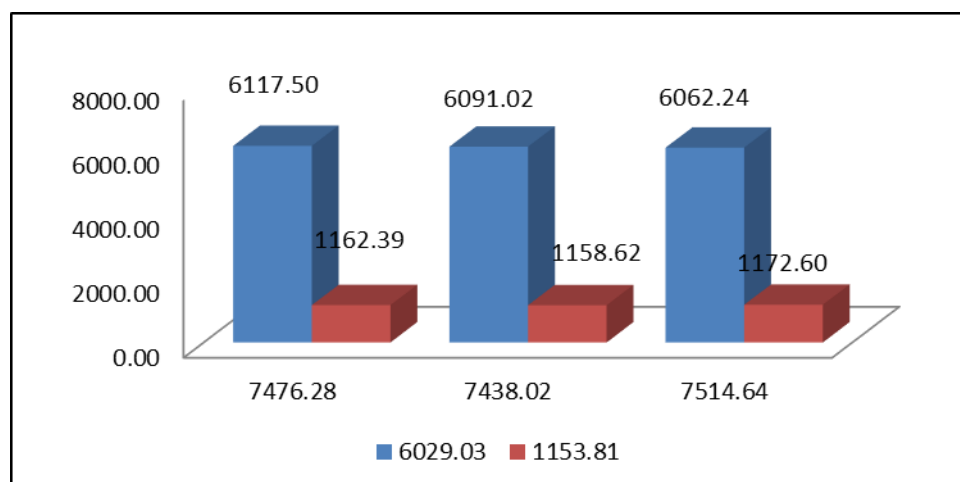
The study further revealed that 1.67 percent male and female were high performer respectively. 43.33 percent male were moderate performer and 41.67 percent female were performing moderately. Similarly, 5 percent male were performing to their lowest level and 6.67 percent female were least performer. This study shows that based on banking performance male employees were found to be performing quite well in comparison to female employees.

4.3   Pre and Post Estimation Test

Under Pre estimation we perform specification error, goodness of fit and other diagnostic test. Specification error is done to find out whether the variable or assumptions of statistical model is correct or not. Similarly goodness of fit is a statistical hypothesis test to see how well sample data *fit* a distribution from a population with a normal distribution. The Stata command linktest can be used to detect a specification error so as to find if the model is properly specified, one should not be able to find any additional predictors that are statistically significant except by chance. Here, we came to know that _hat value is statistically insignificant and _hatsq value, is not statistically significant. The _hat value is 0.350 and _hatsq value is 0.661. So, we can conclude that we have chosen few meaningful predictors and the few variables are wrong or have errors and few of them are correct. To be a goodness of fit, the predicted frequency and observed frequency should match closely, and that the more closely they match, the better the fit. When performed goodness of fit, the result obtained for model is Prob > chi2 = 0.8446. In order to be goodness of fit, p-value should be greater than 5% i.e. 0.05 and so we can say that there is a goodness of fit in our models. This helps to determine goodness of fit. We look towards count R2 in this diagnostic and the more it is, more its better. The count R2 for model is 0.983 which is higher than 0.7, so its excellent.

Studies argued that cross-sectional data analysis involves two problems: the heteroscedasticity in the error term and multicollinearity among explanatory variables. To overcome this the Variance inflation factor (VIF) Test was performed to deal with the problem of multicollinearity. The VIF estimates how much the variance of a regression coefficient is inflated due to multicollinearity in the model.So we need to perform heteroscedasticity and multicollinearity. Variance inflating factor (VIF) is a test to assess multicollinearity in our regression model. Variance inflating factor as per the calculation for model   is 1.19 and we know that if VIF is greater than 10, there exist multicollinearity. So, we can say that there is no multicollinearity in the data set. Heteroscedasticity occures when there is a large difference among the sizes of observation. It is important to identify the Heteroscedasticity as the results will be ruined when running the regression analysis. To understand our data set, we perform heteroscedasticity test. Looking towards hettest, the result appeared for model is prob>Chi2 =0.0000. The assumptions shows that there is presence of heteroscedasticity if the value is less than 0.05. So, there is presence of heteroscedasticity in case of model. Hence, we performed robust standard error test to correct the mentioned problem.

4.4   Logistic Regression

The Binary Logistic Regression has been used to acquire inferential output for this study. The results generated from the regression are presented in table 2.

Table 2: Final Regression

Variables	(1) Logit coeff	(2) Odds ratio	(3) Marginal effects
Organization performance			
Age	-0.0935	0.911	-0.00126
	(0.115)	(0.105)	(0.00171)
Sex	0.876	2.401	0.0118
	(1.071)	(2.571)	(0.0154)
Marital status	-3.051***	0.0473***	-0.0411*
	(1.087)	(0.0514)	(0.0217)
training_and_development	5.017**	151.0**	0.0675
	(2.497)	(377.1)	(0.0416)
Work_Experience	-1.548	0.213	-0.0208
	(2.642)	(0.562)	(0.0340)
Motivation	3.250***	25.80***	0.0438**
	(1.143)	(29.48)	(0.0179)
Satisfaction	0.600	1.821	0.00807
	(0.890)	(1.622)	(0.0111)
Constant	1.344	3.834	
	(4.234)	(16.23)	
Observations	300	300	300

Robust standard errors in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table above shows that there are three significant variables namely, marital status, training & development and motivation having p-value less than 5%. Now we can say that increase in the number of either married or unmarried people, the odds of being increment in organization performance decreases by a factor of 3.051. Similarly, if there is increase in training & development opportunities for employees, the odds of enhancing performance of organization increases by 5.017times. Again, increase in motivation level of employees, the odds of improving organizational performance increases by 3.250 times. Talking about coefficient in logit model, there are three significant variables that are marital status, training & development and motivation having p-value less than 0.05 i.e. 5%. Talking about marital status, if there is increment in married or unmarried employees, then the probability of enhancing organizational performance gets increased by 0.0473 unit. Similarly, if employees given training & development increases by 1 unit, then the probability of enhancing organizational performance is increased by 151.0 units. Also, if the motivation for employees increases by 1 unit, then the probability of improving organizational performance increases by 25.80 units.

Marginal effects are a useful way to describe the average effect of changes in explanatory variables on the change in the probability of outcomes in logistic regression and other nonlinear models. In marginal effects, we have two significant variables, which are marital status and motivation respectively. The results show a marginal effect of marital status, or the effect for an infinitely small change in marital status is -0.041. This indicates that the organizational performance decreases by 0.041 with a marginal change in marital status. Also, the result shows a marginal effect of motivation is 0.043 which indicates that organizational

performance will be enhanced by 0.043 with a marginal change in motivation. The coefficients of -0.041 for marital status and 0.043 for motivation represents changes on probability scale ranging from 0 to 1.

V. DISCUSSION

Gender diversity is not just about ensuring fair representation of men and women in teams but also the diversity spurs innovation and higher-order problem-solving (Joshi, 2017). Firms should foster the right climate of inclusion to leverage gender diversity towards better firm performance. It was found that almost 58.53% respondents are highly concerned regarding gender diversity as they believe that gender diversity brings numerous benefits to an organization like enhanced reputation of an organization, increased innovation, good working conditions and many more. Therefore organizations are ready to accept gender diversity inclusion at the workplace as it provides several benefits to an organization (Bibi, 2016). Also almost 99% of respondents have agreed on the fact that they are treated fairly in their workplace. Likewise, most of the respondents think motivating employees and making them competent enough would result higher performance of a banking organization (Nakagawa, 2015). Similarly, employees were not facing any sorts of gender issues in their job and working environment and also very few of them believe that there could be administrative barriers so as to maintaining gender diversity. There are several employees who are still fighting for the equality at the workplace and that has created a barrier for an organization to gain higher performances (Dauvellier et al., n.d.). 91% respondents believed that building an inclusive workplace could be one of the best managerial solution for enhancing gender diversity in an organization. Organizations have been forwarding these steps so as to minimized the gender bias in an organization and support gender diversity or equality at a workplace so that they can work properly and be effective in their practice (Pham & Thesis, 2017).

VI. CONCLUSIONS AND RECOMMENDATIONS

This study is important in addressing the benefits of gender diversity on banking organization. Achieving gender diversity and gender equality continues to present a challenge for institutions and society as a whole(Gutiérrez-Fernández & Fernández-Torres, 2020). Therefore, it is crucial to continue investigating the reasons that explain the importance of gender quality. The research study concludes that gender diversity is becoming one of the important issues in any particular organization in today's world. This research aims to find current prospects of gender diversity role on banking performance inside the Kathmandu valley. From the study, we came to know that gender diversity is becoming one of the important issues in any particular organization in today's world. Since, we know that gender diversity is one of the major issues in today's context and it helps to bring creativity and innovation in an organization through diverse ideas, processes and much more, such matter must extend beyond regulation and must permeate into the culture and genetic code of the organizations (Talab, Manaf, Malak, Seri, & Abdul, 2017). It must be accepted in spirit and should not just be a matter of compliance for tick box mechanism for mere tokenism. There is not just a need to examine the gender diversity but also one should have a deeper understanding of the impact of diversity and inclusion of the women on the several sectors (Ali et al., 2009). There is also a need to bring more competent women on boards so as to analyze the real impact on the financial performance of an organization(Singh & Point, 2006). From the overall study, we found that there is a need to examine not only the diversity but also it is necessary to have deeper understanding of the impact of gender diversity and inclusion of both male and female on the organizational affairs. We found that as there are

many banking inside the Kathmandu valley that has been fair in terms of their practice regarding gender and employees are experiencing gender equality in an organization.

Based on the findings and conclusion of the study following recommendations are kept forward (i) fostering a climate of inclusion in the workplace (ii) creating a supportive labor market for women (iii) strengthening policies that support work-family balance (iv) expanding the evidence base on gender diversity across all organizational levels and (v) promoting private-sector engagement in designing and implementing policies.

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Corporate Payout Policy and Test of Life Cycle Theory; Evidence from Nepalese Commercial Banks

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Abstract

Dividend policy of firm in theoretical finance is one of the most controversial issue, various theories of dividend policy try to explain the dividend behavior of the firm. The dividend distributed by a firm to its shareholder is very different when it is viewed from the perspective of the company's life cycle. If no regulation forces, then firms at initial stage retain all their earning and pay no dividend, since they have higher investment opportunities. The firms at maturity stage have less investment opportunities, slow pace of growth rate and lower cost of raising external capital, hence, mature firms retain less and pays higher dividend. DeAngelo, DeAngelo and Stulz (2006), empirical work on life cycle hypothesis suggests that firm increases their dividend with their maturity, where the maturity is measured through the ratio of earned to contributed capital or earned capital to total assets. This study investigates the dividend behavior of Nepalese commercial banks, by using the ten years panel data for the period from 2010 to 2019. Using conventional proxies of life cycle, the result of the study consistently shows that Nepalese listed commercial bank follow dividend life cycle theory. The result also shows that larger firms pay higher dividend and dividend history has positive relation with dividend payment. Dividend yield has been used as proxy for dividend payment, which has been used to for the robustness test, which also supports the dividend life cycle theory among Nepalese commercial bank.

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I. BACKGROUND

There has been a substantially huge number of research conducted regarding the firms' dividend after Miller and Modigliani (1961) first proposed the dividend irrelevance proposition. This proposition states that the dividend policy doesn't change the shareholders' wealth. After that, the theoretical and empirical research on dividends has argued on different aspects such as the bird in hand hypothesis (Lintner, 1962), agency theory (Jensen and Meckling, 1976), signalling hypothesis (Bhattacharya, 1979), free cash flow hypothesis (Jensen, 1986), catering hypothesis (Baker and Wurgler, 2004) and life cycle hypothesis (DeAngelo et al., 2006; Fama and French, 2001; Grullon et al., 2002). After the fundamental study of Miller and Modigliani (1961) on dividend irrelevance proposition, most of the study on dividend policy has been conducted on the assumption of market imperfection such as asymmetric flow of information, tax, agency problem to examine the relevance of dividend with firm value.

Fama and French (2001) conducted a study of the nature of dividends in the US firms between 1926-1999, the result of the study shows that the average dividend of the firm has declined significantly after 1978. They found that the reason to be newly listed firms in US securities market, which were paying a low dividend and affect overall average dividend of the listed companies. This was the initial argument made that the firm life cycle affects the dividend policy. According to Grullon et al. (2002), when firms become more mature and there occurs a situation of the declining rate of reinvestment this allows the firms to have excess cash, which should be ultimately paid to investors as dividends. So, the researcher indicated that at the maturity stage firms are able to pay a higher dividend. At this point, however, there was no formal model in finance that explains the firms' life cycle stage change the firms' payout policy.

The hypothesis was explicitly tested by DeAngelo et al. (2006) by assessing whether the firms' probability to pay dividends is positively related to the life cycle stage of the firm. The result indicates that there is an increment in the probability to pay dividends when the firm turns to the mature stage. This was the first strong evidence in the support of life cycle theory of dividend. Afterwards, there have been several empirical studies conducted, that supports the life cycle theory; most of this research has been conducted in developed economies such as DeAngelo et al. (2006) took samples from US firms; Coulton and Ruddock (2011) conducted a study in the Australian context; Denis and Osobov (2008), used the evidence from six developed economies US, Canada, France, Germany, UK and Japan. Flavin and O'Connor, (2017) conducted an empirical study using pieces of evidence from South Korea whereas Bhattacharya et al. (2019) conducted a study among listed firms in the US. There have been very few studies in emerging and developing economies. Wang et al. (2011) tested the theory among the listed firm in Taiwan stock exchange; Hassani and Dizaji (2013) provided the evidence from Teheran stock exchange, Thanatawee (2011) conducted a study among the listed firms in Thailand and Dixit et al. (2020) tested the theory among listed Indian firms. The firms in emerging and developing economies possess different characteristics than the firms in developed economies. According to Black (2001), developing countries generally have weaker law and enforcement and poor corporate governance practices, so the firms in these countries behave differently, this also affects the dividend policy adopted by the firms. So, generalization cannot be made on the basis of a study conducted in developed economies, hence further explicit study is required in emerging and developing countries so that life cycle theory stands in emerging and developing countries as well. This study aims to address this void.

Even though it has been a decent time in the capital market, after it came into existence in Nepal, it lacks several infrastructural arrangements and legal barriers (SEBON, 2018). The

only stock exchange that has been operating for more than two decades-long also lacks advanced trading management which can support high-frequency trading and so on. Also, there are only around 200 companies listed in the stock exchange, which is highly dominated by the financial and insurance sectors. It is often said by the experts that these companies lack proper corporate governance. However, the market is very sensitive towards dividends (Adhikari, 2015). Most of the research suggests that the listed Nepalese companies decide dividend payout policy on the basis of past year dividend, liquidity position, net profit and so on. It is not clear that whether these firms do follow the life cycle theory as suggested by DeAngelo et al. (2006) or not. This study attempts to answer that does Nepalese firms follow the life cycle theory regarding the dividend payout policy?

In Nepal, there have been several studies that examine the firms' dividend policy. Pradhan (2003) examined the major motive for cash dividend by Nepalese firms, the result shows that the firm intent to express the situation of the favourable prospect of the firm through cash dividend. Adhikari (2014) analyzed the perception of managers on dividend policy by surveying the views of managers of various listed companies in the Nepal Stock Exchange. Even though the result of the study indicates that the most important determinant of dividend policy is the growth rate of earning, the researcher did not link up the result with the life cycle stage. Adhikari (2015) analyzed the determinant of corporate dividend payout policy in selected Nepalese listed firms. The researchers used variables such as net profit, size past dividend, liquidity, risk, investment opportunities and the number of the shareholder base. The result of the study shows a net profit, total assets and liquidity are the major determinants of the corporate dividend payout policy among Nepalese firms. The researcher did not even include the life cycle stage as a control variable in the study. Bhandari and Pokharel (2012) conducted a study on dividend policy among selected eight commercial banks of Nepal and could not conclude any appropriate dividend policy that fits Nepalese commercial banks. Bista et al. (2019) analyzed the relationship between firm performance and its dividend policy among selected commercial banks and insurance companies of Nepal. The result of the study shows that foreign ownership, firm size is positively related to dividend payout ratio. The above discussion shows that none of the studies in dividend literature conducted in the Nepalese context has included life cycle theory, there is no strong empirical evidence that the life cycle hypothesis stands in the Nepalese context as well. Furthermore, the result of most of the studies in the Nepalese context remains inconsistent either because of the small sample base. To address this gap this study explicitly examines the life cycle theory in the Nepalese context with a large sample by including all listed 26 commercial banks for 10 years period making the sample 260 firm-year along with the robustness test.

There are sufficiently enough study that concludes that the Nepalese market is sensitive towards dividends and most of the finance managers do not like to reduce the dividend amount (Adhikari, 2015). The growing importance of dividend policy in the Nepalese capital market is to be diagnosed. This study will identify whether the dividend payout policy of the firm is affected by the firm life cycle or not. This study will contribute to the dividend literature in the Nepalese context and also further validate the life cycle theory of dividends proposed by DeAngelo, DeAngelo and Stulz (2006) in developing economics. This study will also serve as a basis for further research and discussion on dividend theory among Nepalese firms.

The layout of the study follows as literature review, hypothesis development, research methodology, explanation of variable, sampling technique, empirical framework, regression model and so on. Discussion on research findings will be conducted afterwards and final discussion, summary and conclusion will be presented at the end along with the future research avenues and limitations of the study.

1.1 Life Cycle Theory

The life cycle theory of dividends argues that the optimal dividend policy of a firm depends upon the firm's stage of the life cycle. The life cycle of any firm from starting to maturity is associated with declining investment opportunities, a slow pace of growth rate and the lower cost of raising external capital. These changes in life cycle stages lead to a higher payout ratio when the firms become more mature. The theory also argues that relatively higher investment opportunities are set for younger firms but they do not earn sufficiently enough profit to grab all those opportunities. They also try to retain most or all of their earnings to invest in those available opportunities. They usually have very little or no money left to distribute as dividends (Bulan and Subramanian, 2011).

1.2 Studies in International Context

In the study of Fama and French (2001) the propensity to pay dividends by US firms between 1926 to 1999, the average dividend declined after 1978. The result shows that the new listing of small firms in exchange with lower profitability and higher investment opportunities retain the cash and most of them never pay dividends. The result indicates that the firms having higher maturity have maturity provides higher dividend and younger firms pay low or no dividend. The firms' maturity was captured using the natural age of the firm. This study was the initial departure to the life cycle hypothesis of dividend.

Grullon et al. (2002) conducted a study to examine whether the changes in dividend is the change in firms' maturity or not. The result of the study also supports the assumptions of the life cycle hypothesis. Also, Brav et al. (2005) survey provides an important insight that around eighty percent of 384 financial executives believe that dividend payout policy conveys information to the market. The other result that was driven from the survey were; maintaining the dividend level higher has importance, so more than two-third of financial executive strongly agree that they try to avoid reducing dividend payment.

DeAngelo et al. (2006) added important evidence in dividend literature by empirically testing the life cycle hypothesis for the first time. Unlike Fama and French (2001), DeAngelo et al. (2006) used the ratio of retained earnings to total assets as a proxy to define the maturity of the firm. In the initial study to test life cycle theory, DeAngelo et al. (2006) argued that the fraction of publicly traded industrial firms has the potential to pay a high dividend when the ratio of RE to TA/TE is high and such dividend falls lower or even zero when most equity of the firm is contributed rather than earned. To test such life cycle theory, scholars argued that a firm is treated to be mature if they have a higher ratio of earned capital to total capital, if such ratio is lower than the firm is treated as younger. The result of the study shows that there exists a high and significant relation between dividend payout decisions and earned/contributed capital mix. Such a result was obtained when the researchers have controlled for the variables such as; profitability, growth, total equity, firm size, cash holding and dividend history. The result of the study shows that firms' propensity to pay dividends is positively related to the firms' life cycle.

Expansion on the study of DeAngelo et al. (2006) was conducted by Denis and Osobov (2008) by including the firms from six developed economies. The monotonic and positive relationship between firms' maturity and dividend policy was further validated in the international context. Further evidence on life cycle theory was presented by Brockman and Unlu (2011). The researcher presented the study with the support of international evidence of payout policy. The result of the study shows that there is a positive influence of the ratio of RE to TE for the firm to pay dividends. In other words, the result supports that the younger firm pays lower dividends than that of the older firm, being consistent with DeAngelo et al. (2006).

Coulton and Ruddock (2011) test the life cycle theory with corporate payout policy in the Australian context. The researchers were also interested to examine whether the dividend tax imputation system of Australia provides additional information on firm life cycle or not. The study included more than nine thousand three hundred firm-year observation and the result of the study shows that the probability to increase dividend increases with the portion of retained earnings, which was the proxy used to measure the firms' maturity as suggested by DeAngelo et al. (2006) and the empirical evidence of the study that the life cycle theory is strongly suggested. In other words, the dividend payment increases with maturity, the firms paying higher dividends are larger, more profitable with limited investment opportunities and higher amounts in retained earnings.

Flavin and O'Connor (2017) used the samples from South Korean firms to examine the life cycle theory. This study arguably used a various range of life cycle indicators to define the different stages of firms' maturity. The result of the study shows that the life cycle stages are economically significant with dividend policy which indicate that the different classification method supports the life cycle theory of dividend.

Bhattacharya et al. (2019) examined the firms' life cycle to explain the propensity to pay dividends. The result of the study shows that the dividend policy adopted by the firm is significant with various stages of the firm life cycle but the relation is non-linear in nature. The researchers used an alternative way to measure the life cycle stages as suggested by Dickinson (2011), which develop the proxy for life cycle using a cash flow pattern that captures non-linear relation of the firm life cycle with firm profitability, size and age.

Dixit et al. (2020) examine the dividend payout behaviour to test signalling, life cycle and catering theories of dividend policy among Indian firms. The result of the study shows that only the life cycle theory can be used to explain the dividend payout behaviour of Indian firms. The researcher did not find any evidence in support of signalling and catering theory.

1.3   Measuring the firms' maturity

In the words of Gort and Klepper (1982), there are five stages of the life cycle of the firm; the first one is the introduction where the firm innovation is produced for the first time, second is the growth stage where dramatically where the high number of producer exceeds, the third one is maturity, where most of the producers reach to their optimum capacities, the fourth stage is the shake-out from where most of the producers capacity starts to decline the final stage is decline form where there is essentially a zero-net entry.

There are many life cycle proxies proposed by the extant literature. DeAngelo et al. (2006) suggested retained earnings to total assets as a proxy for life cycle, while Dickinson (2011) used five life-cycle stages as suggested by Gort and Klepper (1982). Black et al. (2014) use firm age as a proxy to maturity, whereas Faff et al. (2016) used the firm age-adjusted by industry and size. The age of the firm increases monotonically with maturity. Many papers disagree that firm natural age can be a true proxy for a firm's maturity.

Owen and Yawson (2010) conducted a study regarding the impact of corporate life-cycle on takeover activity. The researcher followed DeAngelo et al. (2006) and used the RE proposition as a proxy to measure the firm's life-cycle. The result of the study shows that there is a significant positive relation between firm life-cycle and acquisition attributes. DeAngelo et al. (2006) approach for measuring firm maturity through earned/contributed has been well accepted in dividends.

Denis and Osobov (2008), Brockman and Unlu (2011), Shao et al. (2013) are the other scholars to use Retained Earnings (RE) to Total Equity (TE) (or Total Assets – TA) ratio as a proxy to measure firm maturity. Furthermore, von Eije and Megginson (2008) also suggest

that a firm's natural age is only able to measure its calendar age whereas the ratio of Retained Earnings to Total Assets capture the financial age of the firm. The financial age is able to describe the firm's maturity, so, the ratio of RE/TE and RE/TA has been employed in this study as well. Based on the above discussion and literature, the following hypothesis has been developed:

> *H1: Firms having higher maturity is expected to pay a higher dividend than firms having lower maturity.*

The above mention hypothesis examines the life cycle theory of dividends among Nepalese commercial banks. There is an expectation of a positive relationship between the life cycle stage and dividend policy, which can also be viewed as the firms having lower maturity (young stage) is expected to pay a low dividend as compared to the firms having higher maturity.

II. EXPLANATION OF VARIABLE

2.1 Dependent Variable

The dependent variable of the study is the Dividend Payout policy (DIV). The dividend payout ratio (DPR) is used as a proxy to measure the dependent variable. The total dividend of the firm is divided by the total earnings per share of the firm to calculate the dividend payout ratio. If the firm distributes all its earnings as dividends, then the DPR of the firm will be one, if it doesn't distribute anything the DPR will be zero in such an event. In some extra-ordinary events if the firm also uses the previous year retained earnings to distribute then DPS can be more than one in such case. In the event, that firm has negative EPS but the firm still pays dividends the ratio has been capped to zero for this study. Dividend yield (YIELD) has been taken as the dependent variable for the robustness test.

2.2 Explanatory variable

Firm's maturity: The firm's maturity is the explanatory variable to explain the dependent variable of the study. As mentioned earlier in the literature review segment, there have been various proxies used to measure the firm's maturity. In this study, the ratio of earned to contributed capital has been used to measure the firm's maturity. According to (DeAngelo et al. (2006), the proxy of RE/TE (or RE/TA) is appropriate to measure a firm's maturity. The independent variable has been lagged to one year to minimize the endogeneity issue. The life cycle hypothesis says that firms at younger pay less dividend and firms at higher maturity stage pays a higher dividend, in this study both of the proxies (RE/TE and RE/TA) has been used and both of them are expected to have a positive relationship with the dependent variable.

2.3 Control variables

Several variables have been controlled for this study, they include as control variable of the study; these includes

Growth Opportunities: Assets growth rate (AGR) has been used to measure the growth opportunities of the firm. It is calculated as the percentage of the growth in assets from the previous year. Following Fama and French (2001), AGR is used as a proxy for current investment opportunities. The life cycle hypotheses predict a negative relation between investment opportunities and dividend payouts.

Profitability: Profitability is measured by the earnings per share (EPS) of the firm. The EPS of the firm is received by dividing the net profit of the firm by the number of outstanding shares. In other words, EPS represent the per-unit profit allocation of the firm, which is yet to

distribute to the investor. Profitability is also measured by the Return on Assets (ROA), which is calculated by dividing the net profit by the total assets. It is expected that have a positive relationship between profitability and dividend payout.

Firm Size: It is often argued in life cycle theory that larger firms are more mature than smaller firms. There are different proxies used to measure the size of the firm since it is related to maturity; the market capitalization of the firm has been used to measure the firm size (SIZE). The log value of market capitalization has been employed in this study. It is expected to have positive relation between firm size and dividend payout.

Dividend History: Dividend history or past dividends also affects the dividend policy of the firm, so the previous year dividend payout ratio has been used as a proxy to capture dividend history. Dividend history is assumed to have a positive relation with payout policy.

Table 1: Variable of Study

Type	Variable	Proxy
Dependent	Dividend Payout Policy	Dividend Payout Ratio (DIV)
Independent	Firm Maturity	Retained Earnings/Total Equity (RETE)
		Retained Earnings/Total Assets (RETA)
	Growth Opportunities	Assets Growth Rate (AGR)
Control	Profitability	Return on Assets (ROA)
		Earnings Per Share (EPS)
	Firm Size	Log of Market Capitalization of Firm (SIZE)
	Dividend History	Last year Dividend (DIV(t-1))

2.4   Expected relation

The expected relation between independent variable, control variable and dividend payout has been presented in following table;

Table 2: Expected relation between variables

Variable	Proxy	Expected Relation
Firm Maturity	RETE	+
Firm Maturity	RETA	+
Profitability	ROA	+
Profitability	EPS	+
Growth Opportunities	AGR	-
Firm Size	SIZE	+
Dividend History	DIV(t-1)	+

III.   EMPIRICAL MODEL OF THE STUDY

The general model of the study is as follows;

When Retained Earnings by Total Equity (RETE) is used to measures the firm maturity;

$$DIV_{i,t} = \beta_{10} + \beta_{11}RETE_{i,t} + \beta_{12}ROA_{i,t} + \beta_{13}AGR_{i,t} + \beta_{14}SIZE_{i,t} + \beta_{15}DIV_{i,t-1} + \varepsilon_{i,t} \qquad \dots\dots\dots (1)$$

$$DIV_{i,t} = \beta_{20} + \beta_{21}RETE_{i,t} + \beta_{22}EPS_{i,t} + \beta_{23}AGR_{i,t} + \beta_{24}SIZE_{i,t} + \beta_{25}DIV_{i,t-1} + \varepsilon_{i,t} \qquad \dots\dots\dots (2)$$

When Retained Earnings by Total Assets (RETA) is used to measure the firms' maturity

$$DIV_{i,t} = \alpha_{30} + \alpha_{31}RETA_{i,t} + \alpha_{32}ROA_{i,t} + \alpha_{33}AGR_{i,t} + \alpha_{34}SIZE_{i,t} + \alpha_{35}DIV_{i,t-1} + \varepsilon_{i,t} \qquad \dots\dots\dots (3)$$

$$DIV_{i,t} = \alpha_{40} + \alpha_{41}RETA_{i,t} + \alpha_{42}EPS_{i,t} + \alpha_{43}AGR_{i,t} + \alpha_{44}SIZE_{i,t} + \alpha_{45}DIV_{i,t-1} + \varepsilon_{i,t} \qquad \dots\dots\dots (4)$$

Considering both profitability variables in same equation, the empirical model of the study will be as follows;

$$DIV_{i,t} = \delta_{50} + \delta_{51}RETE_{i,t} + \delta_{52}EPS_{i,t} + \delta_{53}ROA_{i,t} + \delta_{54}AGR_{i,t} + \delta_{55}SIZE_{i,t} + \delta_{56}DIV_{i,t-1} + \varepsilon_{i,t} \qquad \dots\dots\dots (5)$$

$$DIV_{i,t} = \delta_{60} + \delta_{61}RETA_{i,t} + \delta_{62}EPS_{i,t} + \delta_{63}ROA_{i,t} + \delta_{64}AGR_{i,t} + \delta_{65}SIZE_{i,t} + \delta_{66}DIV_{i,t-1} + \varepsilon_{i,t} \qquad \dots\dots\dots (6)$$

For all of the equations, the notation of the variable indicates;

$DIV_{i,t}$ is the ratio of Dividend per share to Earnings per share (DPS/EPS) of *i* company at *t* period.

$RETA_{i,t}$ is the ratio of retained earnings to total assets of *i* company at *t* period.

$SIZE_{i,t}$ is the log of market capitalization of *i* company at *t* period.

$ROA_{i,t}$ is the return on assets of *i* company at *t* period.

$EPS_{i,t}$ is the return on earnings per share of *i* company at *t* period.

$AGR_{i,t}$ measures the growth opportunity through change in assets size of *i* company at *t* period.

$DIV_{i,t-1}$ is the past year dividend, measured by DPS/EPS of *i* company at *t* period.

3.1   Population and Sampling

The population of the study includes the entire listed firm in the Nepal Stock exchange (NEPSE). At the present day, there are more than 200 entities listed in NEPSE. The history of NEPSE lasts for two and a half decades-long. There were very few companies listed in the exchange at the early day (SEBON, 2017). The number of the listed company increased gradually but at a slow pace. For this study, the commercial bank segment has been chosen. Commercial banks are one of the large institutions that are listed in NEPSE. The total market capitalization of the commercial bank only occupies more than 50 percent of total market

capitalization. They are highly regulated institutions and cross-sectional structure sufficiently enough number for study. There are 27 commercial banks in Nepal among them 26 are listed in the exchange, for this study all 26 commercial banks have been considered. The data is collected for ten years period, starting from 2010 to 2019. Few new commercial banks came into existence after 2010, so the data has been started in 2010. And the data is assumed to be free from the impact of the prevailing effect of the Global financial crisis of 2007-2009 as well.

The data for 10 years period for firms should have been 260 firm-year. However, some firms started after 2010 and some firms emerged from mergers and acquisitions from two or more small financial institutions, so no data has been considered for such firms. After clearing the data and removing the missing data there exist only 227 firm-year data. Most of the data were hard collected from the annual report of the corresponding firm. Some of the data has been collected from the website of NEPSE and the central bank of Nepal.

3.2 Results and findings

3.2.1 Descriptive statistics

At first, the summary statistics have been presented at the level data except for the size of the firm. The size is taken as the log of market capitalization, which is calculated by using the last trading day stock value of the corresponding firm. The summary statistics have been presented as follows;

Table 3: Summary Statistics

(Missing values were skipped)

Variable	Mean	Median	Minimum	Maximum
DIV	0.82783	0.80037	0.00000	5.9319
RETE	0.40265	0.30788	-1.0562	1.8563
RETA	0.026447	0.024021	-0.055462	0.11186
ROA	1.6464	1.5609	-3.4340	22.091
EPS	24.996	20.122	-40.231	525.49
SIZE	23.489	23.574	20.595	25.937
AGR	0.25195	0.19944	-0.095614	3.1628
DIVt1	0.82678	0.80708	0.00000	5.9319

Variable	Std. Dev.	C.V.	Skewness	Ex. kurtosis
DIV	0.61114	0.73824	2.8487	19.815
RETE	0.40030	0.99415	0.87344	1.7151
RETA	0.020947	0.79203	0.19611	2.3675
ROA	1.5802	0.95981	8.7913	111.34
EPS	35.469	1.4190	11.233	155.18
SIZE	1.0610	0.045172	-0.38661	-0.14532
AGR	0.29172	1.1579	5.3742	44.987
DIVt1	0.64306	0.77779	2.7061	17.695

The descriptive statistics has been summarized in the table 3. The table shows the mean, median, minimum, maximum value with standard deviation, coefficient of variance (C.V.) Skewness etc.

3.3 Correlation Analysis

Table 4: Correlation matrix with dependent variable RETE

Correlation Probability	DIV	RETE	ROA	EPS	SIZE	AGR	DIV(t-1)
DIV	1.000000						

RETE	0.250314	1.000000					
	(0.0002)	-----					
ROA	-0.020079	0.427088	1.000000				
	(0.7656)	(0.0000)	-----				
EPS	-0.027475	0.731805	0.703364	1.000000			
	(0.6832)	(0.0000)	(0.0000)	-----			
SIZE	0.292432	0.535280	0.535999	0.522270	1.000000		
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	-----		
AGR	-0.139392	-0.212405	-0.253440	-0.226698	-0.261626	1.000000	
	(0.0375)	(0.0014)	(0.0001)	(0.0006)	(0.0001)	-----	
DIV(t-1)	0.220607	0.065594	0.052699	0.022815	0.216905	-0.167284	1.000000
	(0.0009)	(0.3295)	(0.4336)	(0.7347)	(0.0011)	(0.0124)	-----

The values in the parenthesis indicate the p value.

Table 1: Correlation matrix with independent variable RETA

Correlation Probability	DIV	RETA	SIZE	ROA	EPS	AGR	DIV(t-1)
DIV	1.000000						

RETA	0.213007	1.000000					
	(0.0014)	-----					
SIZE	0.292432	0.469650	1.000000				
	(0.0000)	(0.0000)	-----				
ROA	-0.020079	0.496022	0.535999	1.000000			
	(0.7656)	(0.0000)	(0.0000)	-----			
EPS	-0.027475	0.475746	0.522270	0.703364	1.000000		
	(0.6832)	(0.0000)	(0.0000)	(0.0000)	-----		
AGR	-0.139392	-0.157802	-0.261626	-0.253440	-0.226698	1.000000	
	(0.0375)	(0.0184)	(0.0001)	(0.0001)	(0.0006)	-----	
DIV(t-1)	0.220607	0.076496	0.216905	0.052699	0.022815	-0.167284	1.000000
	(0.0009)	(0.2553)	(0.0011)	(0.4336)	(0.7347)	(0.0124)	-----

The values in the parenthesis indicate the p value.

Second, the correlation among the regressor variables has been tested. If two or more variables are correlated highly with each other, this can create the chances of multicollinearity among the series. The ROA and EPS are found to be highly and positively correlated, they are the proxies for profitability and are alternatives to each other. Surprisingly, both of the proxies of profitability are negatively correlated with dividend payout.

3.3.1 Test for multicollinearity

Test of multicollinearity has been conducted through the Variance Inflation Factors (VIF), the result of the test is as follows;

Table 6: Variance Influence Factor

Minimum possible value = 1.0
Values > 10.0 may indicate a collinearity problem

Model 5	Model 6
RETE 2.509	RETA 1.470
EPS 3.622	EPS 2.168
SIZE 1.775	SIZE 1.688
AGR 1.119	AGR 1.116
ROA 2.347	ROA 2.249
DIV(t-1) 1.081	DIV(t-1) 1.081

$VIF(j) = 1/(1 - R(j)^2)$, where $R(j)$ is the multiple correlation coefficient between variable j and the other independent variables. The result suggest that no multi collinearity is suspected in the data.

3.3.2 Test for autocorrelation and heteroskedasticity

Wooldridge test for autocorrelation in panel data suggests that there is no first-order autocorrelation between the data. Furthermore, the Durbin-Watson values are near to two, which also suggest that the data are not autocorrelated. The White test of heteroskedasticity suggests that the data are not homoscedastic and there exist heteroskedasticity. In a pooled OLS model if heteroskedasticity is present, Wooldridge (2010) suggest that the robust standard error should be used and the robust standard error can be obtained by Huber, Eicker and White estimators.

3.4   Regression Analysis

First, for the regression analysis, the pooled OLS of the panel data was conducted. Afterwards, panel diagnosis of the pooled OLS was conducted[1], the result of the panel diagnosis suggests that the fixed effect model should be used for model one and model four, the pooled OLS model is appropriate for the rest of the models. The result of the Hausman test shows that the null hypothesis of the Hausman test is rejected for the entire model, indicating that the fixed effect is consistent with that of the random effect. So, for the final result of the regression, the fixed effect regression model for panel data is employed for models one and model four. The final regression result with appropriate pooled OLS and with fixed effect has been presented in table 7.

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[1]   Pooled OLS and Panel diagnosis of the pooled OLS has not been reported in this paper. The result is available on the request.

Table 7: Final Regression Summary

Variable	Model 1 Fixed Effect	Model 2 Pooled OLS	Model 3 Pooled OLS	Model 4 Fixed Effect	Model 5 Pooled OLS (Robust SE)	Model 6 Pooled OLS (Robust SE)
Constant	-5.1447*** (0.0000)	-2.9685*** (0.0050)	-3.4120*** (0.0013)	-4.3305*** (0.0003)	-2.9685* (0.0602)	-3.8523** (0.0370)
RETE	0.3720** (0.0225)	0.7128*** (0.0000)			0.6961*** (0.0004)	
RETA			5.7039*** (0.0000)	3.9956 (0.1265)		6.3687** (0.0104)
ROA	-0.2823*** (0.0003)		-0.2686*** (0.0000)		-0.0327 (0.7283)	-0.1824** (0.0751)
EPS		-0.0212*** (0.0000)		-0.0173*** (0.0000)	-0.0201*** (0.0025)	-0.0075** (0.0294)
Size	0.2689*** (0.0000)	0.1623*** (0.0003)	0.1893*** (0.0000)	0.2365*** (0.0000)	0.1688** (0.0220)	0.2093** (0.0159)
AGR	-0.2144 (0.1250)	-0.1387 (0.2811)	-0.1703 (0.2067)	-0.2188 (0.1171)	-0.1446 (0.1549)	-0.1832* (0.0921)
Div(t-1)	-0.0089 (0.8922)	0.1236** (0.0323)	0.1311** (0.0292)	-0.0648 (0.3223)	0.1229 (0.2227)	0.1206 (0.2627)
Adjusted R Sq.		0.2334	0.1646		0.2305	0.1774
D/W	1.87	1.80	1.81	1.75	1.81	1.78

Note: *** *Significant at the 1 percent level.*
        ** *Significant at the 5 percent level.*
        * *Significant at the 10 percent level.*
        The values in the parenthesis indicate the p value.

The above table shows the final regression result, where model one and model four are regressed with fixed effect and the rest of the models are regressed with pooled OLS method. When retained earnings by total equity are taken as the firm maturity the entire model shows that they are significant with positive values. This indicates that the dividend payout increases with the firms' maturity. However, when the retained earnings to total assets are taken as the proxy of firms' maturity, there are statistically significant results in some models and statistically not significant in one model. Whenever RE/TA is significant, they have a positive coefficient indicating that mature firms' pay higher dividends. The result is consistent with previous studies of DeAngelo et al. (2006) and other scholars (Flavin and O'Connor, 2017; Thanatawee, 2011; Wang et al., 2011); that mature firm pays a higher dividend, the result supports the hypothesis of the study.

Regarding the other control, variable size is statistically significant in all models with a positive coefficient, which indicates that a larger firm pays a higher dividend. The assets growth rate has a negative coefficient as expected however they are not significant in any of the models. The dividend history is found to be statistically significant in pooled OLS method but not in the fixed-effect method. The coefficient of the previous year dividend is positive, which indicate that firms' increases their dividend in comparison to their previous year dividend. Regarding the profitability variables of the study both the proxies (EPS and ROA) has a negative coefficient. The earnings per share are found to be statistically significant in all cases and return on assets is significant in all cases except model five. The negative effect of earnings on dividends is found in this study in contrast to many previous studies. The negative coefficient of profitability indicates that dividend decreases prior to the increases in profitability. One possible reason can be the dividend payers' omission to dividend might have some effect on this, since the payout ratio of the respective year are not applicable in panel data set because the omitted year cannot be included in panel data analysis. The negative sign of EPS (earnings) still is consistent with the result of Grullon et al. (2002), which is one among the study to purpose maturity hypothesis.

3.5   Robustness Test

To conduct the robustness test the following model has been estimated.

$$YIELD_{i,t} = \delta_0 + \delta_1 RETE_{i,t} + \delta_2 EPS_{i,t} + \delta_3 ROA_{i,t} + \delta_4 PE_{i,t} + \delta_5 SIZE_{i,t} + \delta_6 DIV_{i,t-1} + \varepsilon_{i,t} \qquad \text{……….. (7)}$$

$$YIELD_{i,t} = \delta_0 + \delta_1 RETA_{i,t} + \delta_2 EPS_{i,t} + \delta_3 ROA_{i,t} + \delta_4 PE_{i,t} + \delta_5 SIZE_{i,t} + \delta_6 DIV_{i,t-1} + \varepsilon_{i,t} \qquad \text{……….. (8)}$$

Where,

$YIELD_{i,t}$ *indicates the dividend per share by market price per share of i firm at t period.*

$PE_{i,t}$ *indicates price earning ratio (alternative proxy for growth opportunities) of i firm at t period.*

The result of the regression has been summarized in following table.

Table 8: Regression summary for Robustness Check

	Pooled OLS (with robust standard error)		Fixed Effect	
Variable	Model 7 Fixed Effect	Model 8 Pooled OLS	Model 7 Pooled OLS	Model 8 Fixed Effect
Dependent Variable: YIELD				
Constant	9.4771*	7.9040	5.5381	4.7645
	(0.0696)	(0.1219)	(0.2276)	(0.2845)
RETE	2.7227***		3.4554***	
	(0.0000)		(0.0000)	
RETA		44.0719***		56.5814***
		(0.0000)		(0.0000)
ROA	1.0428***	0.3345	0.8245**	0.3036
	(0.0019)	(0.3057)	(0.0499)	(0.4492)
EPS	-0.0736***	-0.0289***	-0.0380	-0.0004
	(0.0000)	(0.0065)	(0.1194)	(0.9835)
Size	-0.2953	-0.2272	-0.1577	-0.1280
	(0.1883)	(0.2964)	(0.4366)	(0.5147)
PE	-0.0050**	-0.0049**	-0.0036*	-0.0036**
	(0.0374)	(0.0204)	(0.0502)	0.0491
Div(t-1)	0.3219	0.3185	0.1671	0.0974
	(0.2312)	(0.2692)	(0.4907)	(0.6814)
Adjusted R Sq.	0.1381	0.1577		
D/W	1.50	1.55	1.85	1.92

Note: ***Significant at the 1 percent level.*

*   **Significant at the 5 percent level.*

*   *Significant at the 10 percent level.*

The values in the parenthesis indicate the p value.

The result of the robustness test shows that when yield is taken as the proxy for dividend payout, then still the RE/TE ratio and RE/TA ratio are statistically significant with a positive coefficient. The result supports the mature firm pays a higher dividend payout than that of younger firms. However, most of the control variables did not show statistically significant results. The price-earnings ratio was found to be statistically significant in all cases, which can be considered as an alternative proxy to the growth opportunities. By observing the above mention regression summary for robustness check, it can be concluded that the dividend payout ratio is a better proxy than dividend yield for dividend payout.

IV.   SUMMARY, DISCUSSION AND IMPLICATION

The dividend behaviour of Nepalese commercial banks has been examined in this study, with reference to the life cycle theory of dividends. The life cycle theory is a modern theory of dividend literature which states a mature firm pays a higher dividend and the theory has been empirically verified in many countries. However, most of them are developed countries and no significant study has been done in developing countries. The Nepalese commercial banks have been taken for the study in order to investigate whether these firms support the life cycle theory or not. All listed 26 commercial banks were considered for the study, data included the period of 10 years, ranging from 2010 to 2019 are included in the data set to conduct panel data analysis.

Two proxies were used to measure the firms' maturity, namely RE/TE and RE/TA, which were suggested by the previous research studies. These proxies define maturities as a higher ratio of earned capital in comparison to contributed capital or assets. The ratio of DPS/EPS was used as a proxy to measure firms' payout policy and the regression result shows that the Nepalese commercial banks follow the life cycle theory. The only hypothesis of the study was supported by finding. The younger firm pays fewer dividends and mature firms pay a higher dividend; the result was found to be consistent with both of the proxies of firm maturity. There were various other control variables, which were employed in the study, such as; firm size, firm's profitability, dividend history and firm's growth opportunities. Except, growth opportunities the other variables are found to be statistically significant in this study. Both proxies for profitability are found to be negative with dividend payout, which was averse to the expected sign.

The robustness check has been conducted by using dividend yield as an alternative proxy to dividend payout, which shows that mature firms still pay more dividends than that younger firms. Also, the price-earnings (PE) ratio has been used as an alternative proxy to growth opportunity but most of the control variables failed to be statistically significant however PE ratio was found to be significant in robust standard error pooled OLS and panel data regression with fixed effect. Regardless, of the result of the control variables on the robustness test, the test further validates the life cycle theory of dividend among Nepalese commercial banks. Furthermore, the regression analysis also suggests that the dividend payout ratio is a better proxy to payout policy than the dividend yield.

Overall, the dividend policy of listed Nepalese commercial banks is highly consistent with life cycle theory and this result can also help the investor to understand that why some firms pay higher dividends and some firms don't pay any. Previous studies in the Nepalese context covered the identification of determinants of dividend policy, investment opportunities, firm size, the growth rate of enterprise earnings, dividend history, net profit, foreign ownership etc. are the determinant of dividend policy in Nepal. However, firms cannot be forced to pay dividends with single policy-fit-regulation, which means the determinant of dividend policy which are influenced by firm characteristics are in fact changes according to the stage of the life cycle. Furthermore, if the regulation is set in accordance which forces the younger firms to pay dividends or restrict with the upper ceiling for mature firms regarding dividend payment, then the problem of suboptimal investment will occur, which eventually lead to the agency cost problem. For younger firms, it will also be bound for other sources of external financing, since they are not able to retain all their earnings because of the regulation.

The central bank of Nepal, which often tries to regulate the dividend payment of the banks and financial institutions through a single regulation, has to make policy considerations regarding this issue in future days. The other regulator of the financial sector, such as the Insurance Board and Securities Board of Nepal also need to consider this issue while

formulating policy regarding dividend payment. Furthermore, this study covers a new area of the dividend literature which was yet to be tested among Nepalese firms. So, the result has an important contribution in the field of dividend policy literature of Nepal, which also provides comparatively new evidence from developing economies to explain the life cycle theory of dividends.

Nepalese commercial banks are highly regulated firms, during the period of the study the central bank mandate them to hike the paid-up capital fourfold, this eventually leads to various mergers and acquisition activities by the commercial bank. Furthermore, they also used their reserves heavily to distribute the stock dividend. These regulatory changes could have affected their capital structure, such influences have not been addressed in this study. Furthermore, it is also essential to see whether this life cycle theory stands with other sector companies/firms of Nepal such as; insurance, manufacturing, hydropower, other financial institutions etc. The study is also limited to the 10 years data period, a comprehensive study of the longer period can have more exciting results.

4.1   Conflict of Interest

The authors declare no conflict of interest.

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SESSION II

Theme: *Monetary Policy Transmission Mechanism and Sectoral Loan Distribution*

This session was chaired by Mr. Nara Bahadur Thapa, former Executive Director of Nepal Rastra Bank. The paper presenters have presented the papers as per the moderation of the session chairs.

SESSION II-B

Theme: *Stock Price and Profitability*

This session was chaired by Dr. Gopal Prasad Bhatta, former Executive Director of Nepal Rastra Bank. The session chair requested each presenter to present their papers and the comments and suggestions from the participants were discussed with the consent of the session chair.

Assessing the interest rate channel and bank lending channel of monetary transmission in Nepalese economy: A Vector Autoregression approach

Kushal Shrestha [*]

Abstract

The assessment of impact of monetary policy in regards to changes in the real variables remains a key concern for policymakers. This monetary transmission takes place through a number of channels, out of which, this paper attempts to assess the working of interest rate channel and bank lending channel in Nepalese economy. Using vector autoregression, evidence for working of interest rate channel is found, whereas the impact of bank lending channel can be observed only in inflation and not in real output.

JEL Classification: C32, E51

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I. INTRODUCTION

Monetary transmission mechanism explains how the changes in the monetary policy variables translates to changes in the real variables of the economy via various channels, namely interest rate channel, asset price channel, credit channel and exchange rate channel. It is hard to explain the transmission channels and process; not only because different channels tend to operate simultaneously, but also because these tend to change over time (Mohanty, 2012). These channels of monetary transmission are often referred to as black box in the sense that it is agreed that monetary policy decisions do transmit to real sector eventually, influencing output and inflation (Bernanke & Gertler, 1995).

As such, the study of monetary transmission mechanism has always been an interesting topic for researchers and has gathered divided opinions from economists worldwide. Although there are numerous studies undertaken to gauge the efficacies of various channels of monetary transmission, most of them are concentrated on the developed economies and therefore, these studies bear a weak relevance to developing economies. There are limited studies in context of developing economies with varying results.

This paper attempts to delve into two of the widely accepted monetary transmission mechanisms, namely interest rate channel and bank lending channel in case of Nepal. There are various literatures that suggest that interest rate channel and bank lending channel actually co-exist and complement each other, rather than work in isolation. Kashyap and Stein (1994) report that the bank lending channel can co-exist with the traditional interest rate channel, however there remains the need for distinction between the two (Kashyap & Stein, 1994).

The study uses basic VAR approach for each of the channels, focusing on variables like GDP, CPI, money supply, interbank rates, etc. The paper is an attempt to make a simultaneous study of both the demand side and supply side of loan and their respective impact on the real variables like output and inflation since interest rate channel basically represents the demand side of loans and the bank lending channel supposedly works on the supply side of the loan by working on the quantum of funds available with banks for lending. Given the early stage of stock market development in Nepal, in terms of depth of the market and the diversity of listed companies' background, and also given the limited development of other assets markets like bonds, the asset price channel seemingly has limited applicability in Nepal. Likewise, exchange rate channel works as a potent tool of monetary transmission in case of economies with open trade and exposed to international markets. However, given the pegged exchange rate of NPR and INR and lack of diversified trading partners, the exchange rate channel might not be a strong transmission medium in Nepal's present context.

II. REVIEW OF LITERATURE

Interest Rate channel asserts that changes in short term nominal interest rates, resulting from monetary tightening or easing, are likely to get transmitted to first short term money market rates, and then eventually to longer-tenure deposit and lending rates, which represents the real interest rates. Thus, monetary tightening eventually leads to rise in long term real interest rates, leading to decline in business and household expenditures and a decline in aggregate output.

Under Assets price channel, there are two sub channels namely exchange rate channel and equity price channel. The exchange channel asserts that if real interest rate of a currency declines, followed by expansionary monetary policy, then there will be outflow of foreign capital in search of better yield, eventually leading to depreciation of local currency. As a result, net export will benefit in terms of higher proceeds because of currency depreciation.

Likewise, the equity price can be explained by Tobin's q theory, where q is defined as market values of firm divided by the replacement of capital. When the value of q is high, the firm can issue equity to replace the existing capital and thus the expenditure will increase, and vice versa. Therefore, expansionary monetary policy is likely to increase the public's money at disposal, which people will most likely invest in equities, driving the equities price higher vis-à-vis bonds. This will ultimately boost the investment expenditure as suggested by Tobin's q theory (Mishkin, 1996).

Credit channel consists of two sub channels, namely, Bank Lending Channel and Balance Sheet Channel. Under bank lending channel, expansionary monetary policy increases bank reserves and deposits, which increases the quantum of bank loans, and drives up investment and output. The proposition of this channel is that, following a fall in deposits because of monetary tightening, given the non-substitutability of deposits, availability of bank credit will eventually decrease leading to lower spending and output (Disyatat, 2010).

On the other hand, balance sheet channel also arises from information asymmetry, particularly from the problem of adverse selection and moral hazard problems. Following monetary easing which drives up equity prices and net worth of the firm, banks comfortably increase lending to these firms as they have higher collateral to offer, which decreases the moral hazard problems.

In case of Nepal, the excess liquidity of commercial banks is an explicit target of the monetary policy. As such, the central bank relies more on OMOs as a major instrument of monetary operation, although, Standing Liquidity Facility, Cash Reserve Ratio and Bank Rates are also used to meet the desired macroeconomic objectives (Budha, 2015).

Bernanke and Blinder (1992), in their paper, depict the disproportionate impacts of monetary policy stance, measured by Fed Funds Rate, on loans and deposits. Loans seemingly respond slowly – two years, compared to deposits – nine months, but the impact on loan is substantial. The paper also establishes Federal Funds Rate as the best predictive variable of monetary policy actions, as it is less contaminated and is extremely informative about the future movement of real economic variables.

On the credit channel front, Bernanke and Gertler (1995) explain the behaviour of varied response of final demand for consumer goods, inventory, production and fixed business investment in response to monetary tightening. The paper states that final demand for consumer absorbs the initial shocks of monetary tightening, followed by production with a lag. This explains why inventory stocks rise in the short run, only to decline ultimately, accounting for a large portion of decline in GDP.

Hung and Pfau (2008) find evidences of monetary policy affecting the real output in Vietnam. Using vector autoregression approach (VAR) and focusing on reduced form relationship between real output, money, price level, the paper reach to a conclusion than the credit channel and exchange rate channels are more important than interest rate channel.

In Nepalese context, Khatiwada (2005) argues that money supply, rather than interest rate, is one of the major monetary tools at the disposal of Nepal Rastra Bank. He states that quantity of credit availability channel is more relevant as the pass-through of Bank rate to the lending rates is very weak, inconsistent and incomplete given the situations when Banks themselves are over liquid and do not resort to NRB for financing. Likewise, the multitude of interest rates and lack of demarcation of policy rates make it further difficult for the working of interest rate channel.

Mohanty (2012) identifies interest rate as a potent tool of monetary policy and substantiates the efficacy of interest rate channel in India. Based on quarterly Structural Vector Auto-

Regression (SVAR) model, the paper finds negative correlation between policy rate and output growth with a lag of two quarters and also on inflation with a lag of three quarters, persisting through 8 to 10 quarters.

Budha (2013) finds evidence of bank lending channel in Nepal. Using disaggregated bank level data, the paper finds that the loan supply response of commercial banks in Nepal are contingent on their respective balance sheet characteristics like liquidity, capital and assets size, The paper illustrates that banks with less liquid assets are highly responsive to monetary tightening, thus highlighting the role of liquidity. However, capitalization of banks has insignificant relationship on bank lending.

Das (2015) finds support for efficacy of interest rate channel in India and reaches to similar conclusion as Mohanty (2012). Using Vector Error Correction model, the paper finds the presence of significant, albeit asymmetrical, pass-through of policy changes to bank interest rates in India, more so to the lending rate, both in terms of extent and speed and thus provides evidence monetary transmission via interest rate channel.

Can, Bocuoglu & Can (2020) shed light on the working of monetary transmission in Turkey using vector autoregression (VAR), under explicit Inflation targeting regime starting from 2006. They find evidence of effectiveness of monetary policy citing that interest rates, and the nominal exchange rate, which are the main tools of central banks, are determinant of output and inflation rate, respectively. They also conclude that, among the external variables, federal funds rate has impact on Turkish output.

III. DATA, METHODOLOGY AND RESULTS

Quarterly Data of 'A' class commercial banks, licensed by Nepal Rastra Bank, from FY 2003/04 till FY 2019/20 (17 years) are taken for study. The study uses VAR, impulse response function, Granger causality test and variance decomposition in order to assess the monetary transmission.

3.1 Description and Source of data

Real values of GDP, LOAN, M1 and M2 are taken for the study. In case of LOAN, M1 and M2, the nominal figures are adjusted as per CPI to obtain the real values. Likewise, since CCD was introduced by NRB only in the FY 2009/10 as macro prudential regulations, the data for the entire study period are not available. Although, for most of the study period the ratio remained at 80%, some modifications in the calculation procedure were made in line with the tightening or easing stance of monetary policy. To tackle the problem of data unavailability, "0" and "1" are used to simply denote the absence and presence of CCD ratio prescribed by NRB.

Table 1: Definition of variables

Variable label	Variable definition	Source
CCD	Credit to Core Capital plus Deposit ratio	Monetary policies
CPI	Consumer Price Index	Quarterly Economic Bulletins
DR	Interest rate on customer deposits	Quarterly Economic Bulletins
GDP	Gross Domestic Product	Central Bureau of Statistics
IBR	Weighted average of interbank transaction rate	Quarterly Economic Bulletins
LOAN	Volume of loans and advances	Quarterly Economic Bulletins
LR	Interest rate on loans and advances	Quarterly Economic Bulletins
M1	Narrow Money Supply	Quarterly Economic Bulletins
M2	Broad Money Supply	Quarterly Economic Bulletins

3.2 Descriptive Statistics

Appendix I shows that IBR has reached a maximum value of 12.83 percent, closely following the maximum LR of 12.94 percent, whereas the maximum value of DR is 6.83 percent. The real GDP has a mean value of 154.82 billion, and has reached maximum value of 244.03. Whereas the real loan value and real M2 has been at much higher levels. Further, it can be observed that IBR has a relatively weak positive correlation with both DR and LR, as evident from the correlation values of 0.34 (IBR with DR) and 0.39 (IBR with LR). It can be assumed from this analysis that the pass-through of interest rate is rather weak, despite depicting symmetrical relationship with both deposits and loans. Likewise, there exists a relatively weak negative correlation between CRR and LR and also between CRR and R_LOAN.

3.3 Trend analysis of variables

The quarterly data of the study variables are presented in time series graphs and are summarized in the Figure 1.

Figure 1: Trend Analysis of variables

1

From a quick glance at the trends of the data, only CPI exhibits stationarity. R_GDP, R_LOAN, R_M1 and R_M2 can be seen constantly rising over the period. On the other hand, CRR, DR, IBR and LR seem to have high volatility. This is plausible, given the fact that, interest rates are dependent on various factors, including liquidity, which often exhibits seasonality.

3.4 Stationarity Test

Augmented Dickey Fuller (ADF) test, which has widely been adopted to test stationarity, has been used in the study. The Null hypotheses of these tests are that the variable possesses a unit root and thus is not stationary. Appendix II shows that only CPI and IBR are stationary at level. In case of other variables, CRR, DR, LOG_GDP, LOG_LOAN, LOG_M1, LOG_M2 and LR, we cannot reject null hypothesis because of presence of unit roots at their level. This means that their mean, variance and covariance keep changing over time. Thus, we try differentiating these variables at their first level which makes them free of unit roots. In conclusion, the order of integration for CPI and IBR are I(0), whereas for other variables it is I(1).

3.5 Interest Rate Channel

For interest rate channel of monetary transmission to work, there should be evidence of causation relationship between IBR and real variables like CPI and GDP. Under this channel, the study variables taken into consideration are IBR, DR, LR, LOG_M1, LOG_M2, LOG_GDP and CPI. VAR is employed to study the change in one variable as a response to its own lagged values as well as lags of other variables.

Optimal Lag selection Criteria

Appendix III depicts results of the optimum lag length criteria suggested by various criteria. AIC criteria and FPE criteria indicate higher lag length of 5 lags and 4 lags respectively. However, as suggested by SC criterion, which provided the lowest value in VAR results, lag length of 2 lags determined as the optimal lag length. It is also compatible while examining the VAR stability using Autocorrelation LM test.

Inverse Roots of AR Characteristic Polynomial

The dynamic stability of the VAR model can be examined using Inverse Roots of AR Characteristic Polynomial. For the model to be stable, the inverse roots of the polynomial should be less than unity. The result is depicted in the Fig. 2.

Figure 2: **VAR stability condition – Interest Rate Channel**

Inverse Roots of AR Characteristic Polynomial
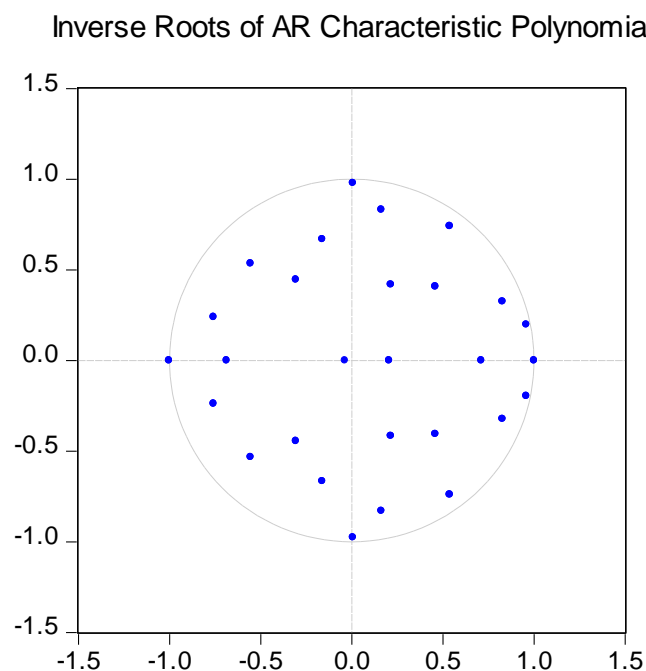
In Fig. 2, both the horizontal axis and vertical axis represent the unit scale of the unit circle. Since most of the plots lie inside the Unit circle as presented in the Fig. 4, we can conclude that the model is stable one.

Autocorrelation LM Test

In order to find out the serial autocorrelation among the error terms among the variables, Autocorrelation test is carried out. The result of the test is presented in the Appendix IV. Except for the first, second and the fifth lags, all the values are above the 5% significance level, which indicates that the series does not suffer from serial correlation.

Granger Causality Test

Appendix V shows that, with GDP as dependent variable, IBR, CPI and M1 have causal impact on GDP, whereas other variables do not have any causation. Similarly, with CPI as dependent variable, only M1 has causal impact. On the other hand, GDP shows causation towards IBR, M1 and M2 whereas no causation can be established towards DR, LR and CPI. Likewise, the findings show that IBR has no causal impact on any variables except GDP. It means that change in IBR has no impact on both DR and LR. In case of CPI, IBR does granger cause CPI, whereas CPI does exhibit causation towards GDP, M1 and M2. Similarly, M1 has direct causation with CPI.

Variance Decomposition

Table 2: Variance Decomposition of Variables – Interest Rate Channel

Period	S.E.	IBR	DR	LR	CPI	LOG_GDP	LOG_M1	LOG_M2
IBR								
1	1.52	100.00	0.00	0.00	0.00	0.00	0.00	0.00
2	1.89	70.08	6.64	1.78	4.92	1.38	3.45	11.75
3	2.12	55.49	10.66	1.49	7.26	1.12	7.95	16.03
4	2.30	47.01	11.29	2.10	6.15	2.73	14.34	16.38
DR								
1	0.39	1.50	98.50	0.00	0.00	0.00	0.00	0.00
2	0.55	5.88	88.45	3.07	1.29	0.03	1.27	0.01
3	0.67	12.51	80.94	4.01	1.01	0.06	0.89	0.59
4	0.76	15.09	75.29	3.47	2.05	0.16	2.16	1.78
LR								
1	0.34	2.06	2.72	95.21	0.00	0.00	0.00	0.00
2	0.55	2.80	7.64	88.45	0.25	0.58	0.27	0.01
3	0.68	1.97	16.38	80.63	0.18	0.59	0.24	0.01
4	0.77	1.70	22.77	74.32	0.14	0.80	0.19	0.08
CPI								
1	1.40	0.56	0.93	3.04	95.47	0.00	0.00	0.00
2	1.52	0.76	2.53	5.33	80.94	0.63	8.86	0.95
3	1.80	2.00	5.77	3.86	80.37	0.68	6.65	0.68
4	1.90	1.89	5.67	4.16	72.00	3.17	12.23	0.88
LOG_GDP								
1	0.01	0.19	2.57	0.01	10.98	86.26	0.00	0.00
2	0.01	6.99	2.25	0.01	10.57	79.42	0.52	0.23
3	0.02	5.65	1.79	0.17	10.28	73.81	7.65	0.66
4	0.02	4.72	1.40	0.17	11.54	69.98	7.78	4.40
LOG_M1								
1	0.01	0.05	5.56	0.43	0.72	12.37	80.86	0.00
2	0.02	0.03	4.67	0.35	6.71	11.65	75.57	1.03
3	0.02	0.23	4.40	0.77	8.09	9.96	75.00	1.55
4	0.02	0.26	4.55	0.71	7.29	9.05	75.76	2.37
LOG_M2								
1	0.01	1.37	1.52	0.01	18.55	1.69	7.38	69.48
2	0.02	3.01	1.33	0.03	24.63	0.90	6.64	63.46
3	0.02	2.28	1.21	0.61	21.29	5.92	4.84	63.85
4	0.02	2.09	1.89	3.52	17.19	8.86	4.12	62.34

Table 2 shows that IBR is not a strong predictor of GDP. Only 0.19 percent of shock on GDP is attributed to shock on IBR in the first quarter, and 4.72 percent in the fourth quarter. Rather, change in GDP is convincingly explained by its own lag in the first quarter, its dominance gradually decreasing while reaching the fourth quarter.

Likewise, in case of CPI, the lag value of CPI is fairly a strong predictor of itself. It is evidenced by the fact that 95.47 percent of shocks to CPI is explained by its past values in the first quarter, gradually declining to 72 percent in the fourth quarter, yet depicting a strong attribution. In the fourth quarter, 12.23 percent of shock in CPI is attributed to shock in LOG_M1, while DR and LR accounted for 5.67 percent and 4.16 percent respectively.

The relationship of IBR on DR and LR as shown by Variance Decomposition is found similar to the correlational relationship highlighted under Descriptive Statistics in the earlier section. Shocks on IBR account for 15.09 percent of shock on DR and only 1.70 percent on LR in the fourth quarter. The finding shows that, although there exists relationship between IBR and DR and LR, the relationship itself is weak, more so in case of IBR and LR.

Impulse Response Function

Under impulse response function, the response of dependent variables, namely LOG_GDP and CPI are examined upon the impulses on the various other independent variables. The results are presented in Fig 5.

Figure 3: **Impulse Response Function of Output – Interest Rate Channel**

Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.
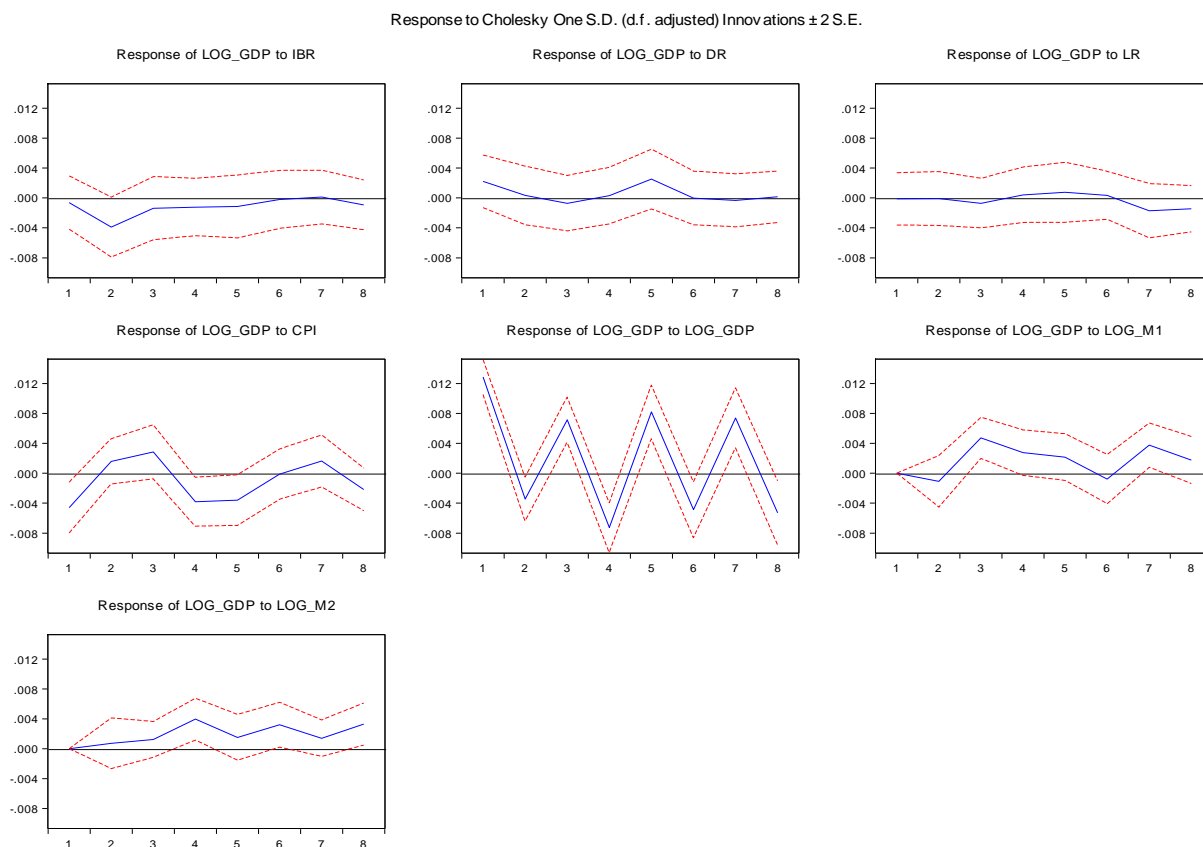
In Fig. 3, the x-axis represents the standard deviation of response, and y-axis represents the lag periods. The lower and upper trajectories represent upper confidence bank and lower confidence band respectively. Narrow money supply and broad money supply seem to have steady and gradual positive impact on the GDP, although upto the second quarter M1 exhibits negative association with GDP growth. However, a shock in IBR results in a sharp decline in

GDP for the first two quarters, after which, GDP gradually recovers with increase in IBR all the way through to the seventh quarter. Thus, from the response function of GDP, it can be concluded that there is presence of monetary transmission through interest rate channel. However, at the same time, it also depicts that the channel is not substantial as the trajectory of GDP is not consistent throughout the subsequent quarters. The correlation matrix and the variance decomposition, both show the weak transmission from interbank rate to deposit and bank lending rates. As such, it can be assumed that subsequent impact on aggregate spending and demand is also weak, leading to incomplete transmission to real variables.

*Figure 4***: Impulse Response Function of Inflation – Interest Rate Channel**

Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.
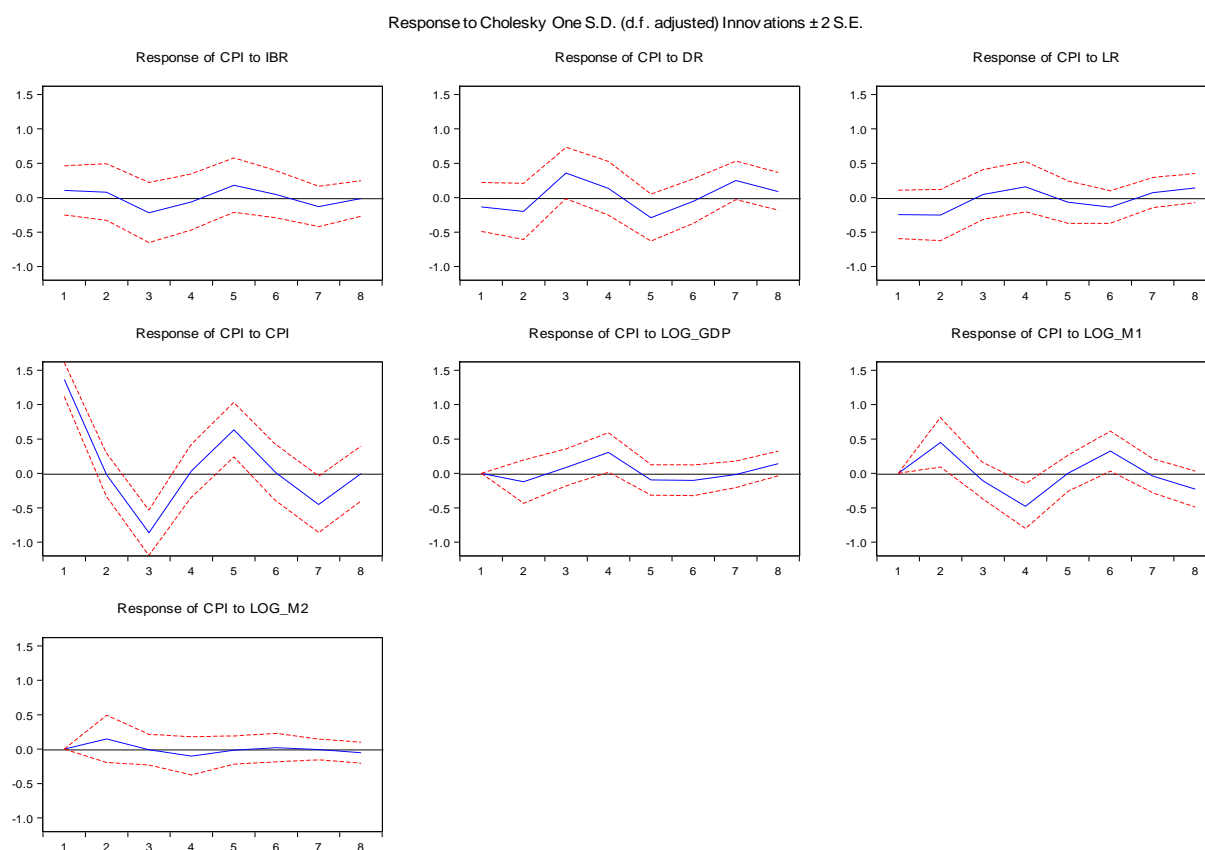
From Fig. 4, it can be illustrated that CPI responds sharply to the changes in the narrow money and broad money real values, which is consistent with the well-established theory relating to inflation "too much money chasing too few goods". However, impact of shock on IBR, which is the key interest rate variable, has a rather subdued impact on CPI at least during the first two quarters. Afterwards, a positive change in IBR is found to have negative impact on CPI. This observation confirms with the standard working of interest rate channel, wherein reduction in short term nominal interest transmits to reduction in real interest rates of deposits and lending and accordingly spurs aggregate demand. Given the fact that aggregate supply function does not adjust immediately to rise in aggregate demand, inflationary pressure is created. The finding too, shows that interest rate channel exists in Nepal.

3.6   Bank Lending Channel

Under bank lending channel of monetary transmission, change in CRR is taken as the proxy of monetary easing or tightening. Increase in CRR, thus, represents monetary tightening, which follows decrease in supply of loans, higher lending rate and eventually, decline in output and inflation.

Under this channel, the study variables taken into consideration are CRR, CCD, LR, LOG_LOAN, LOG_M1, LOG_M2, LOG_GDP and CPI. VAR is employed to study the change in one variable as a response to its own lagged values as well as lags of other variables.

Optimal Lag selection Criteria

The results of optimal lag length selection critera after running a VAR model is illustrated in the Appendix VI. The process of finding lag length criteria for VAR model under interest rate channel is repeated to determine the optimal lag length under bank lending channel. Table 9 depicts the optimum lag length criteria suggested by various criteria. In this study, we choose 1 lag length as suggested by SC criterion (asterisked).

Inverse Roots of AR Characteristic Polynomial

The dynamic stability of the VAR model can be examined using Inverse Roots of AR Characteristic Polynomial. For the model to be stable, the inverse roots of the polynomial should be less than unity. The result is depicted in the Fig 5.

*Figure 5***: VAR stability condition – Bank Lending Channel**

Inverse Roots of AR Characteristic Polynomial
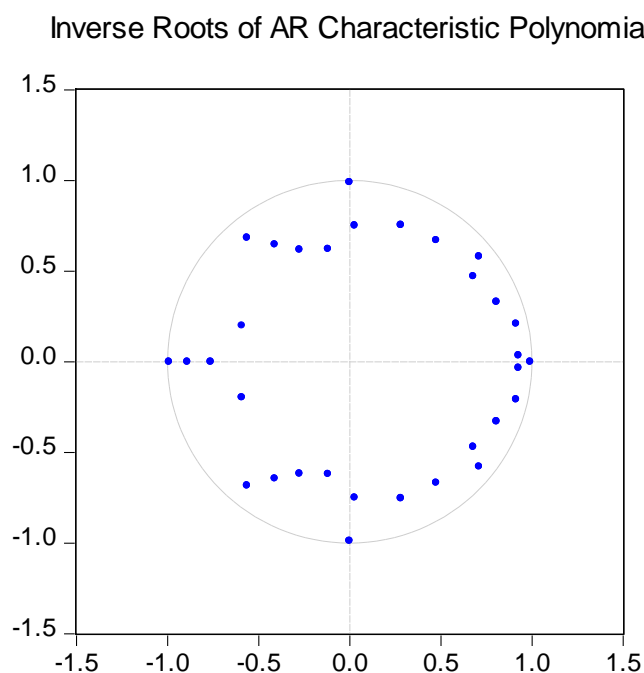
In Fig. 5, both the horizontal axis and vertical axis represent the unit scale of the unit circle. As depicted in Fig. 7, most of the plots reside within the circle of unit. Thus, it can be concluded that the model is stable one.

Autocorrelation LM Test

In order to find out the serial autocorrelation among the error terms among the variables, Autocorrelation test is carried out. The result of the test is presented in the Appendix VII. Since, all the values are above the 5% significance level, it indicates that there is no autocorrelation.

Granger Causality Test

In order to find out the causation among various dependent and independent variables, Granger causality test is carried out. The result of the test is tabulated in Appendix VIII.

Appendix VIII shows GDP as dependent variable is significantly Granger caused by all other variables, most notably by M1, M2, CPI, LR and LOG_LOAN as well. This reflects that LR and LOG_LOAN have causation relationship with GDP. However, CRR does not show any causal effect on LOG_GDP. On the other hand, LOG_GDP shows causal impact on M1.

CPI as dependent variable is significantly granger caused only by LOG_M1. CRR, which is the independent variable under bank lending channel, does not show any causation towards CPI. On the other hand, CPI granger causes CCD, LOG_LOAN, LOG_GDP, LOG_M1 and LOG_M2.

Variance Decomposition

Table 3: Variance Decomposition of Variables – Bank Lending Channel

Period	S.E.	CRR	CCD	LR	LOG_LOAN	LOG_GDP	LOG_M1	LOG_M2	CPI
CRR									
1	0.33	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.44	90.42	0.02	1.53	1.15	2.46	0.02	4.27	0.14
3	0.48	87.55	0.83	1.30	1.33	3.46	0.02	4.85	0.65
4	0.50	83.17	1.19	4.13	2.12	3.83	0.41	4.40	0.75
CCD									
1	0.13	1.59	98.41	0.00	0.00	0.00	0.00	0.00	0.00
2	0.18	2.23	91.34	0.06	0.33	0.06	2.33	0.02	3.62
3	0.22	3.46	85.76	0.05	0.26	0.38	6.95	0.01	3.14
4	0.24	5.00	80.84	0.23	0.22	0.98	10.10	0.03	2.60
LR									
1	0.35	1.17	4.48	94.35	0.00	0.00	0.00	0.00	0.00
2	0.61	0.42	14.28	83.43	1.09	0.59	0.01	0.01	0.18
3	0.81	0.26	17.43	77.07	2.89	0.42	0.66	0.01	1.26
4	0.93	0.22	16.87	74.13	4.35	0.31	1.43	0.06	2.62
LOG_LOAN									
1	0.01	0.54	1.01	15.46	82.98	0.00	0.00	0.00	0.00
2	0.01	0.40	3.33	21.20	72.83	1.46	0.11	0.00	0.67
3	0.01	0.60	11.22	20.83	59.65	1.17	4.77	0.01	1.76
4	0.02	0.83	17.46	17.65	47.43	0.93	13.03	1.19	1.48
LOG_GDP									
1	0.01	0.23	0.01	8.21	25.85	65.70	0.00	0.00	0.00
2	0.01	2.99	1.90	7.21	23.82	62.39	0.48	1.20	0.02
3	0.02	2.08	1.41	4.89	17.53	50.59	15.57	1.03	6.90
4	0.02	2.71	1.17	3.96	13.83	48.19	14.78	8.18	7.18
LOG_M1									
1	0.01	0.81	0.55	5.51	2.71	6.68	83.74	0.00	0.00
2	0.02	2.53	0.78	4.69	1.96	5.78	76.16	1.50	6.59
3	0.02	6.37	4.55	4.14	3.51	5.31	67.73	1.72	6.68
4	0.02	9.62	12.26	3.92	3.04	4.80	58.83	1.50	6.03
LOG_M2									
1	0.01	0.94	0.20	0.59	1.21	0.43	6.25	90.38	0.00
2	0.02	2.78	1.21	0.30	2.43	0.86	4.25	88.03	0.14
3	0.02	2.10	3.42	0.26	4.00	6.20	3.77	79.07	1.18
4	0.02	1.71	5.91	0.28	3.64	8.49	3.17	72.82	3.98
CPI									
1	1.40	0.21	0.19	2.67	30.26	0.00	1.16	10.17	55.34
2	1.57	0.21	1.13	4.15	23.90	0.78	16.28	8.82	44.73
3	1.85	0.85	1.06	3.66	23.45	1.11	11.77	9.24	48.87
4	1.96	0.80	2.03	4.00	21.35	2.23	17.15	8.62	43.81

It can be observed from the Table 3 above that in case of the lag values of GDP itself is relatively a strong predictor for itself. In the first two quarters however, around 25% of shocks

in GDP is explained by LOG_LOAN, which suggests that LOG_LOAN is also a strong predictor of change in LOG_GDP. However, in the fourth quarter, the influence of LOG_LOAN declines to 13.83 percent. Its own lag also constitutes for much less for its change. M1 and M2 explain 14.78 and 8.18 percent respectively of the variations in GDP in the fourth quarter. Shocks to CCD accounted for very insignificant proportion in shocks to GDP.

Likewise, Table 12 shows that both CCD and CRR are weak predictors of CPI. Shocks to CCD and CRR account for a meager 2.03 and 0.80 percent in the fourth quarter.

Another interesting finding from the table above is that shock to LOG_LOAN is rather weakly related to its own lag, and it becomes more pronounced in the fourth quarter. In the first quarter, shock in CPI accounts for 1.48 percent in shock in LOG_LOAN in the fourth quarter. On the contrary, 17.46 percent of shock in CCD is attributable to shock in LOG_LOAN in the fourth quarter. This clearly shows that CCD is a strong predictor of volume of loans and advances.

Impulse Response Functions

Figure 6: **Impulse Response Function of Output – Bank Lending Channel**

Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.
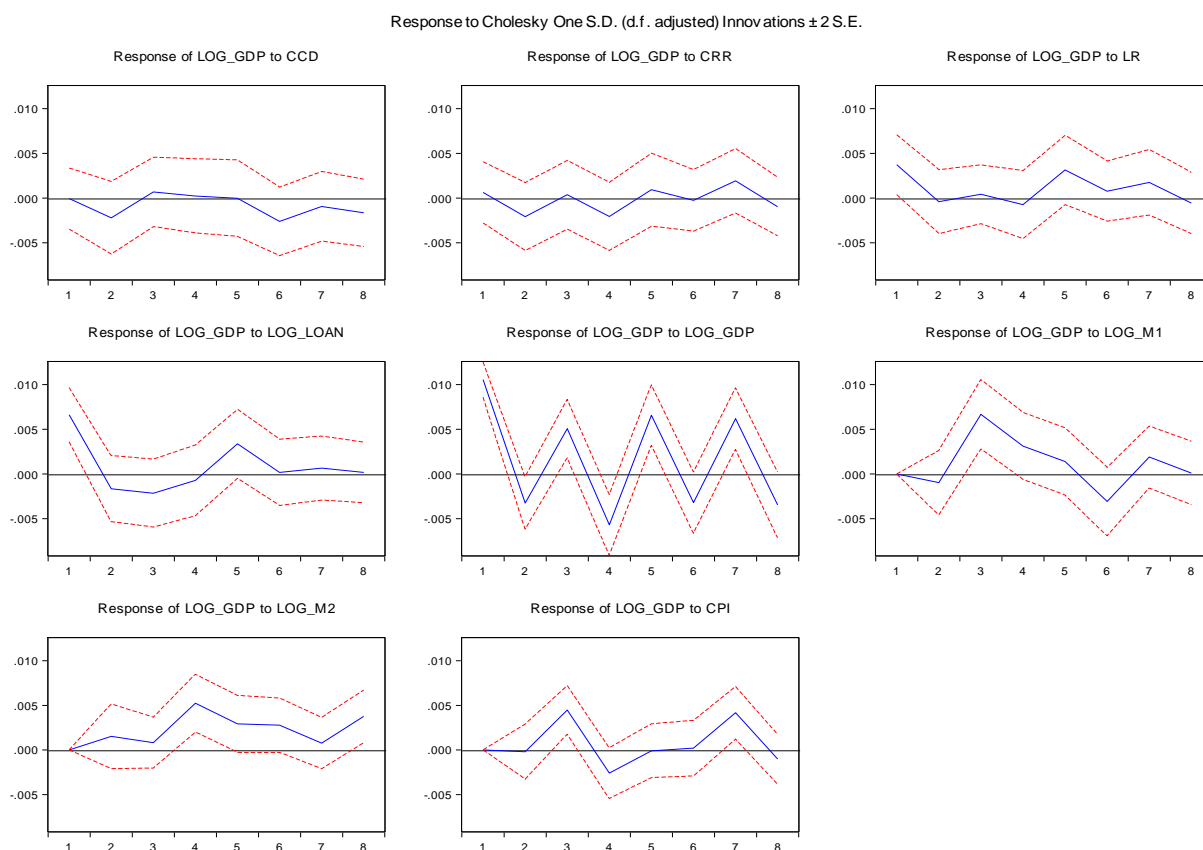
In Fig. 6, the x-axis and y-axis respectively represent the standard deviation of response and the lag periods. The lower and upper trajectories represent confidence bands.

The response of shocks on CRR has inconclusive impact on GDP. At first LOG_GDP responds negatively to CRR shock upto second quarter, then alternatively increases and decreases in the subsequent quarters. Further, LR shocks yields in positive change in GDP from first quarter till the eighth quarter. Bank lending channel maintains that monetary tightening results in decline in loanable funds from BFIs which leads to increase rise in lending rates and the resultant drop in output. Thus, the finding somewhat concurs with the

standard theory as there is a negative relationship of bank lending rate with GDP upto the second quarter

<p style="text-align:center">*Figure 7*: **Impulse Response Function of Inflation – Bank Lending Channel**</p>

<p style="text-align:center">Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.</p>
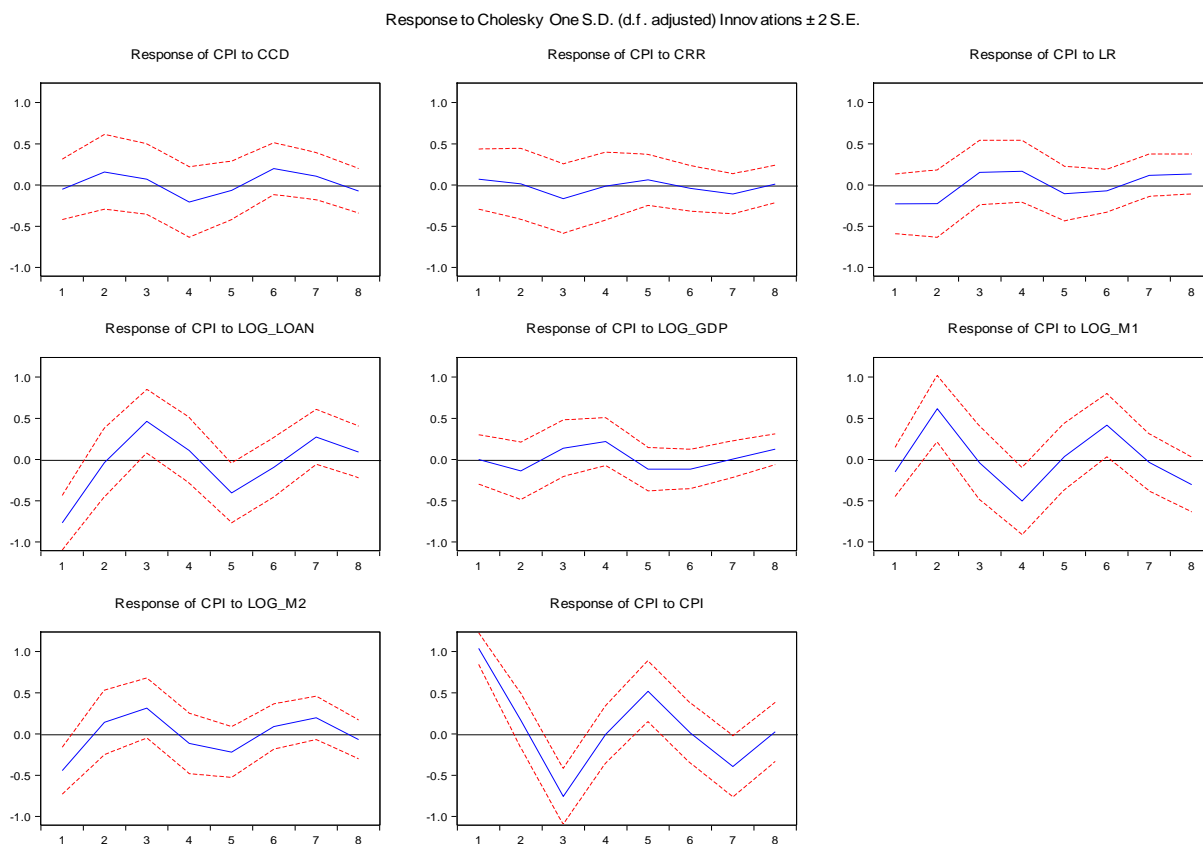
As depicted from the Fig. 7, a shock to CRR leads to insignificant changes in CPI. CPI follows a downward trajectory with increase positive shock provided to CRR. Likewise, it increases sharply following shocks to M1 and gradually in case of M2. Interestingly, a shock given to CCD leads to a positive impact on CPI till the third quarter, after which it starts falling.

IV. CONCLUSION

The study provides the evidence of presence of the interest rate channel; however the finding suggests inconclusive impact of bank lending channel in terms of the response of monetary shocks on real variables like output and inflation. The impulse response functions obtained are fairly consistent with the widely accepted theories of monetary transmission.

 The output and inflation exhibited negative association with interbank rate, which concurs with the standard theory of interest rate channel. However, the working of interest rate channel is weak as the impact can be seen only upto two quarters. On the bank lending channel side, the response of output to CRR is found to be inconclusive, whereas inflation reacts negatively to CRR, thereby concurring with the standard theory of bank lending channel. From variance decomposition, it can be observed that the impact of changes in narrow money supply (M1) is stronger than IBR or CRR in both the channels, in regards to changes in output and inflation.

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Forecasting of Loanable Funds in the Banking System of Nepal

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Abstract

This paper tries to forecast the amount of loanable available in the banking system of Nepal for the period of mid-August 2021 to mid-July 2022. For this purpose, monthly data of 14 years starting from 2007 to 2021 have been used in the systematic process of modeling and forecasting practices. In that process, first of the VECM model has been trained followed by testing and ends with the forecasting exercise. The ex-ante forecast with the selected VECM model reveals that the banking system of Nepal will experience a shortage of loanable funds in the months to come. The forecasted value of loanable funds that would be available in the banking system by the end of FY 2021/22 is about Rs. 35 billion. Results of the empirical analysis and testing of hypothesis as well as the measures of forecast accuracy indicate that the VECM model can be recommended for forecasting of loanable funds by the BFIs.

Key Words: Forecasting, Loanable Funds, Banking System

JEL Classification: C52, E44, E52

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I. INTRODUCTION

1.1 Background

Nepal, a country with the largest area covered by the Hills and Mountains, absence of adequate quality physical infrastructures and a gradually growing economy—is in an enormous need of large volume of investment. Estimates from the World Bank's 2019 Infrastructure Sector Assessment highlight that Nepal needs to invest 10–15 percent of the country's Gross Domestic Products (GDP) annually over the next decade to close infrastructure gaps. Traditionally, it is observed that much of these investments have been planned and executed by the public sector.

However, the capital spending of the governments stood at only 6.3 percent of GDP in Fiscal Year (FY) 2019. Weaker planning and public financial management processes has been fueling the gap to widen which resulted in persistently low capital budget execution. In the meantime, federalism has further amplified this gap, as local governments are now responsible for many infrastructure investments but are not able to execute budgeted spending.

Another source of investment the financial system which comprises of banking and non-banking financial systems. The non-banking financial system—a combination of capital and debt markets—where the capital market is relatively small but gradually developing while the debt market is yet to be developed to serve the investment requirements of the country. Therefore, the banking system has been playing leading role in mobilizing the loanable funds and filling in the investment gaps of the economy.

A sound banking system mobilizes and allocates funds efficiently, make capital more productive and create jobs and finally promote economic growth. Hemchandra (2003) opines that the banking system plays an important role in reducing risk and vulnerability for disadvantaged groups thereby increasing the ability of individuals and households to access basic services like health and education, thus has a more direct impact on poverty reduction. In this context, the banking system of the country has to be competitive, broad based and within the range of outreach and affordability of the mass population.

1.2 Problem Statement

Nepal Rastra Bank (NRB)—the central bank of Nepal—reveals that the banking system of Nepal performed the crucial role of raising the funds for productive investment and channeling the same to the real sector (NRB, 2009). Despite such a remarkable Nepali banking system is playing to improve the productive capacity of the economy, the Banks and Financial Institutions (BFIs) of the system have been struggling to balance the demand and supply of loanable funds for smooth functioning of the system. This has been making the interest rates quite unstable which has been creating hard time for businesses to predict their position in the market while various other players are looking into to tap the opportunities.

The problem of disequilibrium between the demand and supply of loanable funds has been a kind of recurring characteristics of Nepali banking system since long. Although few BFIs may be in a comfortable position, many of them have been facing shortage of loanable funds (excess liquidity) at their disposal to issue the fresh loans. On the other hand, it is also observed that the central bank has been mopping up the surplus liquidity from the banking system with an aim of maintaining interest rate stability.

Time and again, many of the BFIs have found to be struggling to maintain the mandated Credit to Core Capital cum Deposit (CCD) ratio for regulatory requirement.[1] Especially, it is noticed that the banking system has been facing a severe shortage of loanable funds at a time when there is high demand for loans in the markets. This results into frequent change in the interbank rates making the market interest rates volatile fueling the unpredictable investment climate for the private sectors.

1.3 Objectives

This recurring nature of disequilibrium between the demand and supply of loanable funds in the banking system and the balance sheet mismatch of BFIs has long been a topic of discussion among the policy makers (NRB and ministry of finance) and the private sectors (bankers and businesses). One of the issues of such discourse, which found to be appealing for a scientific research is 'Forecasting Loanable Funds'. In this context, the main objective of this paper is to estimate and examine the econometric model that can better forecast the availability of loanable funds in the banking system of Nepal and help minimize the risks of balance sheet mismatch and interest rate instability. In order to draw some precise conclusions and help BFIs make better forecasts of loanable funds, following specific objectives are taken into consideration:

1. Identify the factors that have significant contributions in affecting the loanable funds.
2. Estimate and examine the function (model) of loanable funds.
3. Forecast the loanable funds for the foreseeable future period using VECM approach.

1.4 Scope and Organization of the Paper

This paper aims to provide evidences that the BFIs—operating under the Intermediation of Loanable Funds (ILF) model—can benefit from the scientific forecasting models if they adopt forecasting strategy within their business model. However, the scope of this paper limits on the funds mobilized through 'A', 'B' and 'C' class financial institutions under the regulatory jurisdiction of NRB. Therefore, the term 'loanable funds' represents the amount of money readily available with these BFIs to give fresh credits to the clients after meeting all the statutory reserve requirements set by the central bank.

This paper employs the Keynesian Macroeconomic Framework to identify the aggregate factors affecting the loanable funds and uses monthly time series data of the selected variables collected from the secondary sources. The sample period starts from mid-July 2007—the first month of Nepali FY 2064/65—and ends at mid-July 2021—the last month of Nepali FY 2077/78, covering 168 observations or 14 years.

The organization of this paper has five sections. The next section is the review of literatures followed by methodology used in the study and data analysis. Section four covers the modeling process including training and testing of models with results and discussion followed by forecasting of loanable funds in section five. Finally, section six captures the findings and conclusions obtained from the study.

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[1] Till 2020 the BFIs were allowed to provide loan/credit up to 80 percent of their core capital and deposits (used to called CCD ratio). From 2021 BFIs are allowed to issue loans up to 90 percent of deposits and the ration is called Credits to Deposits (CD) ratio.

II. REVIEW OF LITERATURE

2.1 International Context

A wide range of alternative sources and uses of funds have been shifting banking strategy away from safety (minimum credit risks) toward high profit and growth targets (Bansal & Mohanty, 2013). Authors were of view that this shift has made the internal financial decisions within the banking industry—such as accepting deposits and approving loans—increasingly complex. A good forecast helps the banking system to curb information asymmetries and mobilize resources to their most productive uses (Thomas, 2018).

It is true that banks issue short-term liabilities to lenders while making long-term loans to borrowers which causes the demand supply mismatch (Hanh, 2015). A bank's current financial position is the result of past decisions for acquiring deposits and funds from other sources and investing these funds in alternative investment opportunities, such as loans and bond investments (Howrey & Hymans, 1978). Accordingly, a bank's current decisions on acquiring and investing funds will affect the bank's future position of loanable funds as well as the profitability (Giroux, 1979).

Evidences show that the shortage of loanable funds in the banking system help create horizontal inequality among the BFIs making them vulnerable to the systemic risks (Diamond & Rajan, 2009). The findings are well recognized as balance sheet mismatch and efficiency of managerial decision making, which in turn rests on good forecasting of external economic factors and internal decision variables. An accurate forecasts of deposits collection of the banking system—therefore—is an inevitable prerequisite for the government and the BFIs both to formulate macro policies that are consistent enough with the plans formulated at the bank level (Chiraphadhanakul, Dangpasert, & Avatchanqkorn, 1997).

In the meantime, (Elekdag & Han, 2012) reveal that forecasting of balance sheet is important. This is supported by a multi-country SVAR model where the authors identified that the domestic factors are more dominant than external factors in driving rapid credit growth in Asia. However, (Dembiermont, Drehmann, & Muksakunratana, 2013) opine that even though the sum of domestic factors provide a very good approximation of total credit, it does not capture all sources of influences.

The role of international flow to determine the availability of loanable funds in the domestic banking system of Europe was strongly related to net debt inflows but not to net equity inflows (Lane & McQuade, 2013). Thus, the importance of accurate forecasting of demand for bank credits is a growing matters in empirical literature examining the determinants of deposits and credits as both determine the size of loanable funds in the banking system (Hanh, 2015).

Similarly, (Koray, Mahir, Selva, Hakan, & Özlü, 2016) have investigated the impact of central bank's Reserve Requirements (RR) on the loanable funds and lending behaviour of banks in Turkey. The study suggests that the central bank funding and deposits are close substitutes as alternative sources of loanable funds for banks, and thus the eventual impact of RR on bank lending behaviour and economic activities should be neutral.

Using bank level data of Tunisia, Moussa (2015) highlights the importance of role of the bank in the creation of liquidity. The study gives emphasis on good forecasting of loanable funds—that depends on the bank specific as well as macroeconomic variables—to help determine the optimum level of liquidity necessary for smooth functioning of the banking system.

In the case of Ethiopia, (Malede, 2014) examined the relationship between the lending of commercial banks with bank (capital base) size, credit risk, GDP, investment, liquidity

(loanable funds), interest rate, CRR and deposit for the period of 2005 up to 2011. The findings reveal that; bank size, credit risk, GDP and liquidity were of positive and statistically significant influences on bank lending.

With respect to the role of financial intermediaries (Woodford, 2010) argue that neither deposits nor the capital of banks are main source of funding for the financial sector, even in the case of commercial banks. The study reveals that an alternative source of loanable funds, which facilitate borrowers making them able to borrow is the central bank funding as the capital of intermediaries (banks) also has an adverse effect on the supply of intermediation.

Looking at the credit unions of Ghana (Amoah, Aboagye, Bokpin, & Ohene-Asare, 2018) examined the macroeconomic determinants of lending capacity of credit unions. The study provided evidence that internal pecuniary factors that affect credit union lending include size of the credit union (capital), the return on equity, loan loss, quality of management, net worth to assets, diversification activities, non-loan income, solvency and lending rates.

To identify the determinants of excess liquidity in the banking sector of Bosnia and Herzegovina (B&H), (Hasanovi & Latic, 2017) carried out an empirical analysis for the period 2006 to 2015. The results obtained from the dynamic panel analysis with the generalized method of moments (GMM) show that excess liquidity (the funds readily available for new loan) depends on both the internal as well as external factors.

With reference of the global financial crisis 2007-2009 (Tran, 2020) investigated how funding liquidity affects the bank lending for the large sample of US banks. The study gives clear indication that the banks with adequate funding liquidity are less likely to experience liquidity crunches. However, more reliance to deposit may prompt banks to be firmly cautious to offer more fresh loans in comparison to other banks.

With the data of BRICS countries, (Dahir, Mahat, Razak, & Bany-Ariffin, 2019) have examine the effect of capital and funding liquidity on bank loan growth using a dynamic least squares dummy variable corrected (LSDVC) approach over the period between 2006 and 2015. The study provides significant implications for policymakers to pay close attention in devising policy measures that could be helpful for determination of optimal level of funding liquidity in the banking system. For the period of 2005 up to 2014 (Ahmad & Rasool, 2017) investigated the determinants of commercial banks liquidity in Pakistan. The study highlighted that along with the bank specific variables commercial banks must consider both the internal and external macroeconomic factors together to maintain an optimum level of liquidity position.

The determinants of excess liquidity in the commercial banks of Tanzania were investigated by (Aikaeli, 2006) using monthly data for the period of June 1999 to December 2004. Using Autoregressive Distributed Lag (ARDL) model the excess liquidity (loanable funds) found to be determined by the volatility of cash preference, the bank borrowing rate, credit risk, and the rate of required reserves requirements.

2.2   Nepali Context

Using money supply approach, Shrestha (2013) examined the determinants of loanable funds in Nepali banking system from two different perspectives – mainstream and Post-Keynesian. Results show that disposable high-powered money found to be the major contributor to the change in both monetary aggregates (M1 and M2) and in turn on the loanable funds available in the banking system. Most importantly, CRR and OMO were significant contributors on change in loanable funds.

Similarly, Budha (2013) also examined the bank lending channel of monetary policy transmission in Nepal using dynamic Arellano-Bond GMM estimation with annual data of 25 commercial banks. It was found that the bank size (deposits) had a significant impact on loan supply in Nepal whereas capital base had no significant impact on bank lending. Findings also indicate that the supply of bank loans were significantly affected by GDP.

In a NRB working paper, Timsina (2017) examined the effectiveness of the determinants of commercial banks' lending behavior in Nepal by using time series data with OLS method for the period 1975-2014. The results show that the GDP and liquidity ratio of banks have the greatest impacts on determining the bank lending in Nepal giving evidence for unidirectional causal relationship from GDP to private sector credit.

2.3   Observations and Gap

Although some macroeconomic models have been developed and used in Nepal, these are limited to few government authorities, especially with the central bank. All the models found to be developed with an aim of forecasting of macroeconomic variable and policy simulation, thus have not given priority for forecasting of loanable funds from the private sector (commercial banking) perspectives. Amid such a situation, it is realised that the current paper on forecasting of loanable funds has significant contribution in forecasting of loanable funds from the perspective of BFIs.

III.   RESEARCH METHODOLOGY

3.1   Research Design

This paper follows the quantitative research design—a blend of statistical methods and econometric models—has complementary strengths but do not have overlapping weaknesses (Malhotra & Dash, 2016). The carefully chosen model with identified variables were estimated using multivariate time series methods. The set of hypotheses were tested so as to facilitate the interpretation of results while drawing conclusions.

3.2   Data and Variables

The study covers 156 months of 13 years from the first month of FY 2007/08 to the last month of 2019/20. The data series of study period has been divided into two broad groups i.e. modeling series and forecasting series. The modeling series has been further divided into two separate datasets called training set and testing set. The modeling series covers 156 observations where 96 observations have been classified as training dataset and remaining 60 observations have been set aside for testing purpose.

Moreover, additional 24 months from the first month of 2020/21 to the last month of 2021/22 have been used as forecasting series to forecast the variables of interest with the tested model. The ex-post or in-sample forecasting which produces forecasts of dependent variables for the months outside of the estimation period from August 2020 to July 2021. Finally, ex-ante or out of sample forecasting has been performed to predict the future values of loanable funds for the period of August 2021 to July 2022.

The variables using in this study have been defined below:

Loanable Funds (LF): The dependent variable of this study which represents the amount of funds readily available in the banking system to offer new credits. In order to obtain the amount of loanable funds we have to deduct the uses of funds (UF) from the sources of funds (SF). Therefore, the loanable funds of the banking system can be defined by the following equation:

$$LF = SF - UF \quad \text{Or, } LF = D_t + C_p - (C_r + RRR + V_r) \qquad \text{..........} \quad (1)$$

Where, LF = total loanable funds available with the BFIs
D_t = total deposits cum liabilities of BFIs
C_p = total capital funds of BFIs
C_r = total credits of BFIs
RRR = amount kept for regulatory reserve requirements
V_r = voluntory reserve for day – to – day of operations of BFIs

Equation (1) gives the theoretical definition of loanable funds. In order to figure out the actual size of loanable funds available in the banking system, each of the components listed in the right hand side of the equation (1) have been further defined.

$$D_t = \text{as per NRB report}$$
$$C_p = \text{as per NRB report}$$
$$C_r = \text{as per NRB report}$$
$$RRR = 0.2 \left(D_t + C_p\right)$$
$$V_r = 0.015 \left(D_t\right)$$

There is no uniform rule about the voluntary reserves (V_r) that BFIs should hold with them to ensure smooth daily operation. One of the working papers of IMF by (Gray, 2011) highlighted the importance of voluntary reserves for smooth operations of the BFIs and prevent shortage of funding liquidity, especially for withdrawal of deposits by the customers. The paper found—from a survey of 121 central banks—that the BFIs were given freedom to maintain the voluntary reserve as per their requirements although there were some mandatory provisions in the past. However, the survey results reveal that the BFIs were keeping—in an average—about 1.5 percent of their deposits liabilities as voluntary reserve or funding liquidity.

In Nepal, it was mandatory for BFIs to keep 2 percent of their domestic deposits as cash in vault. The monetary policy of FY 2003/04 has abolished this provision and made BFIs voluntarily accountable to manage the minimum cash requirements (Nepal Rastra Bank, 2020). Considering the national and international evidences it is assumed that the Nepali banking system holds about 1.5 percent of total deposits as a voluntary reserve in addition of the RRR. Therefore, the actual size of loanable funds can be obtained as follows:

$$LF = \left(D_t + C_p\right) - C_r - 0.2\left(D_t + C_p\right) - 0.015(D_t)$$
$$\text{Or, } LF = (1 - 0.2)SF - C_r - 0.015(D_t) \qquad (\because D_t + C_p = SF) \qquad \text{..........} \quad (2)$$

The proportion total outstanding credits (C_r) to the sources of funds (SF) indicates the average CCD ratio of the banking system for particular period of time. Thus, equation (2) can written as:

$$LF = 0.8(SF) - CCD(SF) - 0.015(D_t)$$
$$\text{Or, } LF = (0.8 - CCD_t)SF - 0.015\left(D_t\right) \qquad \text{..........} \quad (3)$$

Equation (3) gives the actual size of loanable funds for a particular period of time where 0.8 is the maximum permissible CCD ratio and CCD_t is the actual CCD ratio of the banking system for a given period of time. Whereas, $0.015*D_t$ gives the level of voluntary reserve BFIs hold for day-to-day operations. Thus, the size of loanable funds is defined as the gap between excess reserves and voluntary reserve (also known as funding liquidity) of the banking system.

Credits (Cr): This is total outstanding credits of the banking system.

Deposits (Dt): This is the size of deposits of the banking system.

Net amount of OMO (On): This is the policy variable and measures the degree of policy intervention by the NRB. Data have been carefully calculated by subtracting the total amount of money mop up from the markets from the total money injected into the markets.

Capital Funds of BFIs (CF): This is the sum total of BFI's paid-up capital and reserve funds.

Inflation Rate (π): This is the monthly percentage change in the Consumer Price Index (CPI).

Interest Rate (R): This is the monthly average of interbank rates.

Government Expenditure (Ge): The sum total of all kinds of expenditure made by the federal government.

Currency Outside the Banking System (Cc): The proxy of currency held by the public.

Balance of Payments (BOP): This is the net foreign receipts on the country's banking system.

Domestic Demand Factor (DF): A proxy of investment demand (proposed by the industries during registration) and consumption demand ($VAT\ collection \div 13\%$).

Data for all of the variables have been collected from the various reports of NRB.

3.3 Formulation of Model

This paper uses the balance sheet approach to analyze the flows of funds in the banking system. The fundamental equation of balance sheet ensures that the total assets of the entity is the summation of liabilities and share capital (equity) for the given period of time.

$$Assets = Liabilities + Equity \qquad \qquad \text{.......... (4)}$$

The both sides of equation (4) can be presented in the model balance sheet (table 1) below:

Table 1: A representative Balance Sheet of BFIs

Assets	Liabilities
Loans and Investment (Total Credits)-C	Deposits (total deposit liabilities)-D
Regulatory Reserves (CRR+SLR+...)-R	Capital Funds (Equity)-CF
Excess Reserves (Loanable Funds)-LF	Debt Funds (Bond/Debenture)-B
Interbank Lending (short-term assets)-I	Interbank Borrowing (short-term funds)-I
Claim to Central Bank (R-REPO+…)-N	Owe to Central Bank (REPO+SLF+RF+…)-M

Source: Author's creation based on theoretical frameworks

Table 1 provides the key building blocks for the models to be developed for forecasting of loanable funds in the banking system of Nepal. According to equation (4) the both sides of table 1 must be in equilibrium i.e.

$$C + R + LF + I + N = D + CF + B + I + M \qquad \qquad \text{.......... (5)}$$

The interbank lending of one banks is the interbank borrowing of the others i.e. $I - I = 0$. Thus equation (5) would be:

$$C + R + LF + N = D + CF + B + M \qquad \text{.......... (6)}$$

Similarly, regulatory reserve requirements (R) is exogenously determined by the NRB and the ratio remains almost constant for the long-run. Thus, the rate of change of $\bar{R}$ will be insignificant ($i.e. \approx 0$) in the very short interval of time a month. Thus, equation (6) would be:

$$C + LF + N = D + CF + B + M \qquad \text{.......... (7)}$$

In the meantime, the amount of debt funds (B) mobilized by BFIs via debenture is very less around 0.4 percent of total deposits of the banking system.2 Therefore, i.e. $B \approx 0$ which results:

$$LF = D + CF - C + (M - N) \quad \text{Or,} \quad LF_t = D_{tt} + CF_t - C_{rt} + O_{nt} \qquad \text{.......... (8)}$$

Where; LF_t = Loanable funds available in the banking system
D_{tt} = Total Deposits with the BFIs (supply function)
CF_t = Total Capital Funds of BFIs (share equity)
C_{rt} = Outstanding Credits of the BFIs (demand function)
O_{nt} = Net money injection through OMO (policy factor)

In the loanable funds equation, the demand function (bank credits) is defined as:

$$C_{rt} = C_{nt} + I_{dt} + \pi_t + I_{rt} \qquad \text{.......... (9)}$$

Where, C_{rt} = Total outstanding bank credits
C_{nt} = Total Consumption Expenditures (domestic consumption demand)
I_{dt} = Planned Investment of Industrial sector (Investment demand)
π_t = Percentage change in Consumer Price Index (Inflation rate)
I_{rt} = Interest Rate (weighted average interbank rate)

Similarly, the supply function of loanable funds (deposits) is structured in the given equation:

$$D_{tt} = G_{et} - C_{ct} + BP_t + I_{rt} \qquad \text{.......... (10)}$$

Where: D_{tt} = Total Outstanding Deposits with the BFIs
C_{ct} = Currency Outside the Banking System (structural/behavioral factor)
G_{et} = Total Government Expenditure
BP_t = Balance of Payments
I_{rt} = Interest Rate (weighted average interbank rate)

The aggregate function of loanable funds can be obtained by substituting the demand function (equation 9) and supply function (equation 10) in equation (8). After some rearrangements the aggregate function of loanable funds would be:

$$LF_t = G_{et} - C_{ct} - DF_t + BOP_t - \pi_t + O_{nt} + CF_t \qquad \text{.......... (11)}$$

IV. TRAINING AND TESTING OF MODEL

4.1 Training of Models

Here the model specified in equation (15) has been trained following the systematic model building process. Performance of the model has been evaluated with respect to the well-established principles and generally accepted key performance indicators. In the process,

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2 Findings of the High Level Committee (December, 2018) formed by the Ministry of Finance, Government of Nepal to study the issues of financial and capital markets and forward the recommendation to the concerned authorities.

attentions have been paid to trim down the specific model if the preliminary results indicate that exclusion of insignificant variable enhances the explanatory power of model.

Unit Root Test

The unit root (stationarity) property of the variables incorporated in the model has been examined with the help of ADF.

Table 2: ADF Unit Root Test for Loanable Funds Second Model

Variables	Intercept				Trend and Intercept			
	Level		First difference		Level		First difference	
	t-stat	p-value	t-stat	p-value	t-stat	p-value	t-stat	p-value
LF	-3.144	0.0234	-3.124	0.0248	-3.214	0.0816	-3.191	0.0863
DF	-0.6707	0.8481	-12.0883	0.0001	-9.4405	0.0000	-12.0194	0.0000
INF	-6.9199	0.0000	-9.3619	0.0000	-6.9433	0.0000	-9.3122	0.0000
CF	-12.121	0.0000	-8.709	0.0000	-12.257	0.0000	-8.868	0.0000
OMO	-5.971	0.0000	-5.352	0.0000	-5.973	0.0000	-5.356	0.0000
BOP	0.5673	0.9881	-8.1879	0.0000	-6.0088	0.0000	-8.2753	0.0000
GE	-8.691	0.0000	-5.558	0.0000	-13.283	0.0000	-10.381	0.0000
CC	-15.767	0.0000	-12.175	0.0000	-15.880	0.0000	-12.350	0.0000

Source: Author's estimation based on NRB data

Table 2 indicates that the variables included in the are mixed stationary in nature. The ADF coefficients and the corresponding $P-values$ confirm that the variables except DF and BOP are stationary at level $I(0)$ whereas DF and BOP are of $I(1)$ stationary. However, none of the variables found to be trend stationary since all of these are stationary with intercept term only.

Cointegration Test

As the variables incorporated in the loanable funds model found to be mixed stationary in nature training of the model starts from cointegration test. The first step of cointegration test is to identify the number of optimal lags to be used in estimation. The simple VAR model has been estimated and two number of lags have been selected as indicated FPE and HQ criteria (Table 3).

Table 3: VAR Lag Order Selection Criterion for Loanable Funds Model

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-2743.233	NA	1.98e+17	62.52801	62.75322	62.61874
1	-2415.083	589.1773	4.91e+14	56.52462	58.55153*	57.34121
2	-2305.254	177.2243	1.79e+14*	55.48305	59.31166	57.02550*
3	-2237.894	96.44759*	1.81e+14	55.40668	61.03699	57.67499
4	-2184.618	66.59419	2.77e+14	55.65042	63.08243	58.64459
5	-2119.559	69.49547	3.71e+14	55.62634	64.86005	59.34637
6	-2043.496	67.41935	4.74e+14	55.35218	66.38759	59.79807
7	-1953.225	63.59999	6.01e+14	54.75511	67.59222	59.92686
8	-1804.567	77.70757	3.43e+14	52.83107*	67.46988	58.72868

Source: Author's estimation based on NRB data

After identification of optimum lag length, Johansen cointegration test has been performed assuming no trend but intercept in cointegrating equations as indicated by ADF test results. The EViews software reports two different types of test statistics: Trace statistics and

maximum eigenvalue statistics. Both of the test statistics have indicated that there are four cointegrating relationship among the variables included in the model (Table 4).

Table 4: Johansen Cointegration Tests for Loanable Funds Model

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.711065	325.2118	159.5297	0.0000
At most 1 *	0.512135	209.7474	125.6154	0.0000
At most 2 *	0.441937	142.9998	95.75366	0.0000
At most 3 *	0.365777	88.75448	69.81889	0.0008
At most 4	0.251391	46.40648	47.85613	0.0680
At most 5	0.123632	19.47937	29.79707	0.4589

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.711065	115.4644	52.36261	0.0000
At most 1 *	0.512135	66.74755	46.23142	0.0001
At most 2 *	0.441937	54.24537	40.07757	0.0007
At most 3 *	0.365777	42.34800	33.87687	0.0039
At most 4	0.251391	26.92711	27.58434	0.0605
At most 5	0.123632	12.27316	21.13162	0.5209

Trace and Max-eigenvalue tests indicate 4 cointegrating eqn(s) at the 0.05 level
 * denotes rejection of the hypothesis at the 0.05 level
 **MacKinnon-Haug-Michelis (1999) p-values

Source: Author's estimation based on NRB data

Besides the number of cointegrating equations, Johansen cointegration test also jointly estimates the long-run and short-run relationships between the variables incorporated in the model. The long-run estimates are called Beta relations while short-run estimates are Alpha relations. The Beta coefficients indicate—as per the expectation—that the government expenditures and currency outside the BFIs significantly contribute to bring positive change in loanable funds in the long run. In the meantime, domestic factor significantly contributes to bring negative change in the loanable funds.

However, capital funds of BFIs seem to have negative impact in loanable funds in the long run, which is not expected. Rest of the variables found to be statistically insignificant to influence loanable funds in the long run. As per the convention, signs of the Beta coefficients reported by EViews have been reversed while making interpretation (Table 5).

Table 5: Johansen Cointegrating Relations of Loanable Funds Model

Variables	Long-run (Beta) relations			Variables	Short-run (Alpha) relations		
	Coefficients	SE	t-stat		Coefficients	SE	t-stat
LF	1.0000			D(LF)	-0.0111	0.0229	-0.4847
GE	-5.3428	1.0051	-5.3157*	D(GE)	0.00001	0.0342	0.0003
CF	10.0752	2.5913	3.8881*	D(CF)	-0.0254	0.0097	-2.6186*
CC	-22.1351	1.9515	-11.3426*	D(CC)	0.0833	0.0067	12.4328*
DF	0.9157	0.2584	3.5437*	D(DF)	-0.0138	0.0299	-0.4615
BP	-0.1205	0.1771	-0.6804	D(BP)	-0.0031	0.0357	-0.08683
OMO	0.1151	0.2358	0.4881	D(OMO)	0.0568	0.0304	1.8684**
INF	7.8094	7.213	1.0827	D(INF)	-0.0016	0.0018	-0.8989

Source: Author's estimation based on NRB data

* Indicates null hypothesis rejected at 5% level, and ** indicates the rejection at 10% level

The Alpha (short run) coefficients indicate that recent change in three variables (CF, CC and OMO) significantly contribute to bring immediate change the loanable funds. Looking at individual coefficients it is found that any change in capital funds (CF) brings opposite change in loanable funds whereas any change in OMO and CC bring similar change in the short run. Despite being statistically significant results of alpha coefficients found to be inconsistent in line of the established theory and general convention.

Vector Error Correction Model

Once long-run cointegrating relationships among the variables have been confirmed by Johansen cointegration test, next step is to examine VECM model. VECM reconfirms the long-run cointegrating relationships for the identified cointegrating equations and estimates the long run relationship (with cointegration equation) first and then the short run relationships (error correction equations) for each of the variables included in the model. The long-run (cointegrating) relationships between the variables have been estimated with the following cointegration equation:

$$\mu = LF_t - (\alpha + \beta_1 GE_t + \beta_2 CF_t + \beta_3 CC_t + \beta_4 DF_t + \beta_5 BP_t + \beta_6 OMO + \beta_7 INF_t) \quad \ldots\ldots\ldots (12)$$

The summary statistics of estimated VECM indicate that the model fits well with about 0.85 R-squared and significant F-statistics (Table 6).

Table 6: VECM Cointegration Relations of Loanable Funds Model

Variables	Coefficients	S.E.	t-stat
Loanable Funds (LF)	1.000	-	-
Government Expenditures (GE)	-7.7045	3.7665	-2.0455*
Capital Funds (CF)	0.4325	6.1296	0.0706
Inflation Rate (INF)	1.9653	0.9363	2.1349*
Currency Outside BFIs (CC)	-11.8271	5.0042	-2.3634*
Domestic Factors (DF)	1.1108	0.9035	1.2295
Balance of Payment (BP)	-0.7514	0.2914	-2.5781*
Net-OMO (OMO)	0.4250	0.3673	1.1573
Constant (Intercept)	-37.2928	-	-
Coefficient of Determination (R2)	**0.8460**	**F-statistic**	**2.8925**
Adjusted R-squared (Adj. R2)	**0.5535**	**S.E. Equation**	**11.2339**

Source: Author's estimation based on NRB data   * Indicates significance at 5 % level

Results show that four of the independent variables (i.e. GE, INF, CC and BP) have been significantly contributing to determine loanable funds in the long run. Despite being significant sign obtained for INF and CC are not as correct as expected. Inference may be drawn that Rupees one billion increase in government expenditures and BOP respectively contribute to bring increase of about Rs. 7.7 and Rs. 0.75 billion in the loanable funds in the long run. None of the other independent variables seem to have significant contribution in bringing changes in loanable funds in the long run since the respective t-stats failed to reject the null hypothesis.

Although, VECM estimates error correction equations for all of the variable included in the system, considering the limitation of this study the error correction equation of loanable funds (dependent variable) only has been taken into account for analysis. The number of optimal

lags identified by AIC and HQ criteria are eight and the selected lags for VECM are one period less ($P-1$) than the optimum lags (P) i.e. 7 for this model. The resulted model is given below (13).

$$
\begin{aligned}
\Delta LF_t = \ & \alpha_1 + \alpha_2 \mu_{t-1} + \beta_1 \sum_{i=1}^{7} \Delta LF_{t-i} + \beta_2 \sum_{i=1}^{7} \Delta GE_{t-i} + \\
& \beta_3 \sum_{i=1}^{7} \Delta CF_{t-i} + \beta_4 \sum_{i=1}^{7} \Delta CC_{t-i} + \beta_5 \sum_{i=1}^{7} \Delta DF_{t-i} + \\
& \beta_6 \sum_{i=1}^{7} \Delta BP_{t-i} + \beta_7 \sum_{i=1}^{7} \Delta OMO_{t-i} + \beta_8 \sum_{i+1}^{7} \Delta INF_{t-i} + e_t \quad \ldots\ldots\ldots (13)
\end{aligned}
$$

The error correction term (0.1835) of this equation is within the theoretical range of zero to one and statistically significant. However, the sign is positive which is against the assumption of VECM model that any short run deviation in the loanable funds from its long run equilibrium path due to changes in independent variables diverges at the rate of about 18 percent per period (month for this study).

It is not possible to present the coefficients of all regressors of error correction equation due to large number of (56) regressors in the model. Thus, the values of regressors—which are statistically significant up to 10 percent—have been presented below (Table 7). The result clearly shows that recent changes in all of the independent variables including previous values of loanable funds itself seem to be instrumental to bring about change in loanable funds. However, signs of only three variables (i.e. CF, BP and OMO) found to be correct as per expectation, indicating any changes on these variables in recent month bring positive change in the loanable funds.

Despite being statistically significant, signs of LF (-1) and GE indicates that recent (previous month) increase in government expenditures and loanable funds itself contribute to reduce loanable funds at the current month. This is an issue for further research and discussion whether it is reasonable or not. The coefficient of CC indicates that any increase in currency outside the BFIs in the recent month help bring growth in the loanable funds, which is also not expected but definitely a matter for further analysis. Looking at sign of DF it can be said that any change in domestic (demand side) factors brings about positive change in loanable funds which is again against our expectation.

Finally, sign of inflation gives a message that a rise in inflation helps reduce the amount of loanable funds available in the banking system. This may be due to dominance of imported goods in the economy where a higher inflation demands more money to purchase the items which flights outside the country. This is also an issue for further study that VECM error correction equation explored some issues for fresh study.

Residual Diagnostics

Residual diagnosis results of the model (Table 7) confirm that the error terms of the selected model are IID white noise since all of the null hypothesis for homoscedasticity, no serial correlation, no ARCH effect and normality of residuals cannot be rejected at 5 percent level of significance.

Table 7: Residual Diagnostic Check for VECM Model

Test Name	Null (H0)	Test-Stat	P-value	Decision
Breusch-Godfrey LM test	No serial correlation at up to 11 lags	F (0.5836)	0.8280	H0 accepted at 5% significance level
Jarque-Bera Normality test	Error terms are normally distributed	JB(2.3780)	0.3045	H0 accepted at 5% significance level
Breusch-Pagan-Godfrey test	Homoscedasticity (no heteroscedasticity)	F (0.9230)	0.6131	H0 accepted at 5% significance level
Heteroscedasticity LM-test	No ARCH effects in the model	F (0.8173)	0.5180	

Source: Author's estimation

Stability Test

In order to check the stability of parameters Cumulative Sum of Recursive Residual (CUSUM) and CUSUM of square test performed and the results have been plotted below (Figure 1). The plot indicates, the residuals are within the defined range of $\pm$ 5 percent significance level. Thus the model found to be satisfactory for further consideration.

Figure 1: CUSUM Plots for VECM Model
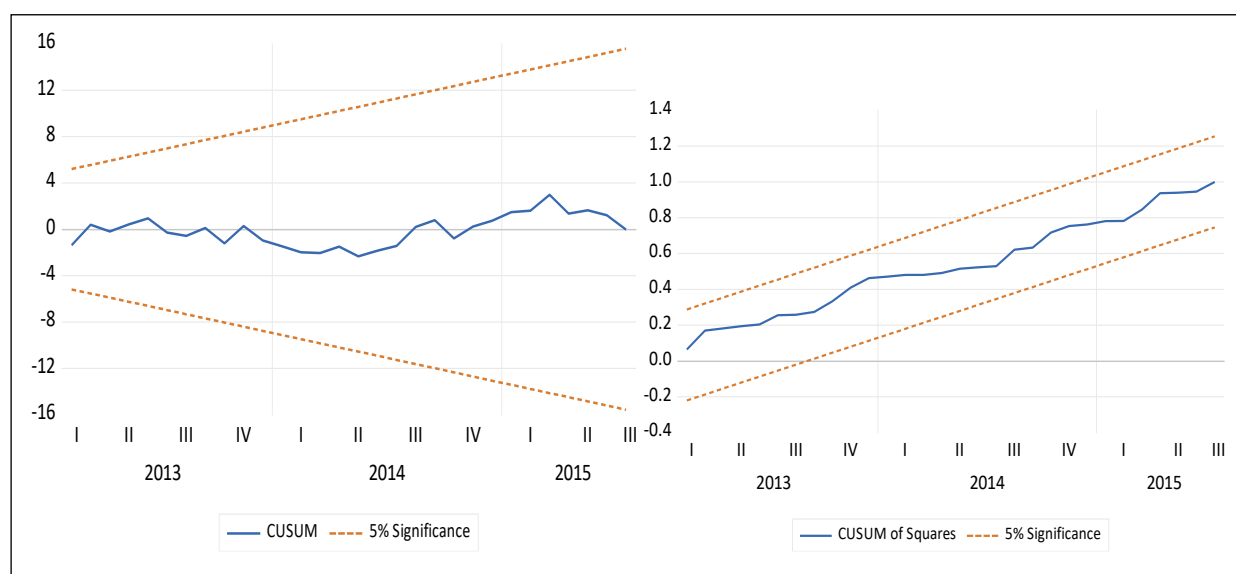
4.2 Testing of Model

The testing of VECM model starts with examination of cointegrating relations, estimation followed by diagnostics of the model and interpretation of the results. With the lesser number of observations the number of optimal lags (P) identified for VECM model are four thus the model has been estimated with 3 (P-1) lags. Despite significant F-statistics, the explanatory power (R^2) of VECM model has gone down (0.68) along with the sample size. However, VECM results of cointegrating relationship found very encouraging than training phase where all of the coefficients (but inflation) have got theoretically correct signs and statistically significant. Despite having correct sign the capital funds of BFIs is not statistically significant.

Table 8: VECM Cointegration Relations of Loanable Funds Model

Variables	Coefficients	S.E.	t-stat
Loanable Funds (LF)	1.000	-	-
Government Expenditures (GE)	-2.1071	0.4248	-4.9607*
Capital Funds (CF)	-0.9540	1.0780	-0.8849
Inflation Rate (INF)	-67.2469	13.1590	-5.1103*
Currency Outside BFIs (CC)	5.7679	1.0301	5.5991*
Domestic Factors (DF)	1.0741	0.2540	4.2279*
Balance of Payment (BP)	-0.8084	0.1135	-7.1221*
Net-OMO (OMO)	-0.6285	0.2277	-2.7602*
Constant (Intercept)	39.1664	-	-
Coefficient of Determination (R2)	**0.6840**	**F-statistic**	**4.9657**
Adjusted R-squared (Adj. R2)	**0.5462**	**D-W statistic**	**2.03242**

Source: Author's estimation based on NRB data   * Indicates significance at 5 % level

The VECM error correction equation of loanable funds also produces better result than training phase, especially in terms of error correction term. The statistically significant error correction term (-0.1928) has got correct sign and lies within the theoretical range of zero to one. This indicates that any short run deviation in the loanable funds from its long run equilibrium path due to changes in independent variables converges at the rate of about 19 percent per month.

As like in the training phase, VECM model could not produce satisfactory results in terms of short run dynamics between the changes in the dependent and independent variables. The results indicate only two regressors i.e. last month's loanable funds (LF_{t-1}) and currency outside the BFIs (CC_{t-1}) are statistically significant but the signs are not theoretically correct.

Residual Diagnostics

The results of residual diagnostics (Table 9) indicate that the VECM model has satisfied all conditions of IID but the null hypothesis of normality cannot be accepted.

Table 9: Residual Diagnostics for VECM of Loanable Funds Model

Test Name	Null (H0)	Test-Stat	P-value	Decision
Breusch-Godfrey LM test	No serial correlation at up to 3 lags	F (0.6203)	0.5433	H0 accepted at 5% significance level
Jarque-Bera Normality test	Error terms are normally distributed	JB(13.7764)	0.0001	H0 rejected at 5% significance level
Breusch-Pagan-Godfrey test	Homoscedasticity (no heteroscedasticity)	F (1.0842)	0.4096	H0 accepted at 5% significance level
Heteroscedasticity LM-test	No ARCH effects in the model	F (0.1583)	0.6932	

Source: Author's estimation

Stability of Parameters

The CUSUM tests (Figure 2) show that the model is fairly stable however, the residual plot of CUSUM square graph has crossed—at some points of time—the lower boundary of ±5 percent significance level.

Figure 2: **CUSUM Plots for Stability Test of Loanable Funds VECM Model**
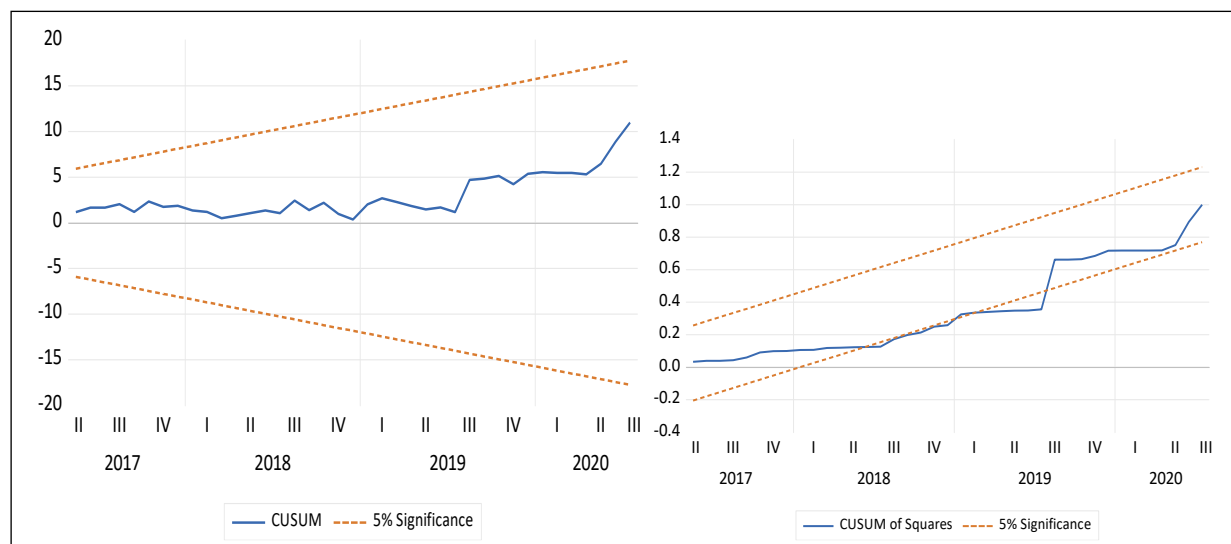
V. FORECASTING OF LOANABLE FUNDS

5.1 Ex-post Forecasting

This covers forecasting of loanable funds for the period of August 2020 to July 2021. The performance of model has been evaluated with the help of two indicators: Root Mean Square Error (RMSE) and Theil Inequality Coefficient (U). However, some supplementary indicators have also been reported with to them in the case the RMSE and U coefficients indicate conflicting solutions. The model is estimated with the 3 (4-1) number of lags as indicated by AIC and forecasting has been made in billion rupees of loanable funds. The forecast results and evaluation indicators of the VECM model have been presented below.

The forecast results (Table 10) show the RMSE is 20.31 whereas MAE and MAPE are respectively 15.35 and 79.19. The values of Theil coefficients also support the results of error coefficients i.e. both U_1 & U_2 as well as bias proportion of U_1 are acceptable. These confirm that the forecasts of VECM model are accurate than naive forecasts and close to the observed values.

Table 70: Performance of Ex-post Forecast

Error Coefficients		Theil Coefficients	
Indicators	**Values**	**Indicators**	**Values**
Root Mean Square Error (RMSE)	20.3100	Theil (U1) Coefficient	0.0600
Mean Absolute Error (MAE)	15.3502	Bias Proportion	0.2127
Mean Abs. Percent Error (MAPE)	79.1939	Variance Proportion	0.0478
Symmetric MAPE	25.9678	Covariance Proportion	0.7395
		Theil (U2) Coefficient	0.1624

Source: Author's Estimation

Figure 4 confirms that the line plots of actual (LF) vs. forecasted (LFF) series almost overlap to each other over the forecast period indicating that the VECM made good forecasts.

Figure 3: Ex-post Forecast vs Actual Series of Loanable Funds
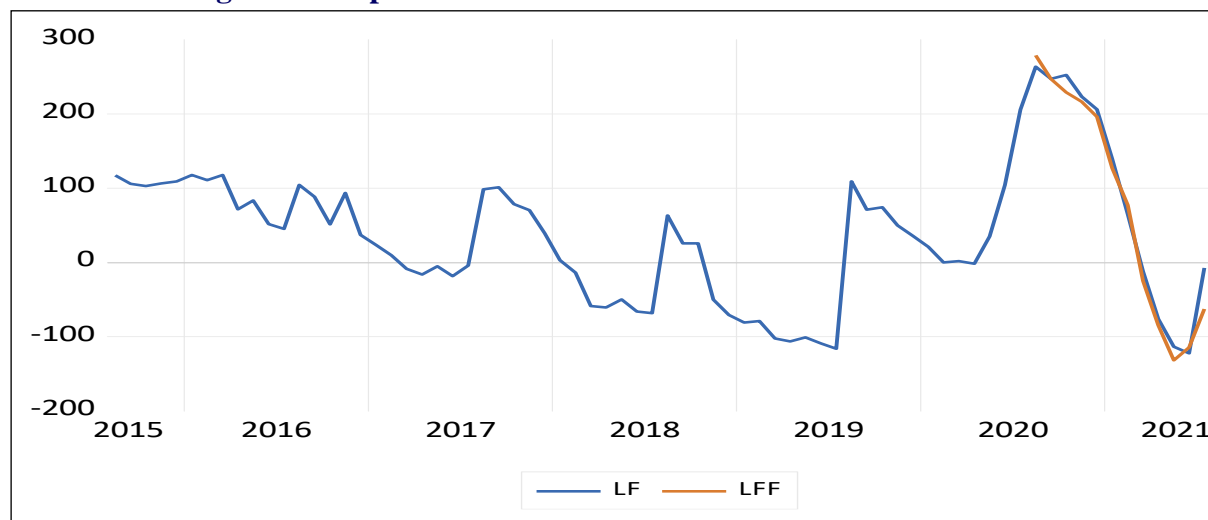
5.2 Ex-ante Forecasting

Here ex-ante forecasting of loanable funds has been made for the period of August 2021 to July 2022. In the process, first of all the values of regressors (independent variables) for the same period have been forecasted using simple exponential smoothing method. Then the selected VECM model has been estimated with the dataset of August 2015 to July 2021 followed by forecasting of LF for the next 12 months.

Table 11: Ex-ante Forecast Performance of Loanable Funds VECM Model

Error Coefficients		Theil Coefficients	
Indicators	**Values**	**Indicators**	**Values**
Root Mean Square Error (RMSE)	269.9760	Theil (U1) Coefficient	0.6982
Mean Absolute Error (MAE)	222.1628	Bias Proportion	0.0480
Mean Abs. Percent Error (MAPE)	14580.44	Variance Proportion	0.1158
Symmetric MAPE	149.4728	Covariance Proportion	0.4038
		Theil (U2) Coefficient	172.6687

Source: Author's Estimation

The results (Table 11) show that the performance indicators of ex-ante forecasts are higher than that of the same indictors obtained during ex-post forecasts.

Figure 4: **Actual vs Ex-ante Forecasts of Loanable Funds**
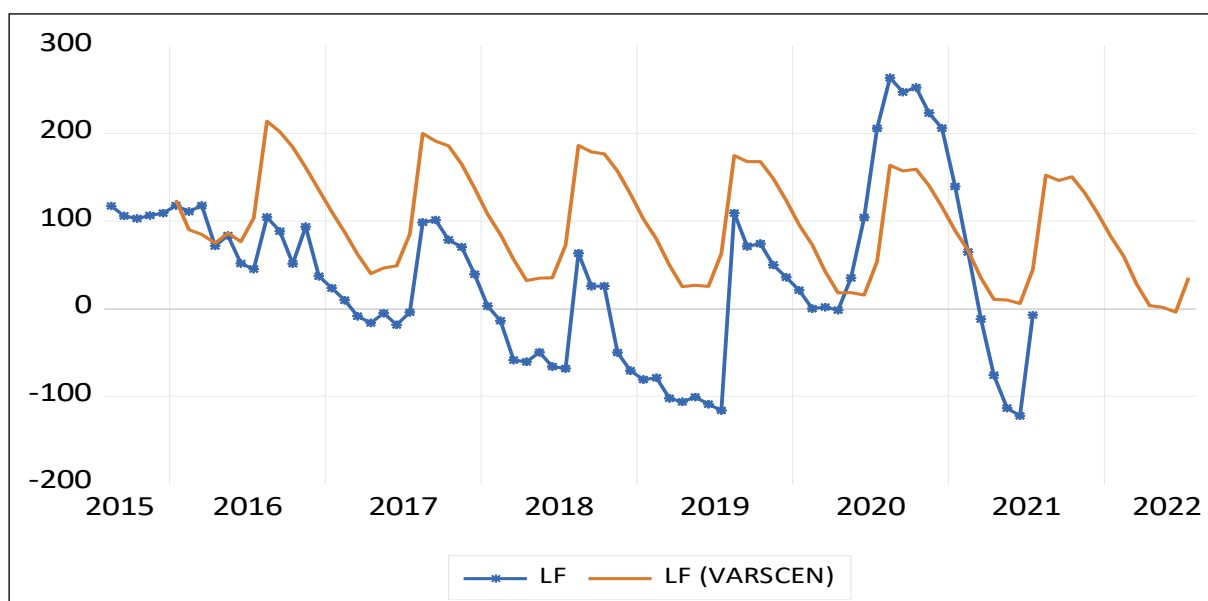
Figure 4 also confirms that the ex-ante forecasts of loanable funds seem to follow the path which was followed by the actual values. However, it seems that the forecasts are not so much close to the actual values that would have been observed in the real scenario. The figure indicates that the loanable funds available in the Nepali banking system will be about Rs. 35 billion during June 2022.

VI. FINDINGS AND CONCLUSION

Looking at the results of ex-post as well as ex-ante forecasts and comparative analysis of performance indicators it found that VECM model produces satisfactory forecasts of loanable funds for Nepali banking system. However, the performance may vary in comparison to the other models still performance indicators of forecast accuracy measures indicate that the VECM forecasts are far better than the naive forecasts. In terms of the determinants, the net amount injected via OMO (policy factor) found to be instrumental in maintaining required amount of loanable finds available for fresh loan. This reinforces the active role of monetary authority for management of loanable funds in the economy.

Since empirical analysis and use of scientific forecasting (econometric) models found to be an additional value for evidence based decision making for BFIs it is worth considering for the board (management) of BFIs to establish a permanent research division with fully equipped advanced technology and a team of experts. Finally, this study has set milestone for an avenue of modeling and forecasting of loanable funds in the banking system of Nepal. However, a single study conducted in a certain scope and limitations may not be the perfect but definitely opens opportunity for more specific and customized studies where new researchers can contribute in.

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ANNEX

VECM Short-run Relationships of Loanable Funds Model

Regressors	Coefficient	Std. Error	t-Statistic	Prob.
Error Correction Term	0.183515	0.073316	2.503059	0.0180
D(LF(-1))	-0.501875	0.224809	-2.232449	0.0332
D(LF(-5)	-0.575082	0.260712	-2.205814	0.0352
D(GE(-2))	-1.230799	0.727616	-1.691550	0.1011
D(GE(-4))	-1.161911	0.625464	-1.857679	0.0731
D(GE(-5))	-0.917660	0.474062	-1.935739	0.0624
D(CF(-1))	0.968362	0.585776	1.653128	0.1087
D(CF(-7))	0.950833	0.439801	2.161961	0.0387
D(CC(-1))	3.857564	1.457887	2.645997	0.0128
D(CC(-2))	2.676710	1.308686	2.045342	0.0497
D(CC(-3))	2.972961	1.359426	2.186923	0.0367
D(CC(-4))	2.234289	1.198640	1.864020	0.0721
D(CC(-5))	2.164343	0.991632	2.182607	0.0370
D(CC(-6))	1.844147	0.704767	2.616675	0.0138
D(CC(-7))	1.111893	0.432428	2.571280	0.0153
D(DF(-1))	0.427235	0.256537	1.665392	0.1062
D(DF(-2))	0.598280	0.277651	2.154789	0.0393
D(DF(-3))	0.635283	0.284049	2.236524	0.0329
D(DF(-4))	0.563217	0.244400	2.304484	0.0283
D(DF(-5))	0.378420	0.202891	1.865141	0.0720
D(DF(-6))	0.467057	0.202599	2.305326	0.0282
D(DF(-7))	0.305826	0.154976	1.973379	0.0577
D(BP(-2))	0.424034	0.132725	3.194839	0.0033
D(OMO(-1))	0.286281	0.150279	1.905004	0.0664
D(OMO(-2))	0.314846	0.143234	2.198117	0.0358
D(OMO(-6))	0.298195	0.172978	1.723887	0.0950
D(INF(-2))	-7.849852	4.132024	-1.899760	0.0671
D(INF(-7))	-6.509581	2.712175	-2.400133	0.0228

R-squared	0.846057	Mean dependent var		0.524655
Adjusted R-squared	0.553565	S.D. dependent var		16.81327
S.E. of regression	11.23392	Akaike info criterion		7.917795
F-statistic	2.892582	Durbin-Watson stat		1.854580
Prob(F-statistic)	0.001142			

Examining the causality of Asset Growth and Income on Share Prices for Commercial Banks in Nepal during COVID using a Panel Vector Auto Regression (PVAR) Approach

Serene Khatiwada [*]
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Abstract

This study uses a Panel Vector Auto Regression (PVAR) model to study the causality of Commercial Bank Loans and Advances and Total Income on Share Prices in Nepal using a monthly time series data set. Data were sourced from publicly available websites of Nepal Rastra Bank and Nepal Stock exchange to build a panel which was estimated using the "panelvar" package in R which uses a generalised method of moment estimator on p lags of endogenous variables.

The results reveal the relationship between fundamentals of Commercial Bank and Share Prices are not visible immediately in one or two months and however are significant in a longer-term horizon (more than four months). Additionally, the significance of external market conditions over a longer-term horizon declines which would imply, Bank Share prices are largely dependent on the Banks own performance. Both Loan and Advances, and Total Income play a significant role in causing the movement of share prices however the dynamics are very different and maybe highly dependent on Central Bank policies.

The industry seems to respond to shocks form credit demand (Loans and Advances) the most which becomes starker post COVID but seems however with a significant seasonal component. Post COVID, shocks from Total Income also appears to have more significance which may signify an increased importance of efficiency in addition to profitability in the Nepalese Banking Industry. This does not mean that efficiency was not important previously in the industry, in-fact our Forecast Error Variance Decomposition (FEVD) graph shows that the variance in Commercial Bank share prices over a 12-month horizon is explained more than 50% by Total Income which is a significant change to the pre-COVID scenario where the maximum explanation was through the lag of Share Prices itself. This may imply that the Share Prices of Commercial Banks are transitioning to a greater emphasis in performance through increased profitability and efficiency, both.

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I. INTRODUCTION AND LITERATURE REVIEW

In literature as early as 1981, share prices have been noted to rely fundamentally on "unobservables" and be impacted significantly by new information making them highly volatile and difficult to evaluate statistically (Shiller, 1981).

Various studies have corroborated this phenomenon in Nepal's market also where share prices have been cited to be difficult to predict where volatilities are not explained by models, indicating ample room for the role of news rumours and speculations in addition to responses being induced by changes in the political environment, Central Bank policies on lending against share collateral and regulatory capital requirements (Shrestha & Pokhrel, 2019). There also have been citations in literature around Nepal's stock market displaying unique trends including a significant role being played by uninformed investors which introduce a "fear of missing out" (FOMO) noise in market trends as well as the deployment of pump and dump schemes which induce positive shocks to increase volatility more than negative shocks (Gajurel, 2021).

Literature around behaviour of markets and the Banking sector during the Pandemic highlight similar patterns in advanced and emerging market economies. Firms had access to increased credit supply when liquidity to capital markets froze, however, after March 2020 Banks seemed to face an unprecedented demand for credit since when share prices have persistently underperformed to those of non-financial firms (Acharya, Engle, & Steffen, 2021). This phenomenon also seems to have been the case for Nepal as we can see a simultaneous increase in credit for Commercial Banks, however the slowest growth in stock market indicators when compared to other Industry Groups.

Commercial Banks in Nepal during COVID have been able to increase balance sheet size despite restrictions and lockdowns. The year-on-year growth of Loans and Advances during 2019/20 which witnessed COVID headwinds for the second half of the Fiscal Year 2020/19 saw a 19% growth, the following year which witnessed a second wave saw a higher growth at 28%. Though Private Sector Claims which historically contributed about 90% to Total Loans and Advances, decreased during COVID to 84% in 2021 and 2020, increased at one of the fastest rates of 27% year on year in 2021 contributing to the overall growth of Loans and Advances given its large base.

Table 1: Increase in Assets of Banks during COVID

Change in Assets/Balance Sheet of Class A Banks (NPR million if not otherwise stated)	2019 July	2020 July*	2021 July**	Year on year Δ			
				2020 – 2019		2021 – 2020	
				Amount	% yoy	Amount	% yoy
Assets = Liabilities	3,611,925.8	4,369,588.9	5,392,526.6	757,663.0	21.0	1,022,937.7	23.4
Liquid Funds	375,666.9	532,194.2	474,058.6	156,527.3	41.7	-58,135.6	-10.9
Loans and Advances	2,884,954.4	3,435,870.5	4,387,958.3	550,916.1	19.1	952,087.8	27.7
Claims on Government	354,888.2	491,382.3	651,641.6	136,494.1	38.5	160,259.3	32.6
Claims on Non-Financial Government Enterprises	9,244.1	7,919.3	7,333.0	-1,324.8	-14.3	-586.3	-7.4
Claims on Financial Enterprises	33,159.9	35,890.6	46,402.5	2,730.7	8.2	10,511.8	29.3
Government	1,029.5	982.7	972.0	-46.8	-4.5	-10.7	-1.1
Non-Government	32,130.4	34,907.9	45,430.5	2,777.5	8.6	10,522.5	30.1
Claims on Private Sector	2,487,561.2	2,900,662.4	3,682,557.0	413,101.2	16.6	781,894.6	27.0
Principal	2,456,591.8	2,850,128.2	3,642,346.0	393,536.3	16.0	792,217.9	27.8
Interest Accrued	30,969.4	50,534.2	40,211.0	19,564.8	63.2	-10,323.2	-20.4
Foreign Bills Purchased & Discounted	101.0	15.9	24.2	-85.1	-84.2	8.3	52.3
NRB Bond	0.0	0.0	0.0	0.0		0.0	
Other Assets	351,304.5	401,524.2	530,509.8	50,219.7	14.3	128,985.5	32.1

Source: Nepal Rastra Bank Macroeconomic and Financial Situation Data as of Mid – July 2021

Commercial Bank stock prices did not witness a decline even during COVID, on the contrary indices for both banking and NEPSE as a whole witnessed an increase (Figure 1). The change that can be eyeballed through trend graphs is that the divergence between the Banking and NEPSE index increased after COVID which would also mean that the composition of the Commercial Banks both in terms of Market Capitalisation and total Value of Shares in the Stock Market vis-à-vis other sectors may have declined. This would be because other industries have grown relatively faster compared to the banking sector which upon analysing the granular data in tables below, makes this point clear.

Figure 1: **Stock market trends vis-a-vis the Banking Index**
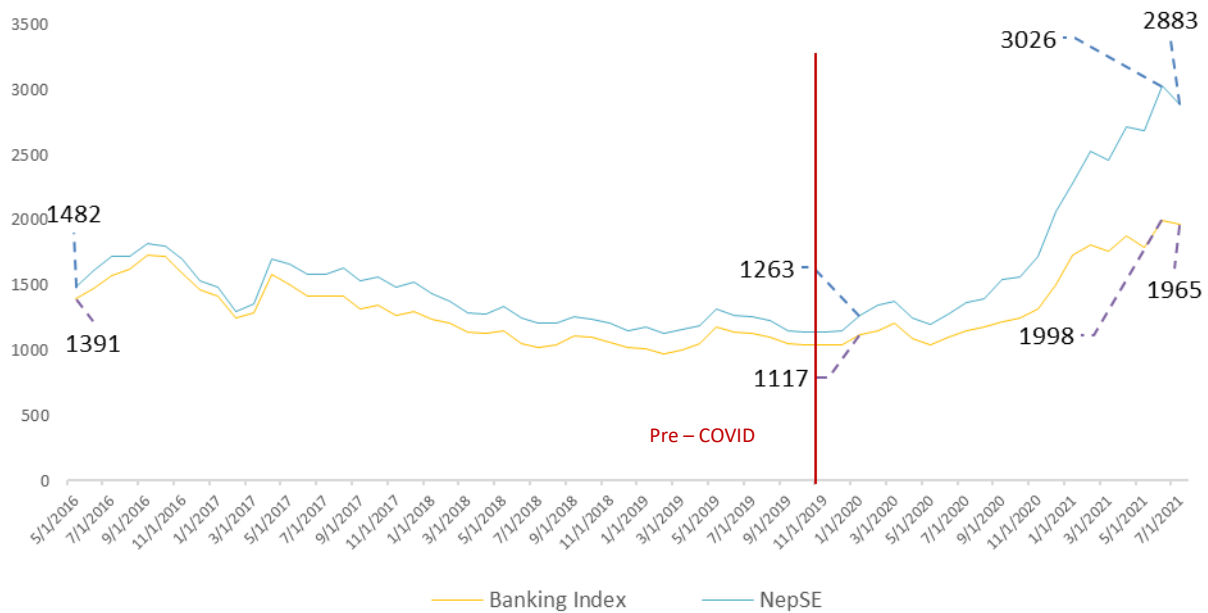
Source: Nepal Stock Exchange Monthly Reports, Various

Commercial Banks have been among the slowest growing industry among other Groups in the Nepal Stock Exchange during COVID and the slowest last year (2021/21) which supports the deviation of observed in Figure 1. The average year on year percentage change of NEPSE Overall and Float Indices are above 100% in 2021 which is significantly higher than the year-on-year growth rates during the first wave of COVID in 2020 when changes were in single digits. In both years, Commercial Banks grew below average as can be seen from Table 2. Another observable pattern is that a major decline in indices during COVID are in sectors that may have seen impacts due to subdued demand including hotels and hydro power.

Table 2: Change in Stock Indices of Major Industry Groups

Stock Indices	2018/19	2019/20			2020/21			Year on year Δ (Closing)	
	Closing	High	Low	Closing	High	Low	Closing	19/20 – 18/19	20/21 – 19/20
Commercial Banks	1133.0	1440.2	1016.3	1153.0	1997.6	1173.4	1964.8	1.8	70.4
Development Banks	1613.9	2063.7	1516.8	1711.4	5099.9	1723.4	4614.4	6.0	169.6
Life Insurance Companies	6018.7	9905.9	4874.5	8087.3	18997.4	8218.5	17017.5	34.4	110.4
Non- Life Insurance Companies	5070.3	7568.6	3947.2	6245.2	15486.3	6275.0	14016.1	23.2	124.4
Finance Companies	626.0	721.2	551.0	654.7	2626.7	650.3	2513.7	4.6	283.9
Microfinance Institutions	1434.3	2803.7	1437.3	2439.0	5672.9	2343.6	5323.8	70.0	118.3
Manufacturing & Processing	2676.8	3243.2	2118.8	2701.7	6449.6	2655.4	6087.6	0.9	125.3
Hotel	2123.7	2116.0	1348.9	1467.7	4128.5	1413.9	3547.3	-30.9	141.7
Trading	259.8	992.2	251.4	876.1	4638.5	829.9	3723.8	237.1	325.1
Mutual Fund	-	-	-	-	15.8	12.3	15.8	-	-
Investment	-	-	-	-	113.2	92.8	106.3	-	-
Hydro Power	1205.5	1224.2	886.3	966.2	3241.4	943.6	2892.8	-19.9	199.4
Others	718.6	822.0	624.1	768.5	2356.6	775.3	2140.5	7.0	178.5
NEPSE Overall Index (Base: Feb 12, 1994)	**1259.0**	**1632.2**	**1109.2**	**1362.3**	**3025.8**	**1381.4**	**2883.4**	**8.2**	**111.6**
NEPSE Sensitive Index (Base: July 16, 2006)	**271.3**	**347.7**	**244.9**	**288.2**	**550.3**	**287.1**	**541.4**	**6.3**	**87.8**
NEPSE Float Index (Base: August 24, 2008)	**92.4**	**115.7**	**82.5**	**95.5**	**210.2**	**96.7**	**200.3**	**3.3**	**109.9**

Source: Nepal Stock Exchange and Nepal Rastra Bank Macroeconomic and Financial Situation indicators

Though Assets and Stock Price indices have been growing for Commercial Banks in Nepal through COVID, the overall composition in terms of Market Capitalization and the value of shares floated have declined which may have thwarted the once held dominant position of Commercial Banks in the stock market. Inorganic growth through intra class acquisition and mergers can also be seen through data which maybe another significant reason on the growth in value. While Commercial Bank Share Units grew by 154% since 2018/19 and value by 56%, Development Bank shares units actually declined by 1% while the value grew by 22%.

Table 3: Change in value composition

Institutions	2018/19			2019/20			2020/21		
	Share Units ('000)	Rs. in million	% Comp. of Value	Share Units ('000)	Rs. in million	% Comp. of Value	Share Units ('000)	Rs. in million	% Comp. of Value
Institutional Groups									
Commercial Banks	243,699	33,682	44.7	359,898	64,331	64.8	619,897	52,587	13.0
Development Banks	38,763	3,876	5.1	69,078	6,908	7.0	38,453	4,745	1.2
Insurance Companies	42,864	4,286	5.7	60,858	6,086	6.1	149,875	14,988	3.7
Finance Companies	20,174	2,017	2.7	8,905	1,296	1.3	11,008	1,551	0.4
Microfinance	37,554	3,755	5.0	21,422	2,142	2.2	39,954	3,995	1.0
Manufacturing	44,000	4,400	5.8	1,928	193	0.2	2,892	289	0.1
Hotel	8,063	806	1.1	537	54	0.1	10,990	1,099	0.3
Trading	307	31	0.0	0	0	0.0	385	38	0.0
Hydropower	223,612	22,361	29.7	123,059	12,306	12.4	120,769	12,077	3.0
Others*	1,992	199	0.3	576,925	5,988	6.0	67,853,274	313,404	77.4
Total	**661,028**	**75,415**	**100.0**	**1,222,610**	**99,302**	**100.0**	**68,847,497**	**404,773**	**100.0**
Instrument-wise listing									
Ordinary Share	289,705	28,971	38.4	136,426	13643	13.7	421661	42166	10.4
Right Share	108,849	10,885	14.4	46861	4686	4.7	55177	5518	1.4
Bonus share	252,126	25,213	33.4	281489	28149	28.3	467374	46737	11.5
Government Bond	-	-	-	-	-	-	67199470	284947	70.4
Debenture	10,347	10,347	13.7	31940	31940	32.2	18552	18552	4.6
Mutual Fund	0	0	0.0	574500	5745	5.8	685262	6853	1.7
Others	0	0	0.0	151393	15139	15.2	-	-	0.0
Total	**661028.0**	**75415.3**	**100.0**	**1222610.2**	**99302.4**	**100.0**	**68847497.0**	**404773.3**	**100.0**

A decline in composition of value with respect to total value can be seen through most industry types which may have been diluted through COVID. A maximum increase has been registered in other sectors which comprised less than 1% during 2018/19 but subsequently has grown to 77% in 2021/20 on account of an increased investment in Government Bonds. Insurance companies also registered an increase the value of shares, however a proportional increase in the total shares floated by insurance companies has diluted the growth rate of the composition in Value for this sector. When trends in market capitalisation are seen, it is clear that there has been no increase in the number of listed entities or market cap in "Others" which vets that an increase in share value witnessed in table two is majorly through government bonds. This could suggest some diversification during COVID to sectors away from traditional institutional groups including Commercial Banks into safer forms of investment. The analysis of market capitalization dynamics makes trends of the investment clearer however investment has been slower in Commercial Banks when compared to the rest of the industry.

Table 4: Trend in Market Capitalisation

Industry Groups	No. of Listed Companies Mid-July			Market Capitalization of Listed Companies (Rs million) Mid-July							
	2019	2020	2021	2019		2020		2021		% Change	
				1 Value	2 Share %	3 Value	4 Share %	5 Value	6 Share %	3 Over 1	5 Over 3
Financial Institutions	**154**	**147**	**143**	**1230665.1**	**78.5**	**1402330.8**	**80.1**	**2762882.2**	**68.9**	**13.9**	**97.0**
Commercial Banks	27	26	26	830790.0	52.7	868998.1	50.6	1513050.0	37.7	4.6	74.1
Development Banks	32	24	17	82101.0	5.2	75570.9	5.3	168377.4	4.2	-8.0	122.8
Finance Companies	26	24	23	20526.4	1.3	21486.9	1.3	84412.6	2.1	4.7	292.9
Microfinance	47	51	49	92661.7	5.8	166769.5	8.6	382308.4	9.5	80.0	129.2
Insurance Companies	22	22	28	204586.0	13.5	269505.5	14.3	614733.9	15.3	31.7	128.1
Manufacturing & Processing	**19**	**19**	**19**	**65509.9**	**4.3**	**65536.7**	**3.8**	**147671.6**	**3.7**	**0.0**	**125.3**
Hotel	**4**	**4**	**5**	**28078.3**	**1.8**	**19405.7**	**1.3**	**61413.5**	**1.5**	**-30.9**	**216.5**
Trading	**4**	**4**	**4**	**1511.5**	**0.1**	**5096.0**	**0.3**	**21671.0**	**0.5**	**237.1**	**325.3**
Investment			**5**					**323777.7**	**8.1**	**-**	**-**
Hydro Power	**30**	**33**	**40**	**93281.8**	**5.9**	**97259.6**	**5.9**	**337025.0**	**8.4**	**4.3**	**246.5**
Others	**4**	**5**	**3**	**148452.8**	**9.5**	**203133.9**	**8.6**	**356516.7**	**8.9**	**36.8**	**75.5**
Total	**215**	**212**	**219**	**1567499**	**100.0**	**1792763**	**100.0**	**4010958**	**100.0**	**14.4**	**123.7**

The market capitalization of Commercial Banks despite a 74% year on year increase declined to total composition of 38% from a historic figure above 50%. An increase in market capitalization registers in insurance companies, microfinance institutions, investment, hydropower, trading, and other sectors – which would mean a rapid growth as the overall base of market capitalization has witnessed a year-on-year growth of over 123%. The maximum year on year increase in market capitalization has been for trading and finance companies at 325% and 290% respectively followed by hydropower at 246%. The growth in market capitalization overall suggests that overall activity has increased in the market and during the recovery phase of various industries there has been diversification away from Commercial Banks.

The extent to the causality of Commercial Bank fundamentals and share price would have an important bearing to pointing towards the true reflection of the Commercial Bank share prices in the industry and the reflection of performance. This paper aims to analyse the association of fundamentals of Commercial Banks using a PVAR approach so that there can be reasonable forecasts of Commercial Bank share prices based on profitability of the industry.

II. DATA AND METHODOLOGY

The objective of this study being to rigorously analyze the dynamic phenomenon of share prices being affected by fundamentals of Commercial Banks in Nepal, we aim to bridge the potential gap of using a dynamic multivariate time series model to analyze the causality. We use a Panel Vector Auto Regression that allows for p lags of m endogenous variables, k predetermined variables and n strictly exogenous variables.

2.1 Model

A PVAR model with is a combination of a single equation dynamic panel model and a vector autoregressive model (VAR) (Sigmund & Ferstl, 2021).

$$y_{i,t} = \mu_i + \sum_{l=0}^{p} A_l y_{i,t-l} + Bx_{i,t} + Cs_{i,t} + \epsilon_{i,t}$$

$$I_m = \begin{pmatrix} 1 & \cdots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & 1 \end{pmatrix}_{m \times m}$$

$y_{i,t} \in \mathbb{R}^m$ be an $m \times 1$ vector of endogenous variables for the ith cross sectional unit at time t.

$y_{i,t-l} \in \mathbb{R}^m$ be an $m \times 1$ vector of lagged endogenous variables.

$x_{i,t} \in \mathbb{R}^k$ be an $k \times 1$ vector of predetermined variables that are potentially correlated with past errors.

$s_{i,t} \in \mathbb{R}^n$ be an $n \times 1$ vector of strictly exogenous variables that neither depend on ϵ_t nor on ϵ_{t-s} for $s = 1,..,T$.

$\epsilon_{i,t}$ are independently and identically distributed (i.i.d) for all i and t with $\mathbb{E}[\epsilon_{i,t}] = 0$ and $Var[\epsilon_{i,t}] = \Sigma_\epsilon$.

Σ_ϵ is a positive semidefinite matrix

A falls inside the unit circle to assure co-variance stationarity

Parameter homogeneity is assumed i.e., A_l $(m \times m)$, **B** $(m \times k)$ and **C** $(m \times n)$ $\forall i$

For our purposes this expands to the following (details in the data section):

$$\begin{pmatrix} Share\ Prices \\ Loan\ and\ Advances \\ Total\ Income \\ Capital\ Fund \end{pmatrix}_{i,t} = \mu_i + \sum_{l=0}^{p} A_l \begin{pmatrix} Share\ Prices \\ Loan\ and\ Advances \\ Total\ Income \\ Capital\ Fund \end{pmatrix}_{i,t-l} + C \begin{pmatrix} NePSE \\ Banking\ Index \\ InterBank \end{pmatrix}_{i,t} + \epsilon_{i,t}$$

Notes:

- Exogenous variables are the same for all Banks as these are single rates applicable to the market therefore for all i, same values have been repeated to run the code. We have considered i to expand the conditions below.
- Predetermined variables for our purposes are nil

- Subscript i expands to the Banks on which our PVAR model is grouped. Banks were number coded as the following to run the model:

Table 5: Bank mappings to numeric codes in the model

Bank Name	Bank Symbol	Code in Model $\in i$
Agriculture Development Bank Limited	ADBL	1
Bank of Kathmandu Ltd.	BOKL	2
Century Commercial Bank Ltd.	CCBL	3
Citizen Bank International Limited	CZBIL	4
Civil Bank Ltd	CBL	5
Everest Bank Limited	EBL	6
Global IME Bank Limited	GBIME	7
Himalayan Bank Limited	HBL	8
Kumari Bank Limited	KBL	9
Laxmi Bank Limited	LBL	10
Machhapuchhre Bank Limited	MBL	11
Mega Bank Nepal Ltd.	MEGA	12
Nabil Bank Limited	NABIL	13
Nepal Bangladesh Bank Limited	NBB	14
Nepal Bank Limited	NBL	15
Nepal Credit and Commercial Bank Limited	NCCB	16
Nepal Investment Bank Limited	NIB	17
Nepal SBI Bank Limited	SBI	18
NIC Asia Bank Ltd.	NICA	19
NMB Bank Limited	NMB	20
Prabhu Bank Limited	PRVU	21
Prime Commercial Bank Ltd.	PCBL	22
Sanima Bank Limited	SANIMA	23
Siddhartha Bank Limited	SBL	24
Standard Chartered Bank Limited	SCB	25
Sunrise Bank Limited	SRBL	26

2.2   General Method of Moments (GMM)

Of the choice available among a first difference or a forward orthogonal method in the "panelvar" package, we chose a first difference method as this sets up an estimator which inherently accounts for the cumulative data structures of Balance Sheet and Total Income in the monthly statistics and the estimator considering monthly fluctuations of the data set.

- The first difference would be as follows:

$$\Delta^* y_{i,t} = \sum_{l=1}^{p} A_l \Delta^* y_{i,t-l} + B\Delta^* \mathbf{x}_{i,t} + C\Delta^* s_{i,t} + \Delta\epsilon_{i,t}$$

$t \in \{p + 2, ..., T\}$ and the set of indexes t for which the transformation exists is $\mathbb{T}_\Delta$.

Stacking the above over time, we get the following:

$$\Delta^*\mathbf{Y}_i = \sum_{l=1}^{p} \Delta^*\mathbf{Y}_{i,l} A_l^\mathsf{T} + \Delta^*\mathbf{X}_i \mathbf{B}^\mathsf{T} + \Delta^*\mathbf{S}_i C^\mathsf{T} + \Delta^*\mathbf{E}_i$$

- First difference GMM moment conditions are as follows:

$$\mathbb{E}\left[\Delta^*\epsilon_{i,t} \mathbf{y}_{i,j}^\mathsf{T}\right] = 0 \qquad j \in \{1, \dots, T-2\} \text{ and } t \in \mathbb{T}_{\Delta^*}$$

$$\mathbb{E}\left[\Delta^*\epsilon_{i,t} \mathbf{x}_{i,j}^\mathsf{T}\right] = 0 \qquad j \in \{1, \dots, T-1\} \text{ and } t \in \mathbb{T}_{\Delta^*}$$

$$\mathbb{E}\left[\Delta^*\epsilon_{i,t} \Delta^*\mathbf{s}_{i,t}^\mathsf{T}\right] = 0 \qquad t \in \mathbb{T}_{\Delta^*}$$

$$\Delta^*\epsilon_{i,t} \text{ is } m \times 1; \ \mathbf{y}_{i,j} \text{ is } k \times 1 \text{ and } \Delta^*\mathbf{s}_{i,t}^\mathsf{T} \text{ is } n \times 1$$

- First difference GMM moment function as follows:

$$\hat{\mathbf{g}}(\mathbf{\Phi}) = \frac{1}{N} \sum_{i=1}^{N} \hat{\mathbf{g}}_i(\mathbf{\Phi})$$

$$\hat{\mathbf{g}}_i(\mathbf{\Phi}) = (\mathbf{Q}_i \otimes \mathbf{I}_{m \times m})(vec(\Delta^*\mathbf{E}_i))$$

- GMM estimator with first difference moment conditions:

$$\Pi(\mathbf{\Phi}) = \left(\sum_{i=1}^{N} \mathbf{Z}_i^\mathsf{T} vec\left(\Delta^*\mathbf{Y}_i - [\Delta^*\mathbf{Y}_{i,-1} \ \Delta^*\mathbf{X}_i \ \Delta^*\mathbf{S}_i]\mathbf{\Phi}\right)\right)^\mathsf{T} \Lambda_Z^{-1} \left(\sum_{i=1}^{N} \mathbf{Z}_i^\mathsf{T} vec\left(\Delta^*\mathbf{Y}_i - [\Delta^*\mathbf{Y}_{i,-1} \ \Delta^*\mathbf{X}_i \ \Delta^*\mathbf{S}_i]\mathbf{\Phi}\right)\right)$$

$\mathbf{\Phi}$ is defined as $[\mathbf{A} \ \ \mathbf{B} \ \ \mathbf{C}]$, being a $m \times (p + k + n)$ matrix . $\mathbf{\Lambda_Z}$ is the GMM weighting matrix.

- System GMM moment conditions:

$$\mathbb{E}\left[(\epsilon_{i,t} + \mu_i)(\mathbf{y}_{i,t-1} - \mathbf{y}_{i,t-2})^\mathsf{T}\right] = 0 \qquad t \in \{3, 4, \dots, T\}$$

$$\mathbb{E}\left[(\epsilon_{i,t} + \mu_i)(\mathbf{x}_{i,t} - \mathbf{x}_{i,t-1})^\mathsf{T}\right] = 0 \qquad t \in \{3, 4, \dots, T\}$$

$$\mathbb{E}\left[(\epsilon_{i,t} + \mu_i)\mathbf{s}_{i,t}^\mathsf{T}\right] = 0 \qquad t \in \{3, 4, \dots, T\}$$

- System GMM estimator:

$$vec\left(\widetilde{\mathbf{\Phi}}_{initial \ estimator \ extended}\right) = \left(\mathbf{S}_{Z*X}^\mathsf{T} \Lambda_Z^{-1} \mathbf{S}_{Z*X}\right)^{-1} \mathbf{S}_{Z*X}^\mathsf{T} \Lambda^{-1} vec(\mathbf{S}_{Z*y})$$

Detailed mathematical expansions, proof and derivations can be found in the paper which we base our work on (Sigmund & Ferstl, 2021).

2.3 Data

We use a monthly timeseries panel for commercial banks using the monthly statistics released from Nepal Rastra Bank. As we wanted to explore the relationship between income and balance sheet also, we converted the publicly available .pdf publications in the Central Bank website both for Profit and Balance Sheet statements to a .csv format so that we could create a univariate series across 26 commercial banks since 2016 which would be a subset of the population of banks which were available then to account for mergers and acquisitions. These univariate series were later combined to form the multivariate panel used for the purposes of the PVAR model.

For Share Prices, Market Capitalisation, NEPSE and the Banking Indices, Nepal Stock Exchange monthly reports were used. The monthly reports for June 2020 or Jestha 2077 was not available on the website for which an average of Share Prices and Market Capitalisation

was used due to the extended series already obtained. We did not go into complex data imputation methods such as Kalman Filter, as this was only one month to be smoothened.

The ample number of observations upon using a monthly time series and a panel allowed us to break the series into two further groups – pre COVID and post COVID.[1]

Table 6: Division of data for our analysis

Data	Points	Observation per Bank	Date	Number of Banks	Variables and total data points	Remarks
Pre COVID	832	32	May 2016 to December 2018	26	8 Variables and 7488 data points	N.A
Post COVID	806	31	January 2019 to July 2021	26	8 Variables and 7254 data points	Extended until January 2019 to get at least 30 points per Bank

Table 7: Variables used

Column in Panel/Variable	Source	Remarks
Date	N.A	As per Pre or Post COVID datasets, these dates are used as ID's in addition to the Bank Variable. On the row for each date, we have the variables used below. Date values are not unique as they repeat after each Bank to create a Panel.
Share Price	Nepal Stock Exchange Monthly Reports	Each data point is unique for the id's date and bank, we have taken closing price for the month. Share prices are endogenous variables as defined in the system.
Bank	N.A	26 banks are used as ID's as per the table above. The banks that have been considered are currently existent banks (after mergers in previous years) which are traded in the Stock Exchange.
Loan and Advances	Monthly Banking and Financial Statistics, Nepal Rastra Bank	Each data point is unique for the ID's in the system date and bank, we have taken Loan and Advances for the month. Share prices are endogenous variables as defined in the system.
Total Income		
Capital Fund		
Market Cap	Nepal Stock Exchange Monthly Reports	These variables are taken from the Nepal Stock Exchange as exogenous to control for any market or industry related movement and the movement in market cap which is already captured in the model through stock prices and capital fund.
NEPSE Index	Nepal Stock Exchange Monthly Reports	
Banking Index	Nepal Stock Exchange Monthly Reports	
Interbank	Nepal Rastra Bank, Macroeconomic and Financial Situation Tables	Interbank is taken to control for liquidity related scenarios in the market.

---

[1] Post COVID would mean post the first wave – used as a short nomenclature for our understanding and does not imply the end of the Pandemic

2.4   On using One Step GMM

Literature on this topic suggest that one would want to go for a twostep GMM only if "if the benefit of doing so clearly outweighs the cost", moreover "as long as there is nonparametric estimation uncertainty in a two-step procedure relative to the one-step procedure, one has to be very cautious about using the two-step procedure". More technically with reference to the long run canonical correlation coefficients, existing literature suggests deploying a two-step estimator only when coefficients are large enough. This coefficient is unique and provides a necessary and sufficient condition for going the extra step. This however is not so straight forward as estimating the long run canonical correlation coefficient with good precision is very challenging which is exactly the reason why a two-step estimator might not outperform. (Hwang & Sun, 2018)

Authors suggest that in an event where there may not be prior information of the long run canonical correlation, a two-step estimator and test would be advisable to use only when the estimated long run canonical correlation coefficient is larger than a theoretical threshold by a margin. On the other hand, when the estimated long run canonical correlation coefficient is smaller than our theoretical threshold, it would be better to use the first step. When the estimated long run canonical correlation coefficient is within the theoretical threshold, authors propose a GMM estimator and test based on a working weighting matrix using VAR(1) as the approximating parametric model (Hwang & Sun, 2018).

2.5   On using the Hahn Kuehrsteiner Estimator for PVAR Model

Following previous suggestion (Hwang & Sun, 2018) to use a GMM estimator and test based on a VAR (1) process if the estimated canonical correlation coefficient is within the theoretical threshold, we also go ahead to deploy a Hahn Kuehrsteiner (H.K) Estimation for a PVAR Model which uses a univariate dynamic panel AR(1) model with fixed effects when both n and T are large (Hahn & Kuersteiner, 2002).

III.   EMPIRICAL ANALYSIS AND FINDINGS

3.1   Canonical Coefficients

Coding the canonical correlation matrix using the "CCA" package in R using share prices as the Y matrix on the matrix of other variables as X through all banks and dates to get an indicative threshold of the coefficient values. We obtain the following coefficients:

Post – COVID

	Loan and Advances	Total Income	Market Cap	NEPSE	Banking Index	Capital Fund	Interbank
Loan and Advances	1.00	0.57	0.24	0.38	0.37	0.61	-0.16
Total Income	0.57	1.00	0.32	0.31	0.31	0.30	0.36
Market Cap	0.24	0.32	1.00	0.08	0.09	0.20	0.26
NEPSE	0.38	0.31	0.08	1.00	0.99	0.23	-0.22
Banking Index	0.37	0.31	0.09	0.99	1.00	0.23	-0.23
Capital Fund	0.61	0.30	0.20	0.23	0.23	1.00	-0.19
Interbank	-0.16	0.36	0.26	-0.22	-0.23	-0.19	1.00

Pre – COVID

	Loan and Advances	**Total Income**	**Market Cap**	**NEPSE**	**Banking Index**	**Capital Fund**	**Interbank**
Loan and Advances	1.00	0.49	0.34	-0.38	-0.40	0.74	0.09
Total Income	0.49	1.00	0.14	-0.31	-0.34	0.34	0.29
Market Cap	0.34	0.14	1.00	0.17	0.17	0.31	-0.05
NEPSE	-0.38	-0.31	0.17	1.00	0.97	-0.41	-0.27
Banking Index	-0.40	-0.34	0.17	0.97	1.00	-0.46	-0.25
Capital Fund	0.74	0.34	0.31	-0.41	-0.46	1.00	0.04
Interbank	0.09	0.29	-0.05	-0.27	-0.25	0.04	1.00

Deriving the Canonical Correlation Matrix from the available data, we observe that most coefficients have a very low value. Assuming a theoretical threshold of say 65% and a margin of 20%, the only variables that would have a high coefficient would be NEPSE and the Banking Index which are anyway controls which are exogenous in our model. This supports our methodology of only sticking with the One Step GMM however, just to be sure, we use the Hahn Kuehrsteiner Estimator elaborated in the next subsection as an initial pointer.

As our canonical coefficients are below the threshold we consider, we go ahead with a one-step GMM.

3.2 Hahn Kuehrsteiner (H.K) Estimator for PVAR Model

Deploying this estimator also would provide an initial direction to the GMM method we later use and also give us insights to a model with one lag on how share prices are impacted in a shorter horizon. We wrote a code using the "parhk" function in the "panelvar" package in R to obtain the following results:

3.2.1 Post – COVID

```
-----------------------------------------------------
Hahn Kuehrsteiner Panel VAR estimation
-----------------------------------------------------
Transformation: demean
Group variable: Bank
Time variable: Date
Number of observations = 806
Number of groups = 26
Obs per group: min = 31
         avg = 31
         max = 31
```

	demeaned_ Share.Price	**demeaned_ Loan.and.Advances**	**demeaned_ Total.Income**	**demeaned_ Capital.Fund**
demeaned_lag1_Share.Price	-0.6240 ***	-97.6692 ***	-5.2293 ***	-11.4069 ***
	(0.0375)	(0.0003)	(0.0007)	(0.0021)
demeaned_lag1_Loan.and.Adv	-0.0003	-0.3219 ***	-0.0408	-0.0064
	(8.5102)	(0.0618)	(0.1643)	(0.4665)
demeaned_lag1_Total.Income	0.0087	1.5830 ***	0.9015 ***	-0.0171
	(1.4533)	(0.0106)	(0.0281)	(0.0797)
demeaned_lag1_Capital.Fund	0.0128	0.5009 ***	-0.1721 ***	-0.1297 *
	(1.0638)	(0.0077)	(0.0205)	(0.0583)

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

3.2.2 Pre – COVID

```
-----------------------------------------------------
Hahn Kuehrsteiner Panel VAR estimation
-----------------------------------------------------
```

Transformation: demean
Group variable: Bank
Time variable: Date
Number of observations = 832
Number of groups = 26
Obs per group: min = 32
        avg = 32
        max = 32

	demeaned_ Share.Price	demeaned_ Loan.and.Advances	demeaned_ Total.Income	demeaned_ Capital.Fund
demeaned_lag1_Share.Price	-0.3210 ***	-3.7791 ***	-0.4555 ***	0.1115 ***
	(0.0408)	(0.0019)	(0.0051)	(0.0086)
demeaned_lag1_Loan.and.Adv	0.0036	-0.3963 ***	-0.0872	-0.0176
	(1.3034)	(0.0598)	(0.1638)	(0.2747)
demeaned_lag1_Total.Income	0.0135	-1.1817 ***	0.6499 ***	-0.4574 ***
	(0.2524)	(0.0116)	(0.0317)	(0.0532)
demeaned_lag1_Capital.Fund	-0.0016	0.2996 ***	-0.1774 ***	-0.1365 *
	(0.2730)	(0.0125)	(0.0343)	(0.0576)

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

3.3   Model Lag Selection

Using the "vars" package to estimate the AIC, HQ, SC and FPE criterions extracting each Bank of the multivariate series using a loop, we get an optimal lag length of 4 months for both pre and post COVID datasets.

3.4   One Step GMM results

3.4.1 Post COVID

Four Lags as per AIC and BIC criterion

```
-----------------------------------------------------
Dynamic Panel VAR estimation, one-step GMM
-----------------------------------------------------
```

Transformation: First differences
Group variable: Bank
Time variable: Date
Number of observations = 676
Number of groups = 26
Obs per group: min = 26
        avg = 26
        max = 26
Number of instruments = 7312

	Share.Price	Loan.and.Advances	Total.Income	Capital.Fund
lag1_Share.Price	-0.2329 ***	-29.4816 ***	4.8024 ***	-4.7797 **
	(0.0413)	(6.8775)	(1.2373)	(1.6772)
lag1_Loan.and.Advances	-0.0011 ***	-0.3826 **	-0.0627 ***	-0.0196
	(0.0003)	(0.1267)	(0.0173)	(0.0205)
lag1_Total.Income	0.0019 **	0.2090	0.9191 ***	-0.1258 **
	(0.0007)	(0.1972)	(0.0491)	(0.0443)
lag1_Capital.Fund	0.0077 ***	0.2798	-0.0060	-0.0890
	(0.0021)	(0.6727)	(0.1084)	(0.1401)
lag2_Share.Price	0.1715 ***	-0.1641	1.0624	0.0923
	(0.0309)	(6.0723)	(1.1132)	(0.4473)
lag2_Loan.and.Advances	0.0001	0.1813 ***	0.0226 ***	-0.0018
	(0.0003)	(0.0352)	(0.0053)	(0.0047)
lag2_Total.Income	0.0056 *	1.6943 ***	-0.0945 *	0.1954 ***
	(0.0024)	(0.301)	(0.038)	(0.0511)
lag2_Capital.Fund	-0.0029	-0.0011	-0.0721	0.2339 ***
	(0.0021)	(0.3513)	(0.0438)	(0.0484)
lag3_Share.Price	0.7209 ***	2.486	-0.7009	1.2606
	(0.0419)	(6.0920)	(0.9656)	(1.0294)
lag3_Loan.and.Advances	0.0003	0.8245 ***	0.0441 ***	-0.0064
	(0.0004)	(0.0528)	(0.0103)	(0.0068)
lag3_Total.Income	-0.0021	-1.4211 ***	0.0469	0.0032
	(0.0024)	(0.2687)	(0.0354)	(0.0323)
lag3_Capital.Fund	-0.0037	-0.3958	0.0716	0.6762 ***
	(0.0020)	(0.2824)	(0.0714)	(0.0426)
lag4_Share.Price	0.3253 ***	27.9201 ***	-4.9597 *	3.5184 **
	(0.0327)	(7.3572)	(2.1761)	(1.1081)
lag4_Loan.and.Advances	0.0008 ***	0.3634 **	0.019	0.022
	(-0.0002)	(-0.1337)	(-0.0118)	(-0.0188)
lag4_Total.Income	-0.0068 ***	-0.6191 **	-0.2076 ***	0.0012
	(0.0007)	(0.2402)	(0.0349)	(0.0424)
lag4_Capital.Fund	-0.0011	0.0812	0.0194	0.1503
	(0.0014)	(0.8286)	(0.0861)	(0.1157)
NEPSE	0.1230 **	29.9246 ***	0.1904	3.4940 ***
	(0.0440)	(6.5584)	(0.9276)	(0.7364)
Interbank	-0.0034	-0.6978	0.0340	-0.0855
	(1.2557)	(419.6394)	(148.8647)	(78.0943)
Banking Index	-0.1470	-35.5345 **	-0.2064	-4.0643 ***
	(0.0825)	(11.9191)	(1.6575)	(1.2311)
const	-0.0006	-0.1080	0.0007	-0.0128
	(35.5874)	(6098.1808)	(1263.4088)	(527.7570)

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

```
---------------------------------------------------
Instruments for equation
  Standard
  FD.(NEPSE Interbank Banking.Index)
  GMM-type
  Dependent vars: L(2, 26)
  Collapse =  FALSE
---------------------------------------------------
```

Hansen test of overid. restrictions: chi2(7232) = 70013830795 Prob > chi2 = 0
(Robust but weakened by many instruments.)Warning message:
In hansen_j_test.pvargmm(object) :
Hansen J test for the first step makes no sense. But still is mathematically possible

Twelve Lags

```
---------------------------------------------------
Dynamic Panel VAR estimation, one-step GMM
---------------------------------------------------
```

Transformation: First differences
Group variable: Bank
Time variable: Date
Number of observations = 468
Number of groups = 26
Obs per group: min = 18
          avg = 18
          max = 18
Number of instruments = 6224

	Share.Price	Loan.and.Advances	Total.Income	Capital.Fund
lag1_Share.Price	0.0058	-0.7800	-0.5939	-0.0416
	(0.0998)	(10.8068)	(3.9758)	(2.1813)
lag1_Loan.and.Advances	-0.0019 **	-0.6554 ***	-0.0874 **	-0.0676 *
	(0.0007)	(0.1199)	(0.0287)	(0.0269)
lag1_Total.Income	0.0002	0.3635	0.8919 ***	-0.0553
	(0.0013)	(0.2302)	(0.0672)	(0.0546)
lag1_Capital.Fund	0.0082 **	0.1883	0.1579	0.0048
	(0.0029)	(0.5853)	(0.1970)	(0.1305)
lag2_Share.Price	0.0183	-0.3615	1.4539	-0.2324
	(0.1286)	(7.6712)	(4.4109)	(1.7993)
lag2_Loan.and.Advances	-0.0015	-0.1304	-0.0959	0.0016
	(0.0010)	(0.1171)	(0.0510)	(0.0143)
lag2_Total.Income	0.0121 ***	2.5032 ***	-0.1770	0.2349 ***
	(0.0034)	(0.3641)	(0.0929)	(0.0508)
lag2_Capital.Fund	-0.0017	-0.2622	-0.3051	-0.0179
	(0.0061)	(0.8009)	(0.2225)	(0.1488)
lag3_Share.Price	0.2458	-0.5061	-1.0062	0.2422
	(0.1313)	(9.6522)	(3.2973)	(1.6311)
lag3_Loan.and.Advances	-0.0005	0.8509 ***	0.0107	-0.0212
	(0.0010)	(0.0830)	(0.0239)	(0.0151)
lag3_Total.Income	-0.0068	-1.8888 ***	0.0170	-0.0200
	(0.0039)	(0.2902)	(0.0947)	(0.0591)
lag3_Capital.Fund	0.0012	0.5964	0.0084	0.8689 ***
	(0.0048)	(0.5108)	(0.1495)	(0.1027)

	Share.Price	Loan.and.Advances	Total.Income	Capital.Fund
lag4_Share.Price	-0.0177	0.7195	-0.3740	0.0330
	(0.0534)	(9.2246)	(5.4452)	(1.6787)
lag4_Loan.and.Advances	0.0005	0.5251 ***	0.1201 **	0.0556
	(0.0009)	(0.1569)	(0.0446)	(0.0285)
lag4_Total.Income	0.0014	-0.0812	-0.4679 *	-0.0492
	(0.0045)	(0.4492)	(0.1860)	(0.0831)
lag4_Capital.Fund	-0.0005	-1.0574	-0.3718	-0.2252
	(0.0031)	(0.8867)	(0.3085)	(0.1185)
lag5_Share.Price	0.0243	-0.4095	1.4176	-0.2291
	(0.1039)	(7.8916)	(2.6740)	(2.4383)
lag5_Loan.and.Advances	0.0005	-0.1354	0.1699 **	-0.0495 ***
	(0.0011)	(0.1448)	(0.0652)	(0.0138)
lag5_Total.Income	-0.0077	-0.9847	-0.1463	-0.0663
	(0.0041)	(0.5954)	(0.2140)	(0.0983)
lag5_Capital.Fund	0.0007	0.4617	0.0617	0.0810
	(0.0042)	(0.7476)	(0.2485)	(0.1171)
lag6_Share.Price	0.2370 ***	-0.9546	-1.0000	0.1914
	(0.0688)	(6.8722)	(4.1550)	(1.9365)
lag6_Loan.and.Advances	0.0005	0.0606	0.0325	-0.0059
	(0.0006)	(0.0884)	(0.0336)	(0.0131)
lag6_Total.Income	0.0068	1.4065 **	0.6330 ***	0.0688
	(0.0042)	(0.4767)	(0.1681)	(0.0994)
lag6_Capital.Fund	-0.0001	-0.4267	0.1991	0.1088
	(0.0039)	(0.4640)	(0.1710)	(0.0738)
lag7_Share.Price	-0.0033	2.2637	-0.0997	0.1437
	(0.0548)	(5.4871)	(4.6126)	(2.3526)
lag7_Loan.and.Advances	0.0001	0.0030	0.0127	-0.0229 *
	(0.0004)	(0.0882)	(0.0335)	(0.0111)
lag7_Total.Income	-0.0023	-0.2330	-0.0682	0.0703
	(0.0043)	(0.4832)	(0.2331)	(0.1339)
lag7_Capital.Fund	0.0020	0.8382	0.2683	0.3146 ***
	(0.0024)	(0.5353)	(0.1682)	(0.0738)
lag8_Share.Price	0.0297	-1.6287	1.0516	-0.2817
	(0.0604)	(10.5185)	(4.8253)	(1.9794)
lag8_Loan.and.Advances	-0.0005	0.1485 **	0.0396 **	0.0070
	(0.0006)	(0.0460)	(0.0142)	(0.0104)
lag8_Total.Income	0.0082	-0.5129	-0.0743	0.0673
	(0.0045)	(0.4169)	(0.2087)	(0.0774)
lag8_Capital.Fund	-0.0015	0.1139	-0.1473	0.1140
	(0.0028)	(0.2976)	(0.1535)	(0.0793)
lag9_Share.Price	0.2092 *	-0.2285	-0.7180	0.2008
	(0.0844)	(10.7158)	(4.4045)	(1.6911)
lag9_Loan.and.Advances	0.0004	-0.0181	0.0452	0.0139
	(0.0007)	(0.0597)	(0.0258)	(0.0138)
lag9_Total.Income	-0.0049	0.0243	-0.2641	0.0357
	(0.0036)	(0.4479)	(0.1724)	(0.1445)
lag9_Capital.Fund	-0.0067	0.1023	-0.4298 *	-0.0694
	(0.0050)	(0.2562)	(0.1877)	(0.0668)
lag10_Share.Price	0.0170	2.6991	-0.0585	0.1873
	(0.0830)	(8.0491)	(4.4767)	(3.0330)
lag10_Loan.and.Advances	0.0013 *	0.0967 **	-0.0815 *	0.0269 ***
	(0.0005)	(0.0369)	(0.0326)	(0.0072)
lag10_Total.Income	-0.0054	-0.0472	-0.0839	0.0338
	(0.0045)	(0.3700)	(0.1791)	(0.0840)
lag10_Capital.Fund	-0.0061	0.1531	0.0130	-0.0281
	(0.0039)	(0.1988)	(0.2426)	(0.0629)

	Share.Price	Loan.and.Advances	Total.Income	Capital.Fund
lag11_Share.Price	0.0368	-1.8257	0.9131	-0.2732
	(0.0578)	(8.2146)	(2.6040)	(1.0898)
lag11_Loan.and.Advances	0.0009	0.2357 ***	-0.1001 ***	0.0376 *
	(0.0007)	(0.0529)	(0.0247)	(0.0176)
lag11_Total.Income	-0.0076 **	0.0072	0.1850	-0.0501
	(0.0025)	(0.5069)	(0.1490)	(0.0982)
lag11_Capital.Fund	0.0022	-0.6319 *	0.4019 *	-0.0651
	(0.0049)	(0.2487)	(0.1679)	(0.0875)
lag12_Share.Price	0.1979	0.7732	-0.6526	0.2553
	(0.1208)	(5.3383)	(3.0709)	(2.2093)
lag12_Loan.and.Advances	0.0001	0.0052	-0.0090	0.0139
	(0.0003)	(0.0358)	(0.0219)	(0.0106)
lag12_Total.Income	0.0057	-0.7760 *	-0.2864 *	-0.1272 *
	(0.0034)	(0.3145)	(0.1413)	(0.0624)
lag12_Capital.Fund	0.0015	0.0181	0.1984	-0.1054 *
	(0.0025)	(0.2867)	(0.1705)	(0.0535)
NEPSE	0.0373	8.1601	0.8036	0.6424
	0.0646)	(4.3973)	(2.1114)	(1.5684)
Interbank	-0.0003	-0.1149	-0.0088	-0.0086
	(1.9459)	(165.0343)	(218.9395)	(39.5726)
Banking.Index	-0.0361	-9.6622	-0.8733	-0.6982
	(0.1087)	(8.4283)	(4.0913)	(2.8275)
const	-0.0001	-0.0284	-0.0026	-0.0021
	(38.2064)	(4377.8321)	(2367.5393)	(1128.9345)

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Instruments for equation
  Standard
  FD.(NEPSE Interbank Banking.Index)
  GMM-type
  Dependent vars: L(2, 18)
  Collapse = FALSE

Hansen test of overid. restrictions: chi2(6016) = 19102992627 Prob > chi2 = 0
(Robust but weakened by many instruments.)

3.4.2 Pre COVID

Four Lags as per AIC and BIC criterion

Dynamic Panel VAR estimation, one-step GMM

Transformation: First differences
Group variable: Bank
Time variable: Date
Number of observations = 702
Number of groups = 26
Obs per group: min = 27
      avg = 27
      max = 27
Number of instruments = 7808

	Share.Price	Loan.and.Advances	Total.Income	Capital.Fund
lag1_Share.Price	-0.3720 ***	-0.8330	0.2433	0.7496 *
	(0.0475)	(0.9681)	(0.2031)	(0.3010)
lag1_Loan.and.Advances	-0.0024	-0.1582 *	-0.0660 ***	0.0191 *
	(0.0017)	(0.0635)	(0.0123)	(0.0092)
lag1_Total.Income	0.0114 ***	-0.5423 ***	0.6188 ***	-0.2777 ***
	(0.0034)	(0.0829)	(0.0238)	(0.0216)
lag1_Capital.Fund	-0.0090 *	0.8767 **	-0.0279	0.0858
	(0.0041)	(0.3378)	(0.0679)	(0.0461)
lag2_Share.Price	0.0582 ***	1.0451	0.0721	0.1956 *
	(0.0085)	(0.5582)	(0.0929)	(0.0980)
lag2_Loan.and.Advances	0.0014 *	0.0414 *	-0.0093	-0.0217 ***
	(0.0006)	(0.0185)	(0.0063)	(0.0058)
lag2_Total.Income	-0.0047	0.3083 ***	0.1045 **	0.1225 ***
	(0.0049)	(0.0918)	(0.0318)	(0.0271)
lag2_Capital.Fund	-0.0035	-0.1125	0.0252	0.1088 **
	(0.0056)	(0.1237)	(0.0341)	(0.0346)
lag3_Share.Price	0.8825 ***	0.4649	-0.1095	-0.0332
	(0.0116)	(0.6218)	(0.0850)	(0.1253)
lag3_Loan.and.Advances	0.0010 *	0.8832 ***	0.0588 ***	-0.0068
	(0.0004)	(0.0355)	(0.0081)	(0.0074)
lag3_Total.Income	0.0033	-0.8421 ***	0.0391	0.0132
	(0.0054)	(0.1871)	(0.0397)	(0.0431)
lag3_Capital.Fund	0.0150 *	-0.9539 ***	-0.0398	0.6167 ***
	(0.0068)	(0.2504)	(0.0364)	(0.0381)
lag4_Share.Price	0.3948 ***	-0.1070	-0.2587	-0.8355 ***
	(0.0557)	(0.7648)	(0.1523)	(0.2240)
lag4_Loan.and.Advances	-0.0014	0.2833 ***	0.0368 ***	0.0161
	(0.0013)	(0.0416)	(0.0095)	(0.0113)
lag4_Total.Income	0.0123 *	0.4948 *	-0.0640 *	0.1237 **
	(0.0049)	(0.2049)	(0.0272)	(0.0432)
lag4_Capital.Fund	-0.0063	0.2317	0.0778	0.1754 ***
	(0.0035)	(0.2047)	(0.0460)	(0.0444)
NEPSE	-1.8504 ***	122.8924 ***	11.8543 ***	26.8981 ***
	(0.2848)	(11.2010)	(1.4471)	(2.2814)
Interbank	-0.0286	1.9032	0.1849	0.4153
	(3.4746)	(113.6687)	(123.4823)	(46.8143)
Banking.Index	2.0999 ***	-137.6007 ***	-13.4822 ***	-30.0595 ***
	(0.3271)	(11.6722)	(1.5194)	(1.8698)
const	-0.0043	0.2840	0.0276	0.0621
	(247.0288)	(7298.7408)	(345.3385)	(1682.5163)

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

```
---------------------------------------------------
Instruments for equation
  Standard
  FD.(NEPSE Interbank Banking.Index)
  GMM-type
  Dependent vars: L(2, 27)
  Collapse =  FALSE
---------------------------------------------------
```

Hansen test of overid. restrictions: chi2(7728) = 33861607885 Prob > chi2 = 0
(Robust but weakened by many instruments.)Warning message:
In hansen_j_test.pvargmm (object) :
Hansen J test for the first step makes no sense. But still is mathematically possible

Twelve Lags

```
---------------------------------------------------
Dynamic Panel VAR estimation, one-step GMM
---------------------------------------------------
```

Transformation: First differences
Group variable: Bank
Time variable: Date
Number of observations = 494
Number of groups = 26
Obs per group: min = 19
        avg = 19
        max = 19
Number of instruments = 6720

	Share.Price	Loan.and.Advances	Total.Income	Capital.Fund
lag1_Share.Price	-0.4542 ***	-1.5531	-0.3319	0.8023 *
	(0.0378)	(0.8757)	(0.2526)	(0.3345)
lag1_Loan.and.Advances	0.0008	-0.3390 ***	-0.0972 ***	-0.0099
	(0.0019)	(0.0549)	(0.0156)	(0.0204)
lag1_Total.Income	0.0119 **	-0.6666 **	0.4869 ***	-0.2617 ***
	(0.0038)	(0.2520)	(0.0342)	(0.0481)
lag1_Capital.Fund	0.0270 **	-0.6110 *	-0.1962 *	-0.2916 **
	(0.0094)	(0.2897)	(0.0820)	(0.0977)
lag2_Share.Price	0.1692 ***	-1.4666	-0.8000 *	0.2649
	(0.0377)	(0.8219)	(0.3707)	(0.1853)
lag2_Loan.and.Advances	0.0014	0.1548 **	0.0345 **	-0.0282 **
	(0.0014)	(0.0475)	(0.0122)	(0.0097)
lag2_Total.Income	0.0084	-0.4545 ***	-0.0560	-0.0415
	(0.0055)	(0.1374)	(0.0419)	(0.0391)
lag2_Capital.Fund	0.0026	-0.1697	-0.0432	0.2726 ***
	(0.0044)	(0.1604)	(0.0338)	(0.0490)
lag3_Share.Price	1.0581 ***	-3.3180 **	-1.5822 **	-0.5727
	(0.0583)	(1.0854)	(0.4964)	(0.2978)
lag3_Loan.and.Advances	0.0007	0.7411 ***	0.1153 ***	-0.0476 ***
	(0.0012)	(0.0569)	(0.0147)	(0.0133)
lag3_Total.Income	-0.0097	0.0005	-0.1274 *	0.3711 ***
	(0.0082)	(0.4575)	(0.0533)	(0.0844)
lag3_Capital.Fund	0.0159	-0.5362 ***	0.0326	0.6471 ***
	(0.0084)	(0.1538)	(0.0551)	(0.0609)
lag4_Share.Price	0.4897 ***	0.2520	-0.1462	-0.8897 **
	(0.1059)	(0.9956)	(0.3420)	(0.3241)
lag4_Loan.and.Advances	-0.0048	0.4622 ***	0.0098	0.0414 *
	(0.0025)	(0.0584)	(0.0123)	(0.0180)
lag4_Total.Income	0.0025	0.2363	0.1485	-0.0428
	(0.0074)	(0.3861)	(0.0820)	(0.0726)
lag4_Capital.Fund	-0.0034	0.5691 **	0.0283	0.3684 ***
	(0.0058)	(0.2050)	(0.0651)	(0.0776)
lag5_Share.Price	-0.2293 ***	3.9240 **	1.8562 **	-0.1432
	(0.0653)	(1.2338)	(0.6910)	(0.3640)
lag5_Loan.and.Advances	-0.0044 *	0.1391	-0.0395 *	0.0501 ***
	(0.0019)	(0.0757)	(0.0179)	(0.0148)
lag5_Total.Income	0.0181 *	-0.7883 **	-0.0296	-0.3112 ***
	(0.0070)	(0.2645)	(0.0799)	(0.0658)
lag5_Capital.Fund	-0.0267	0.8248 ***	0.0767	0.1648 **
	(0.0143)	(0.1903)	(0.0686)	(0.0582)

	Share.Price	Loan.and.Advances	Total.Income	Capital.Fund
lag6_Share.Price	-0.3300 ***	6.1202 ***	2.7433 **	0.7882
	(0.0604)	(1.5739)	(0.8852)	(0.4465)
lag6_Loan.and.Advances	0.0028	-0.1290	-0.0657 ***	0.0038
	(0.0015)	(0.0726)	(0.0132)	(0.0176)
lag6_Total.Income	-0.0219	0.2847	0.1329	-0.1228
	(0.0144)	(0.5236)	(0.0969)	(0.1169)
lag6_Capital.Fund	-0.0247 *	0.0089	-0.0326	0.0684
	(0.0106)	(0.2431)	(0.0570)	(0.0733)
lag7_Share.Price	-0.2469 **	4.8836 ***	1.6284 **	1.0343 **
	(0.0755)	(1.4116)	(0.5999)	(0.3901)
lag7_Loan.and.Advances	0.0085 ***	-0.3125 ***	-0.0393 *	-0.0307
	(0.0022)	(0.0606)	(0.0178)	(0.0177)
lag7_Total.Income	-0.0271 *	-0.2761	-0.4022 ***	0.0088
	(0.0110)	(0.3892)	(0.1073)	(0.1013)
lag7_Capital.Fund	-0.0121	-0.2864	-0.0672	-0.0733
	(0.0089)	(0.1981)	(0.0787)	(0.0954)
lag8_Share.Price	0.1250 **	-2.3910	-0.8214	-0.1952
	(0.0402)	(1.6939)	(0.4971)	(0.3064)
lag8_Loan.and.Advances	0.0018	-0.0149	0.0038	0.0179
	(0.0016)	(0.0862)	(0.0195)	(0.0161)
lag8_Total.Income	0.0421 **	-2.4645 ***	-0.2486	-0.2686
	(0.0162)	(0.5835)	(0.1541)	(0.1729)
lag8_Capital.Fund	0.0205	-0.4759	0.1253 *	-0.3214 ***
	(0.0114)	(0.2583)	(0.0540)	(0.0453)
lag9_Share.Price	0.2154 ***	-5.3547 ***	-1.9988 *	-0.9368 *
	(0.0639)	(1.5794)	(0.7801)	(0.3884)
lag9_Loan.and.Advances	0.0005	-0.2954 **	0.0121	-0.0211
	(0.0022)	(0.1097)	(0.0288)	(0.0124)
lag9_Total.Income	0.0247	2.8051 **	0.5714 ***	0.3984 **
	(0.0143)	(0.8930)	(0.0976)	(0.1325)
lag9_Capital.Fund	0.0039	0.6529 *	0.4047 ***	-0.1859 **
	(0.0076)	(0.2754)	(0.1202)	(0.0569)
lag10_Share.Price	0.1015	-3.3653 ***	-1.5209 ***	-0.7186 **
	(0.0890)	(0.8036)	(0.3662)	(0.2741)
lag10_Loan.and.Advances	-0.0047 ***	0.0856	0.0067	0.0041
	(0.0013)	(0.0552)	(0.0218)	(0.0130)
lag10_Total.Income	0.0096	1.4019 **	0.9251 ***	0.2702 **
	(0.0138)	(0.4613)	(0.1997)	(0.0968)
lag10_Capital.Fund	-0.0089 *	0.4026 *	0.1422	0.0284
	(0.0044)	(0.1579)	(0.0902)	(0.0390)
lag11_Share.Price	0.0086	-0.4440	-0.1306	-0.2099
	(0.0225)	(1.0464)	(0.3284)	(0.1530)
lag11_Loan.and.Advances	0.0035	-0.1408 *	0.0061	-0.0491 **
	(0.0020)	(0.0708)	(0.0168)	(0.0157)
lag11_Total.Income	-0.0933 ***	3.4152 ***	0.2356	0.7796 ***
	(0.0268)	(1.0024)	(0.1898)	(0.2012)
lag11_Capital.Fund	-0.0009	-0.1192	-0.0801	0.0217
	(0.0080)	(0.2271)	(0.0663)	(0.0313)
lag12_Share.Price	0.1577 **	2.4765 *	0.7224	0.6766 ***
	(0.0510)	(1.0857)	(0.3793)	(0.1780)
lag12_Loan.and.Advances	-0.0062 *	0.6465 ***	0.0970 ***	0.0629 **
	(0.0025)	(0.0894)	(0.0285)	(0.0223)
lag12_Total.Income	0.0282	-3.8004 ***	-1.6952 ***	-0.5378 **
	(0.0205)	(0.8336)	(0.2552)	(0.1674)
lag12_Capital.Fund	0.0077	0.0409	-0.1435	0.2780 ***
	(0.0076)	(0.2971)	(0.0943)	(0.0458)
NEPSE	-0.0070	-0.3220	-0.2136	0.0101
	(0.5675)	(35.0764)	(5.2199)	(6.0338)
Interbank	-0.0008	0.0125	0.0041	0.0024
	(12.7853)	(366.6403)	(227.1231)	(89.8257)
Banking.Index	0.0244	-0.9117	-0.4068	-0.0891
	(0.5748)	(34.9803)	(4.1602)	(6.3271)
const	-0.0001	0.0012	0.0004	0.0003
	(212.5247)	(8812.9719)	(2968.9937)	(1782.6219)

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Instruments for equation
  Standard
  FD.(NEPSE Interbank Banking.Index)
  GMM-type
  Dependent vars: L(2, 19)
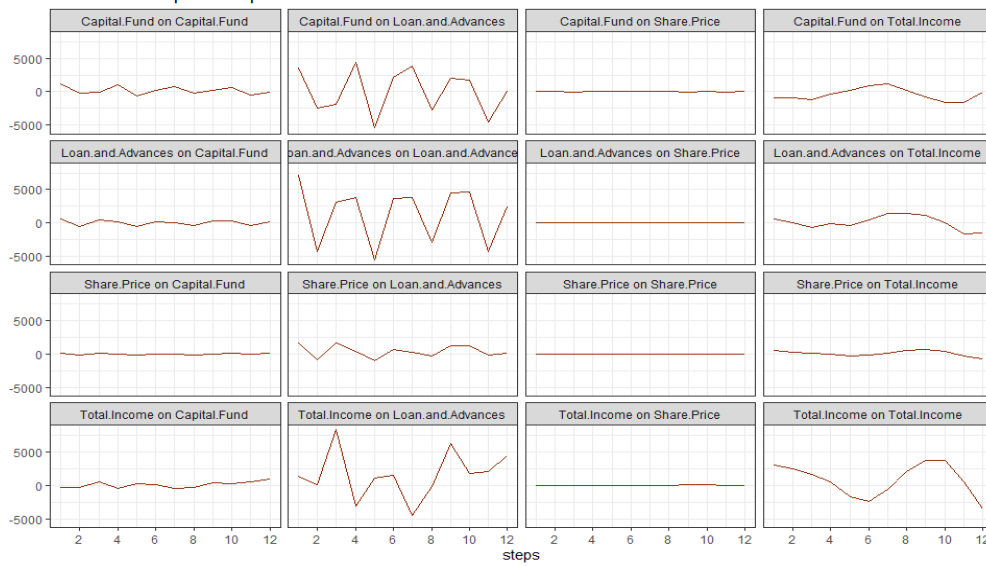 Collapse = FALSE

Hansen test of overid. restrictions: chi2(6512) = 13622947348 Prob > chi2 = 0
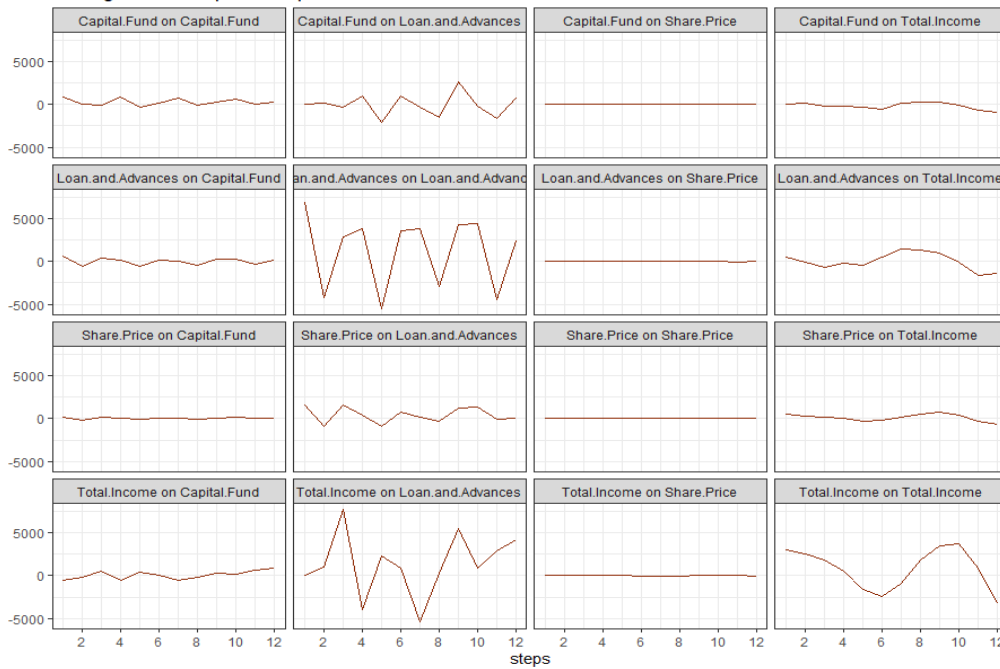(Robust but weakened by many instruments.)

3.5   Impulse Response Analysis

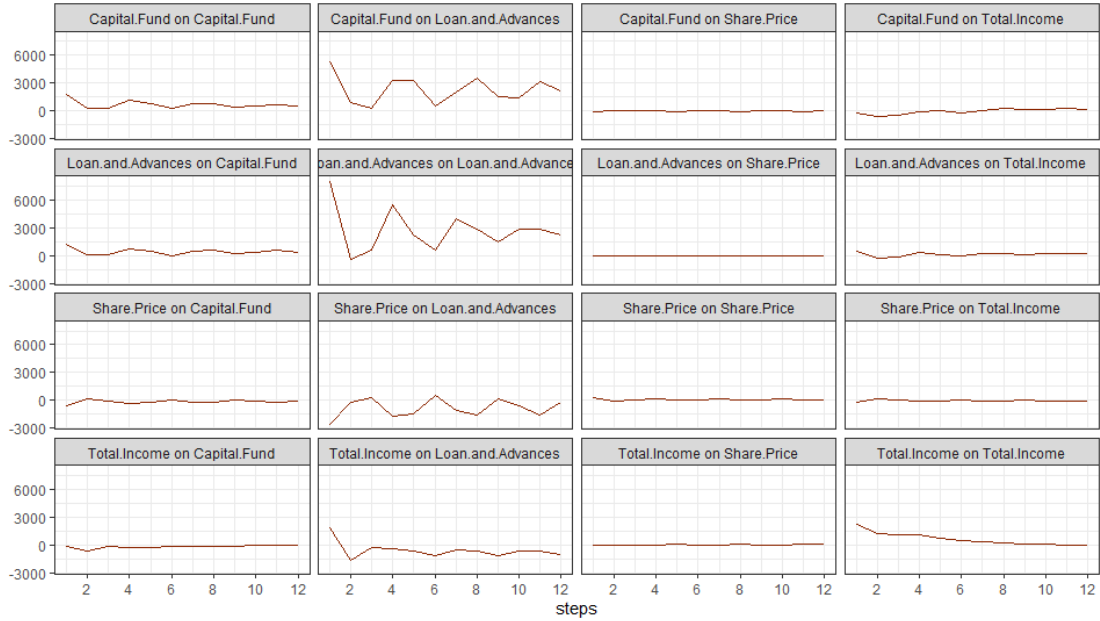### 3.5.1 Post COVID

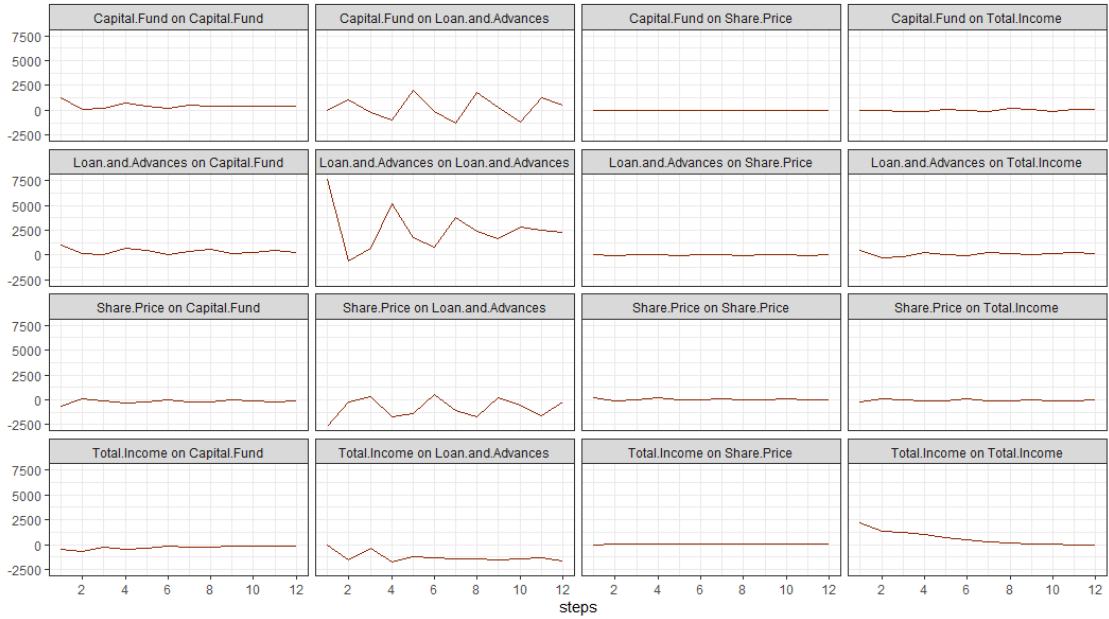Generalized impulse response function

Orthogonalized impulse response function

3.5.2 Pre COVID

Generalized impulse response function

Orthogonalized impulse response function

3.6 Forecast Error Variance Decomposition (FEVD)

3.6.1 Post COVID

$Share.Price

	Share.Price	Loan.and.Advances	Total.Income	Capital.Fund
[1,]	1.0000000	0.00000000	0.000000000	0.00000000
[2,]	0.9569486	0.01993292	0.004199502	0.01891898
[3,]	0.6946658	0.01506809	0.275916335	0.01434979
[4,]	0.7032037	0.01565705	0.265390785	0.01574841
[5,]	0.6688990	0.06047855	0.252344896	0.01827753
[6,]	0.6400234	0.05795308	0.283799744	0.01822376
[7,]	0.6023418	0.05316555	0.328317994	0.01617470
[8,]	0.5650626	0.05015353	0.358356263	0.02642757
[9,]	0.4307975	0.03894414	0.509505250	0.02075315
[10,]	0.4000519	0.03771781	0.545679925	0.01655041
[11,]	0.3821589	0.07381991	0.527666658	0.01635451
[12,]	0.3697371	0.09022039	0.520019979	0.02002249

$Loan.and.Advances

	Share.Price	Loan.and.Advances	Total.Income	Capital.Fund
[1,]	0.05215736	0.9478426	0.00000000	0.0000000000
[2,]	0.04898467	0.9370247	0.01356397	0.0004267127
[3,]	0.04330594	0.5226999	0.43311734	0.0008768212
[4,]	0.03633279	0.5114770	0.44545053	0.0067397204
[5,]	0.03335230	0.5575115	0.38415322	0.0249830051
[6,]	0.03341803	0.5772006	0.36216429	0.0272170769
[7,]	0.02825210	0.5391095	0.40929921	0.0233391841
[8,]	0.02750980	0.5481742	0.39387446	0.0304415892
[9,]	0.02711648	0.5115695	0.41543536	0.0458786767
[10,]	0.03028987	0.5338806	0.39252769	0.0433017879
[11,]	0.02798599	0.5418502	0.38358352	0.0465803398
[12,]	0.02642401	0.5248740	0.40322320	0.0454787863

$Total.Income

	Share.Price	Loan.and.Advances	Total.Income	Capital.Fund
[1,]	0.02666357	0.02707803	0.9462584	0.000000000
[2,]	0.02083137	0.01601376	0.9618196	0.001335270
[3,]	0.01742729	0.03765281	0.9423624	0.002557519
[4,]	0.01716182	0.03831854	0.9408037	0.003715935
[5,]	0.02015747	0.04003743	0.9305471	0.009258047
[6,]	0.01639533	0.04071929	0.9261966	0.016688747
[7,]	0.01598756	0.09818759	0.8703024	0.015522416
[8,]	0.02080602	0.13431525	0.8287413	0.016137385
[9,]	0.02582607	0.11534187	0.8459107	0.012921396
[10,]	0.02318092	0.09064395	0.8757840	0.010391102
[11,]	0.02345868	0.12206464	0.8388399	0.015636811
[12,]	0.02530816	0.12302698	0.8287590	0.022905828

$Capital.Fund

	Share.Price	Loan.and.Advances	Total.Income	Capital.Fund
[1,]	0.01361915	0.2426566	0.1726633	0.5710609
[2,]	0.02224737	0.3399164	0.1599517	0.4778846
[3,]	0.02782361	0.3479981	0.2394217	0.3847566
[4,]	0.01945690	0.2477406	0.2442907	0.4885118
[5,]	0.01815399	0.2850335	0.2530826	0.4437299
[6,]	0.01801448	0.2915657	0.2485153	0.4419045
[7,]	0.01530369	0.2453173	0.2656870	0.4736920
[8,]	0.01693888	0.2660802	0.2636803	0.4533006
[9,]	0.01676689	0.2664677	0.2697022	0.4470632
[10,]	0.02152697	0.2569636	0.2468177	0.4746917
[11,]	0.01978189	0.2562162	0.2899600	0.4340419
[12,]	0.01824598	0.2286205	0.3649038	0.3882298

3.6.2 Pre COVID

$Share.Price

	Share.Price	Loan.and.Advance	Total.Income	Capital.Fund
[1,]	1.0000000	0.000000000	0.00000000	0.000000000
[2,]	0.9749089	0.008341511	0.01450283	0.002246789
[3,]	0.9730496	0.009883127	0.01460332	0.002463932
[4,]	0.9735684	0.009570527	0.01098273	0.005878306
[5,]	0.9035514	0.034542656	0.04755001	0.014355956
[6,]	0.8953433	0.035918556	0.05414915	0.014588965
[7,]	0.9021427	0.032851224	0.04834139	0.016664715
[8,]	0.8442477	0.051578384	0.08250022	0.021673710
[9,]	0.8346356	0.050594289	0.09182315	0.022946966
[10,]	0.8390913	0.048958343	0.08752765	0.024422689
[11,]	0.8008010	0.060350305	0.11237545	0.026473218
[12,]	0.7912440	0.059097316	0.12145273	0.028205906

$Loan.and.Advances

	Share.Price	Loan.and.Advances	Total.Income	Capital.Fund
[1,]	0.10667333	0.8933267	0.00000000	0.00000000
[2,]	0.10073957	0.8446628	0.03677015	0.01782752
[3,]	0.10083405	0.8427796	0.03819475	0.01819162
[4,]	0.09503155	0.8289082	0.05461075	0.02144951
[5,]	0.10388435	0.7775321	0.06344628	0.05513726
[6,]	0.10440227	0.7652716	0.07628560	0.05404057
[7,]	0.09853603	0.7620196	0.08144482	0.05799957
[8,]	0.10785240	0.7308626	0.08723991	0.07404511
[9,]	0.10452567	0.7239907	0.09934920	0.07213443
[10,]	0.09907963	0.7213398	0.10382959	0.07575094
[11,]	0.10641078	0.7065614	0.10690451	0.08012335
[12,]	0.10207408	0.7036033	0.11639480	0.07792782

$Total.Income

	Share.Price	Loan.and.Advances	Total.Income	Capital.Fund
[1,]	0.011697173	0.04408414	0.9442187	0.0000000000
[2,]	0.009758295	0.04013924	0.9499236	0.0001788458
[3,]	0.008363024	0.03486006	0.9560628	0.0007141272
[4,]	0.009195954	0.03959020	0.9495808	0.0016330124
[5,]	0.009874224	0.03845521	0.9480536	0.0036169525
[6,]	0.010082805	0.03779608	0.9485797	0.0035414270
[7,]	0.011121376	0.04299804	0.9417195	0.0041610670
[8,]	0.013174450	0.04627337	0.9337933	0.0067588433
[9,]	0.013153139	0.04696768	0.9326640	0.0072151755
[10,]	0.013569185	0.05045504	0.9284082	0.0075675346
[11,]	0.015691306	0.05438793	0.9205608	0.0093599368
[12,]	0.015769940	0.05691683	0.9170270	0.0102862623

$Capital.Fund

	Share.Price	Loan.and.Advances	Total.Income	Capital.Fund
[1,]	0.11089817	0.3307353	0.06680584	0.4915606
[2,]	0.10210865	0.2927887	0.17104718	0.4340555
[3,]	0.10098450	0.2868216	0.18058449	0.4316094
[4,]	0.09550227	0.2904291	0.17637181	0.4376968
[5,]	0.09124838	0.3032107	0.18640815	0.4191327
[6,]	0.08974511	0.2976566	0.19028875	0.4223096
[7,]	0.08957824	0.2981666	0.18261410	0.4296410
[8,]	0.08982845	0.3157238	0.17773642	0.4167113
[9,]	0.08737029	0.3111719	0.17638786	0.4250700
[10,]	0.08595715	0.3096443	0.17293029	0.4314682
[11,]	0.08771365	0.3230710	0.16700547	0.4222099
[12,]	0.08527289	0.3211200	0.16361167	0.4299954

IV. INTERPRETATION AND CONCLUSION

We deduce a strong lagged effect of share prices however this relationship gets weaker in longer lag models where there is an impact of fundamental indicators like Loan and Advances and Total Income on share prices. This implies that the relationship between fundamentals of Commercial Bank and Share Prices are more significant when a horizon of 4 months or more is taken into consideration and an immediate reflection (within one or two months) would not be significant between share prices and Total Income or Loans and Advances. Additionally, the significance of external market conditions over a longer-term horizon declines which would imply that in the long run, Bank Share prices are largely dependent on the Bank's own performance. Both Loan and Advances play a significant role in causing the movement of share prices however the dynamics are very different and maybe highly dependent on Central Bank policies. The industry seems to respond to shocks form credit demand (Loans and Advances) the most as can be seen through our impulse response graphs, shocks from credit

demand are even starker post COVID but seem to have a significant seasonal component. Post COVID, shocks from Total Income also appear to be significant which may signify an increased importance of efficiency in addition to profitability in the Nepalese Banking Industry. This does not mean that efficiency was not important previously in the industry, in-fact our FEVD graph shows that the variance in share price over a 12-month horizon is explained more up to than 50% by Total Income which is a significant change to the pre-COVID scenario where the maximum explanation was through the lag of Share Prices itself. This may imply that the Share Prices of Commercial Banks are transitioning to a greater emphasis in both performance through increased profitability and efficiency. Also, it maybe timely for the industry to move to more advanced frameworks like Basel III to increase the overall efficiency of the sector.

The significance of Loan and Advances seems to be less pre-COVID in both the 4-month lag and the 12-month lag models, this may be largely due to Central Bank policies which were introduced after February 2019 which capped Bank Spreads (The Kathmandu Post, 2019). This pattern can be observed by comparing the four-month lagged One Step GMM results for both Pre and Post COVID, there seems to be a higher of significance of Total Income Pre COVID only on share prices however Post COVID the significance seems to be on Loan and Advances and Total Income, both. Similar results can be gauged in the 12-month lagged model as well. On Capital Funds, the significance cannot be seen in longer horizons which may indicate that the impact on share price due to the distribution of bonus shares may not be there for after more than 2 months two three months in the market and may indicate that demand does follow performance and efficiency of Banks in the longer term.

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Intellectual Capital and Profitability of Commercial Banks: New Evidence from Nepal

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Abstract

This paper examines the impact of intellectual capital on risk-adjusted returns of the Nepalese commercial banks during 2011-2020 using fixed-effects (FE) and random-effects (RE) along with system generalized method of moments (Sys-GMM) estimators. The findings show significant positive impacts of value-added intellectual coefficient (VAIC) on bank profitability. Bank profitability is driven mainly by human capital efficiency (HCE) followed by structural capital efficiency (SCE). The results also show significant positive impact of capital employed efficiency (CEE) on risk-adjusted return on equity but the coefficients are insignificant positive with risk-adjusted return on asset. The dynamic panel estimation also confirms the persistence of bank profitability. Along with managing physical and financial capital, banks should enhance their competitive advantage by improving employee efficiency and organizational efficiency to attain higher future profitability.

Key Words: Intellectual Capital; Fixed-Effects; Random-Effects; System GMM; Nepal; VAIC; bank

JEL Classification: C23, G21, O34

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I. INTRODUCTION

Traditionally, companies' survival were focused mainly on the input factors, such as capital, labour and raw materials (Tran & Vo, 2018) but today information technology, knowledge and intellectual skills are the need for value creation and sustainable competitive advantage (Gogan et al., 2016). As such, the knowledge-based capital rather than physical capital have started influencing the productivity of business organizations that eventually portrays the development of a country. According to Marr, et al. (2003), in the current business environment, value of firm is based on the intangibles also known as intellectual capital (henceforth, IC) defined by Stewart (1997) as a set of information, intellectual property, knowledge, intellectual materials and experience with potential to create wealth. The literature lacks a widely accepted definition of IC but the general interpretation can be developed by Lev's (2003, p. 7) explanation of intangible assets, "intangible assets are non-physical sources of value (claims to future benefits) generated by innovation (discovery), unique organizational designs, or human resource practices." IC is a unique organizational knowledge having capacity to value creation through the lens of resource-based approach which views knowledge as a strategic asset and a source of organizations' competitive advantage (Barney, 1991). The competitive advantage relies on a bundle of valuable intangible resources and collectively managed would lead to strategic goals benefitting a firm (Zack, 1999).

It is least surprising that in today's knowledge-based socioeconomic era where IC is considered one of the production determinants, many research academicians from management, accounting, and finance, have given IC a lot of attention. In one hand, the theoretical perspective of defining IC has been explored in several studies (Wu & Tsai, 2005; Bontis, 1998) whereas the effectiveness of IC-based performances of firms, industries and countries are explored in many other studies (Liang et al., 2011; El-Bannany, 2008; Pulic, 2000). The latter strand emphasizes on empirically investigating the effect of IC efficiency on financial productivity. Despite fairly available literature on other industries, testing this IC efficiency and performance link in banking sector is very limited. Considering the engagement of educated people, profound customer relationship and technological innovations embracement, banking industry is acknowledged as highly knowledge-intensive industry (Firer and Williams, 2003; Mavridis & Kyrmizoglou, 2005). As such this industry caters an ideal platform for conducting research on knowledge management specifically IC. Le & Nguyen (2020) summarizing different studies have accentuated the importance of efficient IC for attaining success in banking sector than other industries because banks' investments in IC such as in human capital, systems, brand building and processes define and produce the quality products and services for the customers. Hence it is imperative for banks to efficiently manage IC for their survival, existence and growth. Few studies in Nepal that have been carried out to comprehend the relationship between IC and organizational performance are based on respondents' perception (Dhungana et al., 2017; Gautam, 2015) which motivates to explore the relationship based on out-in approach with accounting data.

Following the implementation of Structural Adjustment Programs in Nepal since late 1980s and stepping into an era of economic liberalization since 1991, the banking sector has become a fast-growing industry that eventually has contributed to the development of other major industries. With more private sector banks, the competition has escalated and has escalated the need for IC efficiency and thus more and more banks are following customer-centric approach by enhancing relationship, introducing customer friendly products and extending the services. Despite the need of extensive enquiry, the IC area have not much attracted the Nepalese researchers. This necessitates the empirical investigation into the relationship between IC and bank returns in Nepal. This research contributes to the extant literature of IC

by examining the effect of newly developed value added intellectual coefficient (VAIC) and its components on risk-adjusted returns of selected commercial banks in Nepal by employing fixed effect, random effect and system GMM regression approaches.

The remainder of the paper is organized as follows: literature review on the relationship between IC and bank performance is presented in Section 2 followed by methodology and data in Section 3. Empirical findings are reported in Section 4 and conclusion in Section 5.

II. THEORETICAL BASIS AND INTELLECTUAL CAPITAL

The theoretical underpinning with respect to the relationship between IC and organizational performance rest on resource-based view which emphasizes the significance of intangible assets and productive resources in determining success of an organization (Marti, 2007). The work of Lawrence R. Dick in 1896 (in Kristandl & Bontis, 2007) first recorded the idea of intangibles whose contribution to the market values of firms became the subject of knowledge economy. Widely accepted extension of resource-based approach, the knowledge-based approach (Grant, 1996) also considers knowledge as highly influential strategic resource.

IC is referred to as intangibles, intangible assets or knowledge assets in the modern research literature (Kujansivu, 2005; Bontis, 2001) which is primarily associated with a firm's resources, its capabilities and competence that define its competitive advantage (Lonnqvist, 2004; Bontis, 2001). Despite its significance to the firm, the lack of a generally accepted method of IC measurement led researchers to explore on divergent paths. Chan (2009) explored the contemporary researches and listed 34 methods of measuring IC which were then categorized into five generic approaches (market capitalization approach, scoreboard approach, direct IC measurement approach, economic value-added approach and VAIC approach). The VAIC approach offers a standard and steady measure of IC (Joshi et al., 2010) and the literature review also supports the use of this approach for measuring IC in the financial sector including the banking sector. Thus, this paper uses the VAIC approach proposed by Pulic (2004) to measure IC efficiency of commercial banks in Nepal.

The notion behind VAIC approach is the due importance given to physical and financial capital in addition to human and structural capital where in Pulic (2004) emphasized the role of capital employed to attain overall efficiency. The value creation of a firm is a joint function of both physical and IC capital where IC depends on physical capital and alone cannot generate any value (Tseng & Goo, 2005). The resource-based theory also postulates that collective knowledge resources are distinctive which can be tangible (physical) and intangible (human or organizational) which help to generate returns and build competitive advantage (Amit & Schoemaker, 1993). VAIC is a systematic technique that enables management, owners and other stakeholders of a firm to examine how the firm's total resources and its components (human, capital and structural) contribute to the value added (Firer & Williams, 2003). Human capital is a set of knowledge, skills, experiences and expertise of employees that forms a pivotal resource of an organization where in the roots of creativity and innovation are also vested. This capital can be taken by the employees as they leave the organization. Structural capital however stays with the firm and consists of processes, production techniques, information system, organizational structure, patent, policies and relational capital that the organization develops over a period of time. Capital employed is the total capital harnessed in an organization's fixed and current assets (Ozkan, et al., 2016; Joshi et al., 2010; Mondal & Ghosh, 2012).

Though each dimension of VAIC may not necessarily create value in isolation but contributions of all the components enhance the potential of adding value (Inkinen, 2015). The recent studies have used VAIC model to analyze the relationship between financial

performance and IC (e.g. Nazir et al., 2020; Le & Nguyen, 2020; Tran & Vo, 2018; Ozkan et al., 2016).

III. REVIEW OF LITERATURE

Majority of the studies revealed positive relationship of VAIC and financial performance. Ting & Lean (2009) using a nine-year data from 1999 till 2007 of Malaysian financial institutions found that VAIC affects return on assets (ROA) positively and 71.6% of the variance in ROA is explained by the variance in VAIC components. Chu et al. (2011) measured IC using VAIC in the listed firms on Hong Kong stock exchange and observed a positive relationship between IC and firm financial performance. In Indian banking and electronic sector, Ghosh & Maji (2015) empirically investigated the basic propositions of VAIC and extended VAIC technique and revealed significant positive impact of VAIC and its components on corporate performance, except for SCE. Meles et al. (2016) showed a positive influence of VAIC on the profitability of banks and the human capital component of VAIC was revealed significant in explaining bank performance in the US. Tandon et al. (2016) examined the impact of IC on financial performance and market valuation of publicly listed firms in India. They observed positive association between VAIC and all measures of financial performance such as productivity, profitability and market valuations. Physical capital efficiency component had stronger positive influence on all measures but human capital efficiency (henceforth, HCE) showed strong positive association with profitability. Structural capital efficiency (henceforth, SCE) however had no significant impact. Alhassan & Asare (2016) also indicated positive effect of VAIC on the banks' productivity in Ghana and HCE component and capital employed efficiency (henceforth, CEE) component observed to be the main drivers of productivity. In a more recent study by Le & Nguyen (2020) of Vietnamese commercial banks revealed positive impact of VAIC and its components on bank profitability. Their results also showed an inverted U-shaped relationship in case of VAIC, HCE and CEE.

Many other studies have shown different findings in regard to the impact of VAIC and its components on banks financial performance. Using Indian data, Mondal & Ghosh (2012) suggested that there exist varied relationships between IC and financial performance indicators. Their results revealed that HCE positively affects ROA and return on equity (ROE) whereas there is insignificant contribution of SCE in determining banks' profitability. Shaban & Kavida (2013) investigated information technology industry in India and found varied relationship between the IC and conventional performance indicators. IC and profitability was positively associated, whereas there was no significant relationship among IC, market valuation and productivity. Examining the causal effect of IC performance on bank financial performance in Thailand, Tran & Vo (2018) showed no significant relationship between VAIC and bank profitability. However, the results showed that the profitability of bank was mainly driven by CEE component and HCE component marginally reduced profitability in the current period but affected positively in future. In a more recent study in Pakistan by Haris et al. (2019) confirmed an inverted U-shaped association between VAIC and bank profitability. HCE and CEE are found to positively impact profitability whereas SCE appeared to negatively impact the bank profitability.

In the context of Nepal, Gautam (2015) conducted an opinion survey to examine the relationship between IC and organizational performance in Nepalese pharmaceutical companies. The findings Ishowed that human capital, structural capital and relational capital related positively with organizational performance. Similarly, Dhungana et al. (2017) examined the relationship between IC and organizational performance of commercial banks

using data obtained through survey questionnaire. The findings revealed that variables of IC had strong impact on organizational performance of commercial banks.

In the backdrop of literature review, it can be expected that investment in IC will have positive effect on profitability of banks. Based on this expectation, this study will test the following four hypotheses:

H₁: Overall intellectual capital (VAIC) positively impacts bank returns in Nepal.

H₂: Capital employed efficiency (CEE) positively impacts bank returns in Nepal.

H₃: Human capital efficiency (HCE) positively impacts bank returns in Nepal.

H₄: Structural capital efficiency (SCE) positively impacts bank returns in Nepal.

IV. METHODOLOGY

4.1 Data

As of mid-July 2020 there were 27 commercial banks in Nepal. The sample banks are chosen with paid up capital between 800 and 1050 crore in Nepalese rupees and all other banks above the threshold are excluded to minimize size distortion. The banks with unavailable data for the study period are also excluded to assure balanced panel. Finally, the sample consisted of 17 commercial banks covering the study period 2011-2020 and include eight banks with joint operation after merger during the study period. To avoid data insufficiency, joint operation commencement period of merged banks is not taken into consideration and as such this arrives at a balanced panel data with 170 observations. Bank specific data was obtained from annual reports of the sample banks posted in their websites. The data from mid-July 2017 are taken from financial statements prepared on the basis of Nepal Financial Reporting Standards (NFRS), a Nepali version of IFRS. Prior to 2017 adjustments are made to extract the required data.

Table 1: List of sample commercial banks

SN	Commercial Banks	Paid-up capital till mid-July 2020 (In crore)	Data period	Observation
1	Himalayan Bank Ltd.	937.23	2010/11-2019/20	10
2	Laxmi Bank Ltd.	981.26	2010/11-2019/20	10
3	Citizens Bank International Ltd.	908.98	2010/11-2019/20	10
4	Sunrise Bank Ltd.	896.78	2010/11-2019/20	10
5	Century Commercial Bank Ltd.	841.55	2010/11-2019/20	10
6	Sanima Bank Ltd.	880.14	2010/11-2019/20	10
7	Machhapuchhre Bank Ltd.	845.85	2010/11-2019/20	10
8	NIC Asia Bank Ltd.	971.77	2010/11-2019/20	10
9	Siddhartha Bank Ltd.	978.78	2010/11-2019/20	10
10	Standard Chartered Bank Nepal Ltd.	801.14	2010/11-2019/20	10
11	Civil Bank Ltd.	800.34	2010/11-2019/20	10
12	Nepal Credit and Commerce Bank Ltd.	935.39	2010/11-2019/20	10
13	Nepal Bangaladesh Bank Ltd.	849.58	2010/11-2019/20	10
14	Everest Bank Ltd.	851.02	2010/11-2019/20	10
15	Nepal SBI Bank Ltd.	895.62	2010/11-2019/20	10
16	Rastriya Banijya Bank Ltd.	900.48	2010/11-2019/20	10
17	Nabil Bank Ltd.	1009.75	2010/11-2019/20	10
			Total	**170**

Source: Nepal Rastra Bank

4.2　Econometric methodology

4.2.1 VAIC and its components

This study employed VAIC approach proposed by Pulic (2004) to measure IC. This method is found not to modify or contradict fundamental accounting principles while using accounting data and thus is theoretically and methodologically sound (Iazzolino & Laise, 2013). In terms of performance measurement, higher the VAIC, better the efficiency level indicating more value-added created by overall resources of the firm (Pulic, 2004). Following Pulic (2004), IC efficiency is obtained by summing up efficiencies of human and structural capital.

$$L\ ICE_{i,t} = HCE_{i,t} + SCE_{i,t} \qquad \text{..........（1）}$$

Considering that IC cannot create its own value, Pulic (2004) took physical and financial capital into account by incorporating the efficiency of capital employed to determine the overall value creation efficiency as:

$$VAIC_{i,t} = CEE_{i,t} + HCE_{i,t} + SCE_{i,t} \qquad \text{..........（2）}$$

where $VAIC_{i,t}$ is the value added intellectual coefficient of bank i at year t. $CEE_{i,t}$ is the capital employed efficiency component that indicates marginal contribution of each unit of physical and financial capital to value added. $HCE_{i,t}$ is the human capital efficiency that shows marginal contribution of each unit investment on human capital to value added and $SCE_{i,t}$ is the structural capital efficiency that measures the contribution of structural capital to value added. In general, this method assumes the contribution of physical and financial, human and structural resources of a bank to create value. Total value added is required to define the components of VAIC and is calculated as:

$$VA_{i,t} = OP_{i,t} + PE_{i,t} + AD_{i,t} \qquad \text{..........（3）}$$

where OP is the operating profit; PE represents personnel expenses (salaries, wages and other benefits); AD refers to amortization of intangible assets and depreciation. Upon calculating VA, the components of VAIC can be calculated with much ease. $CEE_{i,t} = VA_{i,t}/CE_{i,t}$ where CE is the capital employed by bank and is measured as book value of net assets. $HCE_{i,t} = VA_{i,t}/HC_{i,t}$ where HC is the human capital or the capital invested in knowledge workers such as salaries, wages and training (Pulic, 2004). The study used personnel expenses as HC (Meles et al. 2016; Tran & Vo, 2018) that also include trainings and personal development programs. $SCE_{i,t} = SC_{i,t}/VA_{i,t}$ where SC is the structural capital measured as $SC_{i,t} = VA_{i,t} - HC_{i,t}$ which means structural capital is the part of added value not generated by human capital. Structural capital is the knowledge at organizational level and its value denotes the additional amount required to acquire value added over the use of human capital (individual knowledge) (Ordonez de Pablos, 2004).

4.2.2 Models specification

The linear relationship between VAIC performance and financial performance of banks is tested using the following general model:

$$\pi_{i,t} = \alpha_{i,t} + \beta_i X_{i,t} + \gamma_i Z_{i,t} + \varepsilon_{it} \qquad \text{..........（4）}$$

Applying OLS estimator to panel data may result spurious regression because unobserved bank specific effects may correlate with other independent variables (Antoniou et al., 2008). Thus, to account for differences across banks, random-effects and fixed-effects models are employed based on Hausman test of model retention (Tran & Vo, 2018; Ozkam et al., 2016).

Financial performance is a basis for determining investments in IC resources (Murthy & Mouritsen, 2011) which in turn may contribute to the financial performance. Thus, the return in the previous period have potential to influence the return in the current period. Thus to examine the dynamic relationships that exist between IC and banks returns, this study also employed dynamic panel model estimation (system-GMM) proposed by Arellano and Bover (1995). The issue of endogeneity have been raised in the recent studies on relationship of IC and organization performance (Le & Nguyen, 2020; Tran & Vo, 2018; Anifowose et al., 2018). The GMM estimator technique uses internal instruments thus controlling for the potential endogeneity. The study follows Bond (2002) using lagged values of endogeneous variables as instruments. The GMM results are valid if there exist no second-order autocorrelation in the model and the instruments used are exogenous (Tran & Vo, 2018). The dynamic model of bank returns take the following form:

$$\pi_{i,t} = \alpha_{i,t} + \theta_i \pi_{i,t-1} + \phi_i X_{i,t} + \varphi_i Z_{i,t} + \omega_{it} \qquad \ldots\ldots\ldots (4)$$

where, $\pi_{i,t}$ is vector of dependent variables (RARROA and RARROE) of bank i at time t and following Le et al. (2019) and Le & Nguyen (2020) they are measured as $RAR_{ROA} = \frac{ROA_{it}}{\sigma_{ROA_i}}$ and $RAR_{ROE} = \frac{ROE_{it}}{\sigma_{ROE_i}}$. ROE is the return (profit before tax) on total assets and ROE is return (profit before tax) on equity. σ_{ROA} is standard deviation of return on assets over the study period for bank i and σ_{ROE} is standard deviation of return on equity over the study period for bank i. π_{t-1} measures banks' persistence of profits indicating its dynamic feature. LOAN is the ratio of total loan to total assets incorporated to control for the liquidity risk effect; LNTA is natural logarithm of the total asset used to control size effect (Le & Nguyen, 2020). ε_{it} and ω_{it} are composite error terms. Further description of variables are presented in Table 2.

Table 2: Variables description

Variables	Description
Dependent	
RAR_{ROA}	Risk-adjusted return on asset (ROA adjusted by periodic risk of individual banks). ROA measures how the bank performs in terms of assets utilization.
RAR_{ROE}	Risk-adjusted return on equity (ROE adjusted by periodic risk of individual bank)s. ROE measures how the bank serves its shareholders' at the expense of utilizing their fund.
Independent	
VAIC	Value-added intellectual capital that measures the overall IC efficiency derived as a sum of SCE, CEE and HCE
SCE	Structural capital efficiency that measures per unit marginal contribution of structural capital to value added, calculated by dividing difference of value added and human capital by value added
CEE	Capital employed efficiency that measures per unit marginal contribution of physical and financial capital to value added, calculated by value added/book value of net asset
HCE	Human capital efficiency that measures per unit marginal contribution of employee expenses to value added, calculated by value added/staff expenses
Control	
LOAN	The ratio of total loan to total assets of the bank to measure liquidity risk.
LNTA	The natural logarithm of the total assets of the bank to measure bank size.

<center>**V. EMPIRICAL RESULTS**</center>

5.1 Descriptive statistics and correlation of variables

The descriptive statistics in Table 3 shows that average VAIC of the sampled commercial banks is 4.130 for the study period which is greater than 0.683 in Thailand (Tran & Vo, 2018), 3.886 in Turkey (Ozkan et al., 2016), 3.646 in Saudi Arabia (Al-Musali & Ismail, 2014) and less than 4.783 in Vietnam (Le & Nguyen, 2020). The most important component of VAIC is HCE. The average risk-adjusted returns on assets and equity are 3.9 and 3.3 percent respectively for the sampled commercial banks over the study period. The correlation analysis shows significant positive relationship of all independent variables with both the returns. Among the three components of VAIC, HCE has the highest positive correlation with return on assets (0.652) and SCE has the highest with return on equity (0.480). VAIC is correlated more with return on assets (0.656) than with return on equity (0.485). There is strong correlation of HCE (0.976) and SCE(0.899) with VAIC but these variables are not used jointly in a single model. The table also show strong positive correlation (0.917) between HCE and SCE and to avoid the issue of multicollinearity, these variables are summed up to create ICE (Pulic, 2004).

<center>**Table 3: Descriptives and correlation**</center>

	RAR_{ROA}	RAR_{ROE}	VAIC	CEE	HCE	SCE	ICE	LOAN	LNTA
Descriptives									
Mean	3.902	3.313	4.130	0.328	3.152	0.650	3.801	0.690	24.771
Min	0.028	-0.857	0.496	-0.607	1.053	0.050	1.103	0.292	21.696
Max	8.268	7.180	6.195	2.434	4.959	0.798	5.757	6.719	26.310
Std.	2.128	1.674	1.051	0.237	0.862	0.132	0.984	0.474	0.775
Obs.	170	170	170	170	170	170	170	170	170
Correlations									
RAR_{ROA}	1								
RAR_{ROE}		1							
VAIC	0.656***	0.485***	1						
CEE	0.214***	0.305***	0.388***	1					
HCE	0.652***	0.434***	0.976***	0.183**	1				
SCE	0.584***	0.480***	0.899***	0.101	0.917***	1			
ICE	0.649***	0.444***	0.975***	0.174**	0.999***	0.937***	1		
LOAN	0.009	0.094	0.022	-0.043	0.027	0.071	0.033	1	
LNTA	0.230***	0.133	0.173**	0.269***	0.118	0.124	0.120	-0.110	1

, * Significant at 5 and 1 per cent levels, respectively.

5.2 Unit root test

Time series is a part of panel data and unit root if any in the time series may show a systematic unpredictable pattern which lowers the strength of regression results if untreated. In addition, prior to moving on for empirical estimation by system GMM, it is necessary to confirm that the variables under investigation are at stationarity in their level forms (Bayar, 2019; Jung & Kwon, 2007).

Table 4: Panel unit root test

Test		RAR$_{ROA}$	RAR$_{ROE}$	HCE	SCE
Levin-Lin-Chu (at level)		-4.870***	-6.907***	-1.910**	-3.797***
p-values		0.000	0.000	0.028	0.000

Test	VAIC	CEE	ICE	LOAN	LNTA
Levin-Lin-Chu (at level)	-3.551***	-5.822***	-2.027**	-2.952***	-4.312***
p-values	0.000	0.000	0.021	0.002	0.000

**, ***Significant at 5, and 1 per cent levels, respectively.

This study performed Levin, Lin & Chu (2002) panel unit root test in all variables with null hypothesis that all panels contain unit roots. The results in Table 4 show that all the variables are at stationarity in their level forms.

5.3 Fixed effects and random effects models

In Panel A of Table 5, the results in models 1 and 2 reveal strong positive relationship between VAIC and risk-adjusted return on assets inferring VAIC's influence on bank profitability in terms of assets utilization. The VAIC components in models 3 through 8 illustrate that there exists highly positive and significant relationships of HCE and SCE with risk-adjusted return on assets. CEE however showed statistically insignificant positive relationship with the return. t-statistics in parentheses reveal that HCE has higher statistical explanatory power. Control variables loan and size variables are statistically and positively significant with loan be more statistically significant in determining return on assets in commercial banks.

Table 5: Regression results of fixed effects and random effects models

	VAIC	CEE	ICE	HCE	SCE	LOAN	LNTA	Reg.	Adj. R^2	F	p-value
				Panel A: Risk adjusted return on assets (RAR$_{ROA}$) as dependent variable							
1	0.80***							FE	0.84	54.19	0.00
	(5.66)										
2	0.76***					0.59***	0.26**	FE	0.86	56.40	0.00
	(4.90)					(8.80)	(2.49)				
3		0.38	0.91***					RE	0.31	38.75	0.00
		(0.94)	(8.29)								
4		0.41	0.87***			0.55***	0.27**	RE	0.38	26.82	0.00
		(0.94)	(8.29)			(8.35)	(2.52)				
5		0.37		1.05***				RE	0.31	38.48	0.00
		(0.92)		(7.93)							
6		0.39		1.01***		0.56***	0.29***	RE	0.38	27.13	0.00
		(0.92)		(7.14)		(8.32)	(2.71)				
7		0.46			5.23***			FE	0.83	48.13	0.00
		(0.94)			(6.47)						
8		0.51			4.79***	0.57***	0.18	FE	0.86	56.40	0.00
		(0.94)			(5.53)	(8.65)	(1.48)				
				Panel B: Risk adjusted return on equity (RAR$_{ROE}$) as dependent variable							
1	0.84***							RE	0.33	82.61	0.00
	(8.07)										
2	0.86***					-0.29***	0.05	FE	0.76	30.42	0.00
	(7.59)					(-5.24)	(0.28)				
3		2.08***	0.65***					RE	0.40	57.40	0.00
		(2.63)	(6.42)								
4		2.08***	0.66***			-0.25***	0.05	FE	0.79	22.31	0.00
		(2.73)	(6.46)			(-4.81)	(0.35)				
5		2.08***		0.75***				RE	0.40	57.35	0.00
		(2.62)		(6.12)							
6		2.08***		0.77***		-0.25***	0.06	FE	0.79	33.78	0.00
		(2.72)		(6.37)		(-4.76)	(0.45)				
7		2.17**			3.94***			RE	0.37	50.52	0.00
		(2.52)			(5.30)						
8		2.17**			3.91***	-0.25***	-0.01	FE	0.78	31.23	0.00
		(2.60)			(4.68)	(-4.89)	(-0.08)				

The models are selected based on Hausman test. For risk-adjusted return on assets as dependent variable (Panel A), models 1, 2, 7, 8 are estimated using fixed effects and models 3,4,5,6 using random effects. For risk-adjusted return on equity (Panel B), models 1,3,5,7 are estimated using random effects and models 2,4,6,8 using fixed effects. Heteroscedasticity for all selected models are dealt by using White (1980) heteroscedasticity-consistent standard errors. t-statistics are in parentheses. **, *** indicate significance at 5, and 1 per cent levels, respectively.

Panel B also reveal that VAIC coefficients are statistically significant with positive relationship with risk-adjusted returns on equity. The VAIC components in models 3 through 8 illustrate that there exists highly positive and significant relationships of all three efficiency components with risk-adjusted return on assets. HCE again has stronger statistical explanatory power in determining return on equity. With respect to control variables, loan is observed to have statistically significant but negative relationship with returns on equity and bank size is insignificant. The variance in dependent variables are satisfactorily explained by the regressors in all the models and significant F-statistics show that regression models fit the data.

5.4   Dynamic panel data estimation: system GMM

Four models each for risk-adjusted return on assets and risk-adjusted return on equity as dependent variables are estimated using system-GMM approach.

<div align="center">

Table 6: Regression results of two-step system GMM method

</div>

π	RAR$_{ROA}$				RAR$_{ROE}$			
π$_{t-1}$	0.456*	0.399***	0.420***	0.271	0.374***	0.231	0.259*	0.249**
	(0.248)	(0.126)	(0.121)	(0.168)	(0.090)	(0.136)	(0.146)	(0.105)
VAIC	1.191***				0.800***			
	(0.331)				(0.073)			
CEE		1.315	1.238	1.65		3.222	2.878**	3.224**
		(0.820)	(0.821)	(1.00)		(1.991)	(1.255)	(1.149)
HCE			1.064***				0.514***	
			(0.277)				(0.171)	
SCE				5.908***				3.517***
				(1.630)				(1.039)
ICE		0.926***				0.484		
		(0.241)				(0.411)		
LOAN	-0.016	-0.219	-0.35	0.495	-0.752	-0.829**	-0.601**	-0.584**
	(1.085)	(1.353)	(1.457)	(0.549)	(0.492)	(0.288)	(0.215)	(0.204)
LNTA	-0.103	-0.051	-0.043	-0.079	-0.029	0.013	0.021	-0.010
	(0.047)	(0.033)	(0.033)	(0.056)	(0.017)	(0.053)	(0.028)	(0.030)
No. of observations	153	153	153	153	153	153	153	153
No. of instruments	8	15	15	15	16	10	15	15
No. of groups	17	17	17	17	17	17	17	17
AR1 (p-value)	0.046	0.061	0.058	0.07	0.037	0.028	0.027	0.068
AR2 (p-value)	0.376	0.334	0.372	0.238	0.529	0.090	0.117	0.346
Hansen test (p-value)	0.100	0.341	0.356	0.258	0.368	0.424	0.827	0.130

Results estimated using twostep system GMM estimator. Variables in italics are instrumented through the GMM procedure following Arellano and Bover (1995). Robust standard errors are in parentheses. *, **, ***Significant at 10, 5, and 1 per cent levels, respectively.

In system GMM endogeniety problem is addressed by using lagged values of the dependent variable (in levels and differences) and lagged values of other regressors with potential endogeniety problem as instruments. This study used lagged values of possible endogenous variables as instruments (Bond, 2002) shown in italics in the Table 6. The table shows that in all models, p-value of Hansen test exceed 5 per cent threshold sufficient to not reject the null hypothesis suggesting that there is no evidence of over-identifying restrictions and instruments used are exogenous and accepted. Further p-values of AR(2) in all the models are statistically not significant leading to failure to reject the null hypothesis of 'no autocorrelation of second order' This suggests that the instruments (moment conditions) of the model are met (Le & Nguyen, 2020). The number of instruments in all the models are less than the number of groups.

The overall results of system GMM are in line with the results in Table 5. VAIC is statistically and positively significant to determine both bank returns. CEE's relationship with return on assets and return on equity show a similar conclusion as with fixed and random effects models. HCE component is statistically and positively significant in determining the returns. SCE also shows statistically significant and positive impact on the bank returns. Most of the models show that one year lagged returns have significant positive relationship with current returns confirming the dynamic nature of bank profitability. The statistical negative coefficients of loan variable with return on equity is also consistent to the results in Table 5.

5. DISCUSSION

The findings of the study provide overwhelming evidence to verify that VAIC positively influences the financial performance of banks. This finding also endorse the principles of resource-based theoretical approach, that postulates higher productivity based on integrated intangible and tangible assets in the production process (Barney, 1991). The positive significant coefficient of VAIC is also consistent with the findings of contemporary researches (Le & Nguyen, 2020; Nazir et al., 2020; Oppong, et al., 2019; Tandon et al., 2016). The positive and significant association of VAIC with bank returns suggest that an increase in the IC management enables the commercial banks to attain sustainability in operations and improve the profitability.

The study revealed the CEE has positive and significant relationship only with risk-adjusted return on equity which is consistent with the findings of Le & Nguyen (2020) but contradicts the same study in regard to risk-adjusted return on asset where the result revealed positive but insignificant coefficient. The insignificant coefficient of CEE with return on assets also do not align with the findings of recent researches (see Oppong et al., 2019; Tran & Vo, 2018; Ozkam et al., 2016; Tandon et al., 2016; Al-Musali & Ismail, 2014). The insignificant relationship of CEE with return on assets suggest lesser role of physical and financial capital of the banks to enhance profitability in terms of asset utilization. However, the result with return on equity suggests that capital employed in fixed and current assets significantly serves the interest of shareholders.

HCE as an IC component is significant and positive with both the returns. This shows that employees of bank are highly important for growth in returns with respect to knowledge economy, specifically when the employees are equipped with skills, competencies and technological knowhow to give out innovation and creativity. The descriptive average and t-statistics in panel regressions also provide sufficient empirical evidence that human capital is a major component of IC in improving financial performance of banks. The positive significant coefficient of HCE is consistent with the findings of (Le & Nguyen, 2020; Oppong, et al., 2019; Asare et al., 2017; Tandon et al., 2016).

The SCE component of VAIC shows significant positive association with both forms of returns. However in most of the existing literature, it is revealed that SCE although positively associated is the only component that has no significant impact on productivity (see Le & Nguyen, 2020; Oppong et al., 2019; Ozkam et al., 2016; Al-Musali & Ismail, 2014). The positive association revealed sharply contradicts with the findings of Nazir et al. (2020) and Tran & Vo (2018) which showed negative impact of SCE on return. On the other side, the studies have also noted that structural capital lead to knowledge creation in a firm (Asare et al., 2017; Chen et al., 2014). This knowledge created in banks in terms of processes, information system, relationship, policies, organizational structure and others that constitute the structural capital have significant role in determining returns in the Nepalese commercial banks as revealed by the results.

The results of system-GMM show that the coefficient of π_{t-1} is positive is all and significant in six models out of eight. This is consistent with the findings of Le & Nguyen (2020) and Le & Ngo (2020) but contradicts with the findings of Tran & Vo (2018). The findings suggest that profits are persistent over time and thus the previous financial performance have the capacity to influence the current performance. This dynamic nature of bank profitability has been established in the literature (see Le & Nguyen, 2020; Sinha & Sharma, 2015).

In regard to the control variables, LOAN is observed to have negative significant relationship with risk-adjusted return on equity and the result contradicts with the findings of Le & Nguyen (2020). The finding suggests that high liquidity risk reduces profitability and thus do not serve the interest of shareholders. However, the positive relationship of LOAN with

RARROA in random and fixed effects models implies that the Nepalese commercial banks take advantage of scale economies (increased loan) to improve profitability by efficient asset utilization. The result though contradicts to the findings of Tran & Vo (2018). The size of banks is observed to positively impact return on assets however the relationship is insignificant with return on equity as observed in fixed and random effect models. The system-GMM however show negative insignificant impact of size in determining bank returns which is consistent to the findings of Le & Nguyen (2020) and Nazir et al. (2020). This suggest that larger banks are less profitable than their smaller counterparts as observed by Le (2020b).

VI.   CONCLUSION

The current study investigated the influence of VAIC and its components on risk-adjusted returns of the Nepalese commercial banks for the period 2011-2020 by using fixed-effects, random-effects and system-GMM estimators. The findings revealed that risk-adjusted returns of the sample commercial banks are positively related with VAIC and specifically its two components: HCE and SCE. The inconsistent coefficients of CEE indicate low reliance of the Nepalese commercial banks on traditional resources such as physical and financial capital to generate profit. This further suggests enough room for the Nepalese commercial banks to utilize the capital base in full capacity. Among the VAIC components, HCE makes the highest contribution followed by SCE to determine bank returns and thus can be considered as a significant driver of commercial banks' efficiency in Nepal. However, human capital is always associated with the risk of leaving the organization and thus bank management in addition to investment on trainings and facilities to improve employee performance should also invest in structural capital by developing organizational practices to ensure that knowledge attained is applied in the bank, shared and well documented for future use.

Thus in the Nepalese commercial banks, IC has a greater role to determine financial performance than the physical capital suggesting the Nepalese commercial banks to pursue IC investments to create competitive advantages over their competitors. The results also indicate that bank profitability is also determined by the lower liquidity risk suggesting the management to maintain the liquidity risk in the interest of shareholders.

The study of only one country, limited period, overlooked joint operation and data based on accounting profit could be the limitations of this research. Future research may incorporate other emerging markets, more data set and use of market measures such as market-to-book ratio as financial performance to enhance the robustness of the findings.

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SESSION III

SESSION III-A

Theme: *FDI, Tax System and Green Finance*

This session was chaired by Dr. Ram Kumar Phuyal in which he requested each presenter to present their papers. Furthermore, the participants were asked to provide their comments regarding the papers.

SESSION III-B

Theme: *Banking Sector Development and Disaster Risk*

This session was chaired by Prof. Dr. Dhruba Kumar Gautam and the presenters have presented the papers as per the moderation of the session chair and comments were taken from the participants.

Productivity of Tax System in Nepal
(1990 – 2020)

Kul Prasad Prasai *

Abstract

This paper aims to measure the productivity of tax system in Nepal using the concepts of elasticity and buoyancy during the period from FY 1990/1991 to 2019/2020. The time series data analysis was employed through a standard double log linear model for the sake of finding the elasticity and buoyancy coefficients of the tax system in Nepal. An adjusted revenue series have been prepared for total and the individual taxes by using the Sahota method of proportional adjustment. Moreover, major tax heads and sub-heads were analyzed as a proportion of the gross domestic product (GDP) during the study period. The findings reveal that the elasticity coefficients of all the major revenue heads (except direct tax and income tax) during the study period were found less than unity which is inelastic, meaning that the total revenue and its components were not responsive to GDP. Interestingly, the elasticity coefficients of direct tax and income tax with respect to GDP remained elastic, being responsive and positively associated with GDP. But, the buoyancy coefficients of major tax heads with respect to GDP remained buoyant with greater than unity. The study concludes that there is less elastic and more buoyant tax system in Nepal which indicates the increasing trend of discretionary efforts for mobilizing the additional revenue. The higher discretionary efforts signify more burdens to the taxpayers, which restrict the ground of equity. Therefore, the government of Nepal has to focus on automatic response of tax raising system rather than the discretionary efforts.

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I. INTRODUCTION

The domestic revenue mobilization in developing countries gained increasing prominence in the policy debate in recent years. This is due to several factors, including the potential benefits of taxation on state building; long term independence from foreign assistance and the shifting aid paradigm; trade liberalization; and the continued acute financial needs of developing countries (European Parliament, 2014). Donor agencies, both multilateral and bilateral, have increasingly recognized the central role of taxation in ensuring sustainability and ownership in the development process. Therefore, domestic revenue mobilization has a crucial role in fiscal policy implementation particularly in the least developed countries (LDCs) like Nepal where the demand for public funds is very high to meet an increasing level of government expenditures.

Nepal has been undertaking considerable tax reforms for more than two decades but suffering from different problems like resource constraint, lack of revenue surplus for development, increasing reliance on foreign loans and grants, and widening resource gap. Nepal's economy is characterized by a low revenue mobilization in contrast to the growing public expenditure. Although the domestic revenue mobilization has improved since the early 1990s despite a prolonged period of domestic conflict and political turmoil, it is still less than the government expenditure. Reforms to strengthen domestic resource mobilization in Nepal are critically important not only to curtail reliance on donor funding, but more importantly to provide the governments with a dependable, steadily expanding source of domestic revenue for investing in development activities and delivering essential public goods and services (USAID, 2018).

Revenue adequacy is the basic elementary standard that a tax system ought to achieve. The existing budget deficits in many developing countries suggest that the tax systems are not revenue productive. Some may overlook this and attribute the cause of deficits to excessive spending, or temporary adverse economic conditions (Osoro, 1993). The importance of taxation as a veritable tool of economic growth and development depends on a proper tax system which has the capacity to generate revenue through tax. This implies that the tax system must be efficient and effective.

Tax buoyancy and elasticity estimates are the dynamic tools for measuring the performance or productivity of any type of tax or the whole tax system. The measurement of tax elasticity and buoyancy would be very useful in terms of reforms in tax structure as well as revenue administration. In addition to this, the study of tax elasticity and buoyancy is also helpful for revenue forecasting. Sahota (1961) defines the elasticity of the tax system as 'the extent to which the tax system gives and increased returns with every increase in the Gross Domestic Product (GDP or GNP) without any change in either the tax base or the rates or existing taxes or the addition of new taxes is known as the elasticity (built-in-flexibility)'. According to Mukul (1977), 'Tax elasticity may be defined as the ratio of a percentage change in adjusted tax revenue to a percentage change in income, i. e., nominal GDP. On the other hand, tax buoyancy refers to changes in actual tax revenues due to the changes in income as well as due to the changes in discretionary measures such as tax rates and tax bases.' The distinction between the tax elasticity and buoyancy is very useful in analyzing and evaluating whether future revenues will be sufficient to meet the resources needs without changing the rates or bases of existing tax.

Using tax productivity to facilitate new investment is a necessary condition for developing an avenue for managing the unsustainable fiscal deficits in emerging economies (Oriakhi & Osemwengie, 2013). Thus, productive tax systems are not only central to promoting economic growth but also crucial for achieving macroeconomic goals. Analyzing the productivity of existing tax system is allied with the methodological avenues, popularly

naming elasticity and buoyancy. Tax buoyancy measures the degree of reaction of tax to economic growth, without extricating the impact of discretionary and automatic response of tax differences. Tax elasticity measures the responsiveness of taxes disregarding the impact of discretionary tax changes (Craig & Heins, 1980; Oriakhi & Osemwengie, 2013). Both the methodological perspectives overarch the overall performance of tax system, being based on the time series data. However, such studies being devoted in the use of these performance indicators for the analysis of tax system, especially in developing countries (Mahdavi, 2008), are scanty. More specifically, studies in tax performance with segregating all its components and with econometric analysis on updated time series data in Nepal is almost vacant, and those available are limited on descriptive analysis. Therefore, this paper aims to measure the productivity of tax system in Nepal using the methods of elasticity and buoyancy during the period from FY 1990/1991 to 2019/2020. Moreover, major tax heads and sub-heads have been analyzed as a proportion of the gross domestic product (GDP) during the study period.

Following the introduction, the rest of the paper is organized into four sections. Section II consists of research methodology and model estimation. The results are presented in section III. Section IV contains the discussion of the results. Finally, section V concludes the paper with some policy implications.

II. RESEARCH METHODOLOGY

2.1 Research Design

Time series analytical economic evaluation design is employed using secondary data from FY 1990/1991 to 2019/2020. The major sources of data include the budget speech and economic survey of various fiscal years published by the Ministry of Finance, Government of Nepal. Similarly, the data from CBS, NRB, ADB, WB, and IMF are also used. Moreover, annual reports and tax bulletins published by IRD, articles published in national and international journals have also been used in this study.

As per the aim of this study, the methods of elasticity and buoyancy are used to measure the productivity of tax system in Nepal and also the tax effort ratios are calculated and the graphs are used to illustrate the trend of total revenue and its components during the study period. Besides, the direct and indirect tax revenue and its sub-heads have been separately diagnosed to measure the productivity and calculated tax-to-GDP ratio. MS-Excel and SPSS are used as the statistical tools for the data management.

Conceptual Framework
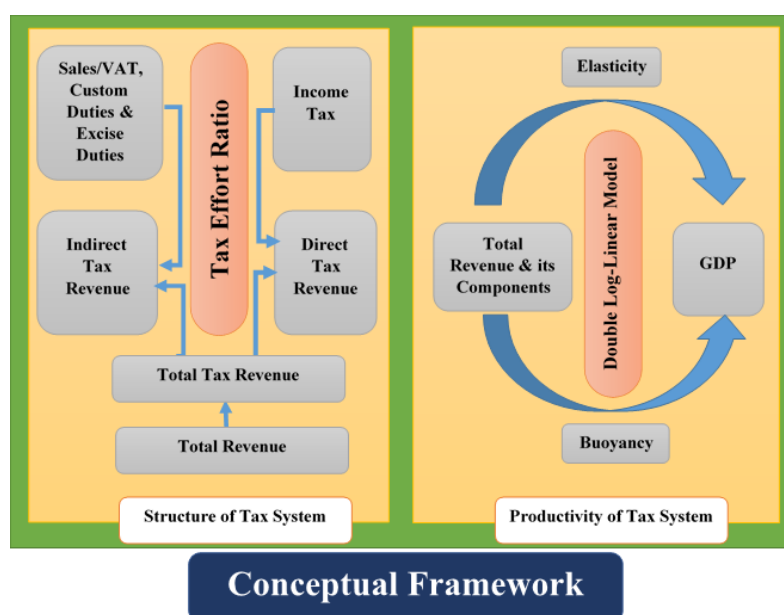
2.2 Econometric Methods

2.2.1 Methods to Measure Productivity of Taxes

The concepts of tax elasticity and buoyancy are generally used to measure the responsiveness of any type of tax or the whole tax system with respect to change in GDP. The elasticity measures the automatic response of revenue to changes in GDP. The data on revenue collection used in estimating elasticity excludes the impact of any discretionary changes during the reporting period. The buoyancy measures the total response of tax revenue to changes in income. The data on revenue collection used in estimating tax buoyancy incorporates the impact of any discretionary changes in the tax rate or base or both during the reporting period. The given tax system is said to be elastic if elasticity coefficient exceeds unity otherwise it is considered as inelastic. In general, the revenue performance is considered to be satisfactory if the buoyancy or elasticity is greater than one. In this case, the revenue collection keeps up with the growth of the economy. Elasticity is measured by constructing a hypothetical series of tax revenues with adjusted data while buoyancy is measured with unadjusted data.

2.2.2 Methods to Separate Automatic from Discretionary Tax Revenue

In order to estimate elasticity and buoyancy, it is necessary to separate automatic growth of revenue from total revenue growth by eliminating discretionary changes. The discretionary effects are referred to as the net effect on tax yields of any change in the tax rate or base, which occurs through legislative or executive action. The change in the yield of taxes due to improvement in the tax administration is also considered as a discretionary change. The automatic effects are the total tax increase in any given time period excluding the increase due to discretionary actions.

Experts have used several methods to separate automatic and discretionary changes in tax revenue system. There are various methods like Constant Structure Method, Divisia Index, Dummy Variable and Proportional Adjustment Methods.

Proportional Adjustment method is relevant in undeveloped countries like Nepal where data system is not well organized and managed. This method further includes the methods like Prest, Sahota and Chand and Chelliah. Since all these three methods produce the same adjusted revenue series, Sahota method has been used to calculate the adjusted revenue series.

Sahota Method (1961)

Sahota has used a comprehensive proportional adjustment method to separate the discretionary change of revenue from total growth of revenue. In this method, the percentage contribution of new tax proposal to the total estimated revenue is taken in the same proportion to calculate discretionary change from actual collection of total revenue. For instance, if a new tax proposal is estimated as 5 percent of the total estimated revenue, the same proportion of 5 percent will be deducted from or added to the actual tax collections to make the revenue series adjusted and cleared by eliminating the effects of discretionary changes.

This method is expressed as follows:

$$IT_t = \frac{AT_t \pm RT_t}{AT_{t-1}} \times IT_{t-1}$$

Where,
IT_t = Adjusted or net tax yield at time t, AT_t = Actual tax yield at time t,
AT_{t-1} = Actual tax yield at time (t-1) RT_t = Actual discretionary change at time t
IT_{t-1} = Adjusted or net tax yield of previous year (t-1)

2.2.3 Model Specifications

The model specified in this study has taken GDP as independent variable and various individual taxes as dependent variables. The model consists of various equations to measure the productivity of Nepalese tax system. Regression analysis has been used to estimate elasticity and buoyancy coefficients of various revenue series. The regression equations have been transformed to double log linear model to estimate the elasticity and buoyancy of various specified relation in this study.

2.2.3.1 <u>Model for Elasticity Coefficients for Various Taxes</u>

$$\log T_{at} = \log \alpha + \beta \log Y_t + u_t$$

Where,

T_{at} = adjusted total and individual tax revenue for the study period

α = constant term

β = elasticity coefficients

Y_t = GDP at current price

u_t = error term

In the double log-linear model, the slope coefficient (β) measures the elasticity of total and individual tax revenue (T) with respect to GDP (Y).

The equations specified to show the relationship between various variables are given below:

$$\log TRat = \log \alpha + \beta \log Yt + ut \qquad \qquad \ldots\ldots\ldots (1)$$

$$\log TTRat = \log \alpha + \beta \log Yt + ut \qquad \qquad \ldots\ldots\ldots (2)$$

$$\log DTRat = \log \alpha + \beta \log Yt + ut \qquad \qquad \ldots\ldots\ldots (3)$$

$$\log ITRat = \log \alpha + \beta \log Yt + ut \qquad \qquad \ldots\ldots\ldots (4)$$

$$\log ITat = \log \alpha + \beta \log Yt + ut \qquad \qquad \ldots\ldots\ldots (5)$$

$$\log SVATat = \log \alpha + \beta \log Yt + ut \qquad \qquad \ldots\ldots\ldots (6)$$

$$\log CDat = \log \alpha + \beta \log Yt + ut \qquad \qquad \ldots\ldots\ldots (7)$$

$$\log EDat = \log \alpha + \beta \log Yt + ut \qquad \qquad \ldots\ldots\ldots (8)$$

2.2.3.2 <u>Model for Buoyancy Coefficients for Various Taxes</u>

$$\log Tt = \log \alpha + \beta_1 \log Yt + ut$$

Where,

T_t = total and individual tax revenue for the study period

α = constant term

β_1 = buoyancy coefficients

Y_t = GDP at current price

u_t = error term

In the double log-linear model, the slope coefficient ($\beta 1$) measures the buoyancy of total and individual tax revenue (T) with respect to GDP (Y).

The equations specified to show the relationship between various variables are given below:

$$\log TRt = \log \alpha + \beta 1 \log Yt + ut \qquad \qquad \ldots\ldots\ldots (9)$$

$$\log TTRt = \log \alpha + \beta 1 \log Yt + ut \qquad \qquad \ldots\ldots\ldots (10)$$

$$\log DTR_t = \log \alpha + \beta_1 \log Y_t + u_t \qquad \ldots\ldots\ldots (11)$$

$$\log ITR_t = \log \alpha + \beta_1 \log Y_t + u_t \qquad \ldots\ldots\ldots (12)$$

$$\log IT_t = \log \alpha + \beta_1 \log Y_t + u_t \qquad \ldots\ldots\ldots (13)$$

$$\log SVAT_t = \log \alpha + \beta_1 \log Y_t + u_t \qquad \ldots\ldots\ldots (14)$$

$$\log CD_t = \log \alpha + \beta_1 \log Y_t + u_t \qquad \ldots\ldots\ldots (15)$$

$$\log ED_t = \log \alpha + \beta_1 \log Y_t + u_t \qquad \ldots\ldots\ldots (16)$$

Where,

TR = Total Revenue
TTR = Total Tax Revenue
DTR = Direct Tax Revenue
ITR = Indirect Tax Revenue
IT = Income Tax
SVAT = Sales Tax / VAT
CD = Custom Duties
ED = Excise Duties

III. RESULTS

3.1 Results of Descriptive Analysis

3.1.1 Total Revenue and Total Tax Revenue as Percentage of GDP

The ratio of total revenue (TR) and total tax revenue (TTR) to GDP during the study period from FY 1990/1991 to 2019/2020 has been presented in figure 1. In 1990/1991, the country's total revenue to GDP ratio was 8.7 percent and increased significantly to 24.2 percent of GDP in 2018/2019. However, the ratio declined to 21.3 percent in 2019/2020 due to the effect of COVID-19 on the economy. As the country's revenue collection has recorded high growth each passing year, Nepal's total revenue to GDP ratio has reached the highest among South Asian countries. The government has been expanding the revenue collection target every year. Though there has been a long debate between the private sector and the government regarding the limit of tax collection, the government has been raising its annual revenue collection target despite the slow economic expansion.

In order to understand the growth pattern of taxation properly, it would be desirable to examine the share of tax revenue to GDP. This is an indicator of the utilization of taxable capacity. The share of tax revenue increased from 6.6 percent of the GDP in 1990/1991 to 21.3 percent in 2018/2019. It remained almost stable for a decade from 1994 to 2003. However, the ratio increased continuously from 2006/2007 to 2018/2019. The ratio is still lower than that of emerging market economies. The ratio declined to 18.5 percent in 2019/2020 due to COVID-19.

Figure 1: **Total Revenue and Total Tax Revenue as Percentage of GDP**
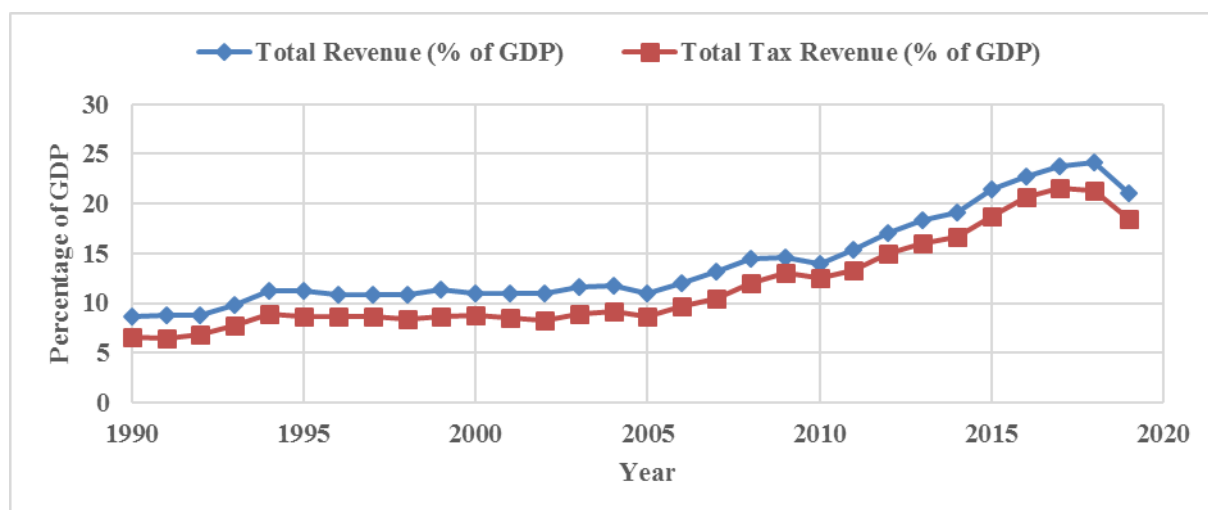
3.1.2 Direct Tax and Indirect Tax Revenue as Percentage of GDP

The share of the direct and indirect tax revenue to GDP has been increasing during the study period (Figure 2). The share of the direct tax to GDP has reached 6.5 percent of GDP in 2018/2019 while it was 1.1 percent in 1990/1991. Similarly, the share of indirect tax to GDP was 5.5 percent in 1990/1991 and increased to 13.0 percent in 2018/2019. This indicates that the contribution of both direct and indirect taxes to the GDP has been increasing continuously during the study period, except in 2019/2020.

Figure 2: **Direct and Indirect Tax Revenue as Percentage of GDP**
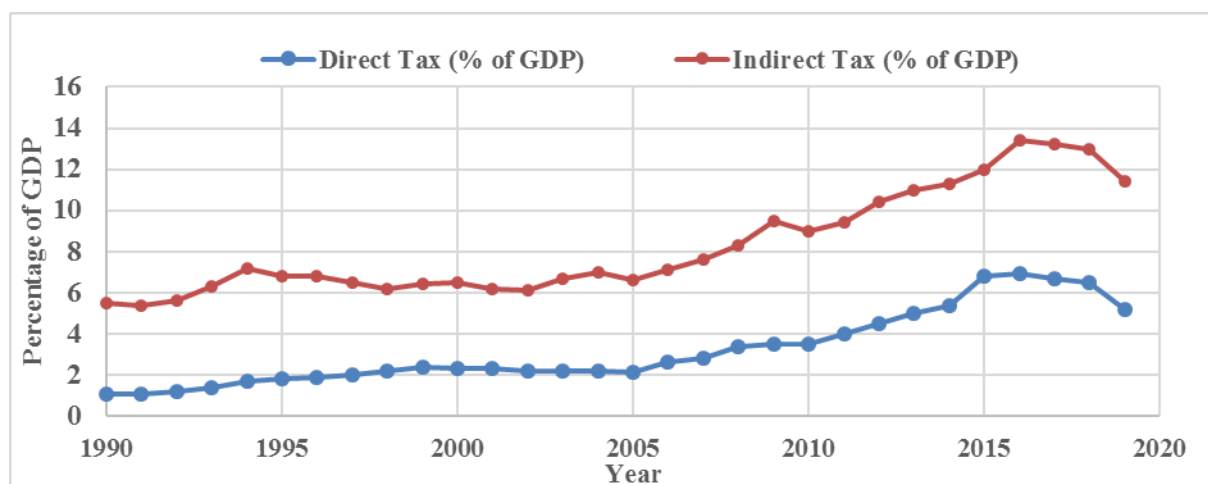
3.1.3 Income Tax, Sales Tax/VAT, Custom and Excise Duties as Percentage of GDP

The share of major components of direct and indirect taxes to GDP has been shown in the figure 3. Among these categories, sales tax/VAT contributed the highest to GDP from 2.0 percent in 1990/1991 to 6.9 percent in 2018/2019. The contribution of income tax stood at 0.6 percent in 1990/1991 and increased to 5.6 percent in 2018/2019. The custom duties contributed from 2.5 percent to 3.5 percent during the study period. The excise duties which had 1.0 percent of share to GDP increased to 3.5 percent during study period. But, the share of all tax sub-heads to GDP declined in 2019/2020 due to COVID-19.

*Figure 3***: Sales Tax/VAT, Income Tax, Custom Duties & Excise Duties as Percentage of GDP**

3.2   Results of Econometric Analysis

3.2.1 Elasticity Coefficients of Various Taxes

The elasticity coefficients of different revenue heads during the study period of 30 years from FY 1990/1991 to 2019/2020 have been presented in table 1.

The elasticity coefficient of total revenue with respect to GDP is found to be 0.82 which implies that one percent increase in GDP causes 0.82 percent increase in total revenue due to the automatic growth. Here, coefficient is inelastic in nature which indicates that the total revenue in not responsive to GDP but positive coefficient reflects that the total revenue is positively influenced by GDP. The high level of R^2 and adjusted R^2, which is 0.98, indicates that 98 percent of total revenue is explained by GDP. F and T statistics are significant at 1 percent level which implies that the model is best fitted and relation is reliable. This means the influence of any other independent variable to total revenue is nominal. The DW statistics is 0.28 which implies that there is positive autocorrelation among the disturbance terms.

Similarly, the elasticity coefficient of total tax revenue with respect to GDP is 0.88 which is also inelastic in nature, indicating that the total tax revenue is also not responsive to GDP but its positive value reflects that total tax revenue is positively influenced by GDP. Here, total tax revenue is inelastic in nature, which implies that the lesser the automatic growth and larger the need for discretionary change to mobilize the additional revenue from taxation.

The elasticity coefficients of all major tax heads and individual sub-heads are examined as follows:

The elasticity coefficient of direct tax is found with greater than unity, 1.09, (i.e., elastic) implying that every one percent increase in GDP on an average associated with 1.09 percent increase in direct tax revenue. The high value of R^2 and adjusted R^2 (0.98) is best fitted of the model. F and T statistics support the significance at 1 percent level. The DW statistics is found to be 0.37 which implies that there is positive autocorrelation among the disturbance terms.

Among the direct tax categories, the elasticity coefficient of income tax is 1.17, which is elastic in nature. Income tax is found to be responsive to change in the country's GDP. The high value of R^2 and adjusted R^2, 0.97, is best fitted of the model. F and T statistics support the significance at 1 percent level. The DW statistics is found to be 0.37 which implies that there is positive autocorrelation among the disturbance terms.

The elasticity coefficient of indirect taxes is found to be 0.81 which implies that one percent increase in GDP is associated with 0.81 percent increase in indirect tax revenue. The R^2 and

adjusted R2 which stand at 0.97 implies that 97 percent change in indirect tax is explained by change in the country's GDP and the remaining 3 percent is explained by other insignificant factors. The model is best fitted at 1 percent significance level. The DW statistics is found to be 0.29 which implies that there is positive autocorrelation among the disturbance terms.

Among the components of indirect taxes, custom duties have an elasticity coefficient of 0.64 indicating that one percent increase in GDP is accompanied by 0.64 percent increase in custom duties. The R2 and adjusted R2 value of 0.95 best explain the independent variable, i.e., GDP for the change in collection of custom duties. F and T statistics support the significance at 1 percent level. The DW statistics is found to be 0.45 which implies that there is positive autocorrelation among the disturbance terms.

Similarly, sales tax/VAT has elasticity coefficient of 0.86, which is less elastic and implies that one percent increase in GDP has contributed 0.86 percent increase in sales tax/VAT. The relationship between the dependent and independent variables are best explained by the high value of R2 and adjusted R2, which stand at 0.97 percent. The F and T statistics support the statistically significant fit of estimated parameters at 1 percent significance level. The DW statistics which is at 0.36 shows positive autocorrelation among the disturbances terms

Excise duties, however, was surprisingly found to be negative (-0.44) implying that increase in GDP has caused a decline in excise duties. This result can be attributed to the large variations in tax rate during the period. The test statistics, however, explains the theoretical fit of the model. The high value of R2 and adjusted R2 is best fit of the model. F and T statistics support the significance at 1 percent level. The DW statistics is found to be 0.39 which implies that there is positive autocorrelation among the disturbance terms.

Table 1: Elasticity Coefficients of Various Taxes

Dependent Variables	Independent Variable	Coefficients	R2	Adjusted R2	F	DW	N
Total Revenue	GDP	0.821* (36.754)	0.982	0.981	1350.820	0.283	30
Tax Revenue	GDP	0.880* (33.035)	0.978	0.977	1091.298	0.256	30
Direct Taxes	GDP	1.093* (35.532)	0.981	0.980	1262.535	0.370	30
Indirect Taxes	GDP	0.810* (30.801)	0.974	0.973	948.672	0.293	30
Income Tax	GDP	1.170* (28.793)	0.971	0.970	829.036	0.378	30
Custom Duties	GDP	0.642* (22.528)	0.953	0.951	507.521	0.457	30
Sales Tax/VAT	GDP	0.869* (30.077)	0.973	0.972	904.630	0.366	30
Excise Duties	GDP	-0.449* (-68.924)	0.995	0.995	4750.510	0.386	30

Source: Author's own calculation using SPSS

Note: Figures in parenthesis represent t-values, * = p<0.1 and ** = p<0.05

3.2.2 Buoyancy Coefficients of Various Taxes

The buoyancy coefficients of major tax heads and individual sub-heads during the period of 30 years from FY 1990/1991 to 2019/2020 have been presented in table 2.

The buoyancy coefficient of total revenue with respect to GDP is found to be 1.27 which indicates that the total revenue for the study period is buoyant with automatic growth and discretionary changes. The values of R2 and adjusted R2 are 0.99 which indicate that 99 percent of total revenue is influenced by GDP and influence of any other variable to total revenue is nominal hence the relationship between total revenue and GDP holds significant. The buoyancy coefficient is significant at 1 percent level. F and T statistic are significant at 1 percent level, which indicates that the equation is best fitted and relation are reliable. The DW statistics is found to be 0.42 which implies that there is positive autocorrelation among the disturbance terms.

Similarly, the buoyancy coefficient of total tax revenue is 1.33 implying that the tax revenue during the period under study is buoyant. The high value of R2 and adjusted R2 which are found to be 0.99 is best fit of the model. F and T statistics support the significance at 1 percent level. The DW statistics which is 0.34 implies that there is positive autocorrelation among the disturbance terms.

Similarly, the buoyancy coefficients of all major tax heads and individual sub-heads are explained as follows:

The buoyancy coefficient of direct taxes is found with greater than unity 1.54, implying that every one percent increase in GDP on an average associated with 1.54 percent increase in direct tax revenue. The high value of R2 and adjusted R2 is best fit of the model. F and T statistics support the significance at 1 percent level. The DW statistics is found to be 0.51 which implies that there is positive autocorrelation among the disturbance terms.

Among the direct tax categories, the buoyancy coefficient of income tax is 1.61. Income tax is found to be more sensitive to change in the country's GDP. The high value of R2 and adjusted R2, 0.98, is best fit of the model. F and T statistics support the significance at 1 percent level. The DW statistics is found to be 0.45 which implies that there is positive autocorrelation among the disturbance terms.

The buoyancy coefficient of indirect taxes is found to be 1.25 which is buoyant in nature. The R2 and adjusted R2 which stand at 0.99 percent implies that 99 percent change in indirect tax is explained by change in the country's GDP and the remaining 1 percent is explained by other insignificant factors. The model is best fit at 1 percent significance level. The DW statistics is found to be 0.36 which implies that there is positive autocorrelation among the disturbance terms.

Among the components of indirect taxes, custom duties has a buoyancy coefficient of 1.09, which refers to buoyant. The R2 and adjusted R2 value of 0.98 best explains the independent variable, i.e., GDP for the change in collection of custom duties. F and T statistics support the significance at 1 percent level. The DW statistics is found to be 0.60 which implies that there is positive autocorrelation among the disturbance terms.

Similarly, sales tax/VAT have a buoyancy coefficient of 1.31, which is buoyant. The value of R2 and adjusted R2 stand at 0.99 percent. The F and T statistics support the statistically significant fit of estimated parameters. The DW statistics which is at 0.39 shows positive autocorrelation among the disturbances terms at 1 percent significance level.

Finally, excise duties have a buoyancy coefficient of 1.46 which is the highest buoyancy coefficient among individual categories of indirect taxes. The high value of R2 and adjusted R2 is best fit of the model. F and T statistics support the significance at 1 percent level. The DW statistics is found to be 0.39 which implies that there is positive autocorrelation among the disturbance terms.

Table 2: Buoyancy Coefficients of Various Taxes

Dependent Variables	Independent Variable	Coefficients	R2	Adjusted R2	F	DW	N
Total Revenue	GDP	1.271* (67.023)	0.994	0.994	4492.096	0.420	30
Tax Revenue	GDP	1.330* (58.668)	0.993	0.993	3441.953	0.345	30
Direct Taxes	GDP	1.542* (56.190)	0.992	0.992	3157.295	0.513	30
Indirect Taxes	GDP	1.259* (56.433)	0.992	0.992	3184.722	0.364	30
Income Tax	GDP	1.619* (42.759)	0.987	0.986	1828.347	0.456	30
Custom Duties	GDP	1.091* (44.474)	0.988	0.987	1977.957	0.606	30
Sales Tax/VAT	GDP	1.319* (52.350)	0.991	0.991	2740.515	0.395	30
Excise Duties	GDP	1.461* (32.710)	0.977	0.976	1069.924	0.398	30

Source: Author's own calculation using SPSS

Note: Figures in parenthesis represent t-values, * = $p<0.1$ and ** = $p<0.05$

IV. DISCUSSIONS

The share of total revenue and total tax revenue to GDP in Nepal is low compared to global economies. Similarly, the share of direct tax and indirect tax revenue to GDP is not satisfactory and is still low compared to developing and emerging market economies.

The elasticity and buoyancy coefficients of tax system in Nepal during the study period of 30 years from FY 1990/1991 to 2019/2020 shows that the elasticity coefficients of all the revenue heads (except direct and income tax) are inelastic as compared to their respective buoyancy coefficients. The general analysis shows that there is less elastic and more buoyant tax system in Nepal. The present study shows the increasing trend of discretionary efforts except for few categories for mobilizing revenue. This indicates additional efforts of government for the mobilization of additional revenue to meet the increasing trend of expenditure. The higher discretionary efforts signify more burdens to the taxpayers, which is not suitable on the ground of equity.

On the other hand, the high buoyancy shows the role of discretionary measures in maintaining a steady source of tax revenue throughout the review period. Therefore, the government has to focus more on the implementation of policies to raise the government revenue by automatic response of tax system rather than that of discretionary efforts.

Adhikari (1995) found the elasticity and buoyancy coefficients of 0.65 and 1.10 respectively during the period from 1975 to 1994. Similarly, Timsina (2007) found the elasticity and buoyancy coefficients as 0.59 and 1.14 respectively for the extended period from 1975 to 2005. Both of these studies indicate an inelastic but buoyant tax system which is parallel to this study. Another study of Nigeria has found that Nigerian tax system is found productive with the high buoyancy coefficient as 1.85 (Eugene & Chineze, 2015), which is consistent with this study. Inland Revenue Department (2015) in a study for the period of 1998 to 2013 found 0.64 and 1.27 of elasticity and buoyancy coefficients respectively which is also similar to this study. A study in Pakistan found elasticity and buoyancy coefficients of 0.88 and 0.92 respectively for the period between 1975 and 2003 (Bilquees, 2004). Acharya (2011) found elasticity and buoyancy coefficients of 1.2 and 1.3 respectively for India during the period from 1991 to 2010 which exhibits elastic and buoyant tax system.

A study inferred that tax system in Nepal is attributed to a number of factors such as large share of agriculture remaining under-taxed, service sector still lightly taxed, low literacy rate, large rural population, large informal economy, poor governance and the underdeveloped financial sectors which transact directly in cash outside the tax net, making it difficult to track tax evasion (Gupta, 2015). Similarly, weak administrative and enforcement capacity, narrow tax base, high tax rate, low tax compliance, excessive exemptions, corrupt practices and politically driven tax favors are responsible for low productivity of tax system in Nepal. An IMF study found a relatively low productivity of revenue collections as one of the main issues of Nepal's tax system (IMF, 2011).

This study is also not free from some pitfalls. This study has covered only the period of 30 years from 1990/1991 to 2019/2020. Moreover, this study has applied limited econometric analysis to identify the productivity of tax system, being based on the secondary data only. However, keeping these limitations aside, this study has developed a strong evidence to guide the current tax system with highest level of revenues and its productivity.

With present productivity of tax system as high buoyancy and low elasticity as explored by this study, policymakers of the country should be aware about discretionary changes being higher than the automatic growth. To address this situation, an effort should be made to increase automatic response of taxes and broaden the tax base. Importantly, every sector of the economy should be brought under the tax net as much as possible. The tax authority should increase the voluntary compliance and improve efficiency of tax administration. Tax procedures, rules and regulations should be comprehensive and simple for all tax payers. The long-term objective of tax reform should be towards broadening the tax base and lowering the tax rates, rather than promoting other flexible options.

V. CONCLUSION

This paper has developed a framework digging out the productivity of tax system in Nepal. The elasticity and buoyancy coefficients of major tax heads and sub-heads solely infer that tax system in Nepal is undesirably inelastic but buoyant, meaning that discretionary efforts remain prevailing in the collection of revenue rather than the automatic growth of revenue mobilization. Besides, the tax-to-GDP ratio concludes that revenue collection has been continuously better up over the study period. The policymaker needs to take necessary actions and steps to sort out the emerging problems in the effective implementation of tax system for future prosperity as well as present needs of economic development. Therefore, the government needs to focus more on the implementation of policies to raise the government revenue by automatic response of tax system rather than that of discretionary efforts. Some strong causality relationship among taxes and their influential factors can further dig out the causes over the current less productive tax system in Nepal.

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A nexus of foreign direct investment and trade liberalization: An empirical analysis through VECM Approach

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Abstract

This paper has examined the impact of trade liberalization on foreign direct investment in Nepal by using time-series data from the period 1972 to 2019 through vector error correction (VEC) model. The study has used the Johansen co-integration test to confirm the long-run relationship between the variables. The results of the Johansen co-integration test reject the null hypothesis of no co-integration which indicates that there is a causal relationship between trade liberalization and foreign direct investment in Nepal. The VEC model supports that there is a significant relationship between trade openness, inflation, GDP per capita growth, and foreign direct investment flow in the long run. The presence of causality was also tested by using the Wald test which provides evidence of short-run causality of trade openness and joint impact of inflation and GDP per capita growth on foreign direct investment. The robustness test results concluded that the analysis results are not spurious to the generalization and implementation of the study outcomes. Overall, the analysis suggests that trade openness is important factor for the attraction and inflow of FDI in Nepal along with domestic inflation and GDP per capita growth.

Key Words: Trade liberalization, FDI, VECM, economic growth, Nepal

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I. INTRODUCTION

An open market economy has a multi-dimension of investment and capital formation. In the globalized and integrated economic system, all economies are interlinked to the world marketplace for production, supply, technology transfer, and knowledge dissemination across the world and between the economies. In the 1980s most of the developed and developing nations began to open their economies to the world and started to align through different means of economic activities (Guris and Gozgor, 2015). Thus, foreign direct investment is also becoming a part of capital inflow and a source of financial resources to invest in impactful national pride projects and physical infrastructure development especially in young and developing nations where domestic capital is not enough to meet the demand for financial resources.

Foreign direct investment and financial or economic liberalization are interlinked with each other. Where the FDI comes into discussion, there is automatically trade openness comes in front. These two factors are the drivers of sustainable economic growth in today's integrated and globalized economy. The study of Romer (1986) and Grossman and Helpman (1991) have argued the significant contribution of the World trade openness on economic growth. They have also suggested that trade openness attracts the FDI with minimum hurdles of investment. There are two parts of trade openness: first is financial openness and second is trade openness. Trade openness is a foundation for the international markets which allows products supply to the world market and imports from them. Financial openness is more related to the removal of restrictions to inter and goes financial intermediaries and service providers to operate their services in and outside the country.

Nepal has no specific historical date of entering into the global market but its long history. However, Nepal has pursued open economic policies since the mid1980s which was accelerated in the 1990s with the enactment of the Privatization Act, Industrial Enterprises Act, Foreign Investment and Technology Transfer Act, Industrial Policy, and Trade Policy. In 2004, Nepal became a member of the World Trade Organization (WTO). After the Trade Policy-1992, a formalized export-import policy which helps to facilitate the cross-country trade in Nepal. Nepal and India have an open border and no restriction on the movement of a certain limit of products. Therefore, major international trade is with India and second with China. With the official participation in the global marketplace, Nepal had also received some financial benefits in terms of foreign direct investment inflow in the economy and participating in the international labor market. The contribution of the international labor market to the economy is very high and remittance is one of the pillars of an economy. The trend of foreign direct investment and trade openness is presented in figure 1.1.
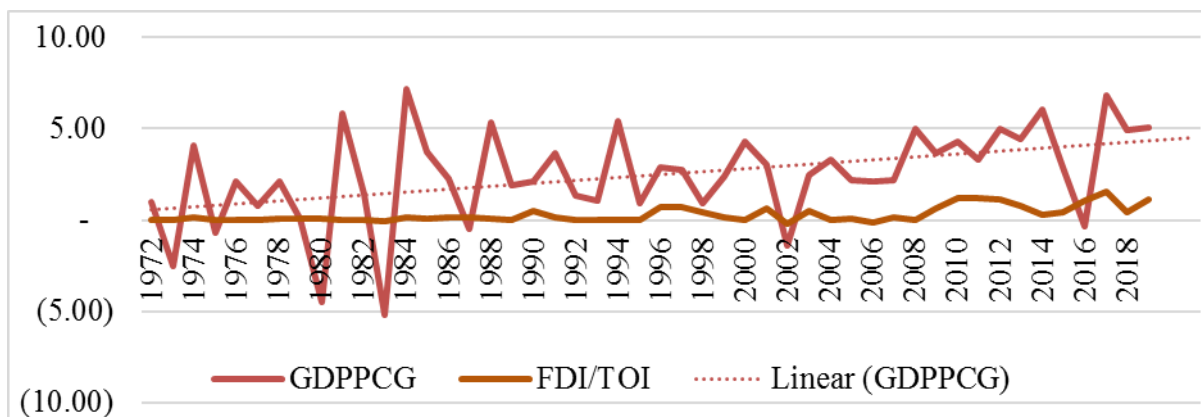
Figure 1.1: **Historical trend of FDI and trade openness in Nepal**
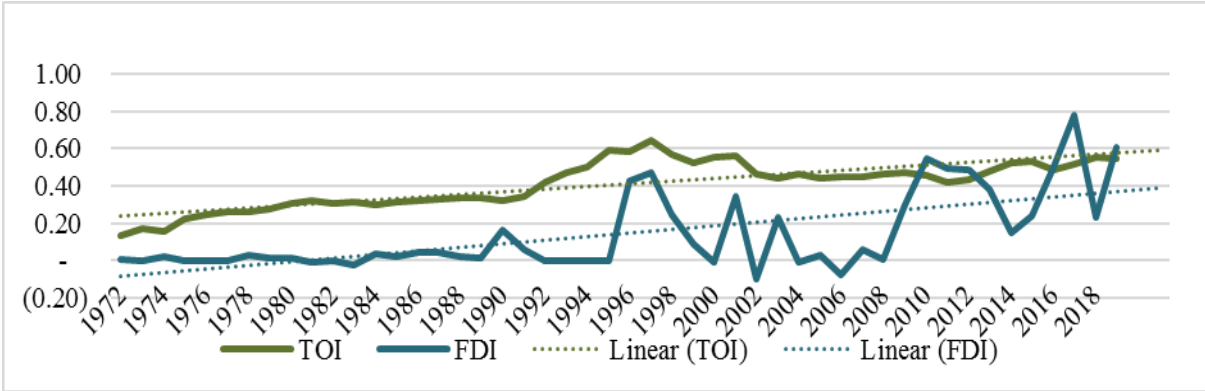
Source: Author's own calculation based on WBDI by using Microsoft Excel 2013.

Figure 1.1 illustrates the historical trend of FDI flow and international trade as an openness index in Nepal over the period 1972 to 2019. Formally, Nepal goes to an open market economic system after the 1990s. After the enactment of liberalization policy, the FDI inflow increases in 1996 but the pattern of inflow cannot sustain over a long time. Before the 1990s, the trend of FDI and TOI was not fluctuating highly because the portion of FDI and TOI was limited to below 10 and 30 percent of the GDP. With enter into the world marketplace, Nepal's foreign trade reached up to 65 percent of GDP, and FDI also increases significantly. Further, how the trade openness and FDI inflow is being moved in Nepal? With the help of figure 1.2, the answer to this question might provide some general idea over the period.

Figure 1.2: **Historical trend of GDP per capita and FDI per TOI in Nepal**

Source: Author's own calculation based on WBDI by using Microsoft Excel 2013.

Figure 1.2 presents the linked the FDI to TOI ratio and GDP per capita growth over the period 1972 to 2019. As argued by the Lucas (1988) and Chakrabarti (2001), foreign direct investment and foreign trade are the key driver of economic growth. The figure gives the ratio of FDI to GDP which shows how international trade and economic growth move together. FDI is the result of trade liberalization and openness. Without participation and provide access to the global market, FDI cannot flow to the economy which is considered as the major source of capital investment. Therefore, while presenting FDI and trade openness, economic growth cannot be ignored.

There are many studies that are conducted by taking foreign direct investment, economic growth, and trade openness along with other macroeconomic variables in different economies and regions. However, there are no literature founds which is based on Nepal. Therefore, to break the ice in this area of academic literature, this study has tried to establish the relationship between foreign direct investment, trade openness, and economic growth in Nepal. The main focus will be given to address the relationship between foreign direct investment and trade openness. Further, the rest of the paper will be organized as follows: section II will give a brief review of existing literatures followed by data and methodology in section III and data analysis and result discussion in section IV. Final section V provides a summary and conclusion of this study.

II. LITERATURE REVIEWS

Foreign direct investment is widely discussed and reported terms in financial and investment literature (Chakrabarti, 2001); Umoh et al. (2012); Jenkins and Thomas (2002), and Dunning (1993). The study of Isabel (2009) explained the positive impact of foreign direct investment on economic growth in the long run. The study also suggests that government policies are important factors to bust foreign trade and attract FDI inflows. The study result of Lane and Ferretti (2001) found the positive contribution of trade openness on the FDI inflow in

developing countries. Similarly, the study of Ponce (2006) findings that the FDI growth is affected by the trade agreements and trade pattern of the country. Ghosh (2007) examined the causal relationship between trade openness and FDI by using a panel data model over the period 1970 to 1997. The study also explained that trade liberalization increases trade openness but trade openness has no explanatory power to FDI liabilities by using IV regression with FDI and trade liberalization. The study of Nath (2009) has used fixed-effects panel data approach to examine the effects of trade and foreign direct investment on economic growth in 13 transition economies of central and Eastern Europe and the Baltic region from the period 1991 to 2005. The study examine the effects of trade and FDI on growth by controlling gross domestic investment, inflation, fiscal balance and size of the government. The liberal trade policy helps to provide appropriate environment for the human capital investment, technology transfer and financial capital investment in the developing countries (Bhagwati, 1973; and Balsubramanyam et al, 1996). The study of Balasubramanyam et al. (1996); Cleeve (2008); Borensztein et al. (1998); and Findlay (1978) have used cross-section data analysis approach to examine the role of FDI in economic development in different facets.

Similarly, Ebere et al. (2016) conduct a study to examine the relationship between foreign direct investment and trade openness using the ordinary Least Square Regression (OLSR) method in Nigeria. The study provides evidence of the strong positive impact of trade liberalization on FDI inflow in Nigeria. Dritsaki et al. (2004) investigate the relationship between trade, foreign direct investment, and economic growth in Greece over the period 1960 to 2002 by using the vector autoregressive (VAR) model. The results of the co-integration analysis provide evidence of a long-run equilibrium relationship between FDI, trade, and economic growth in Greece. The study also found a causal relationship between economic growth, trade, and FDI. This finding also supported by Grossman and Helpman (1991); Zafar et al. (2016); and Bosworth et al. (1999). By using numerical simulation methods relating General Agreement on Trade in Services (GATS) in the WTO, Huang et al. (2009) analyze the role of financial intermediation services and policy options in joint intertemporal-spatial trade models. They have considered the liberalization of trade in financial services in an inter-spatial and inter-temporal model to two countries and found that the services liberalization can be welfare worsening in the presence of a tariff on spatial trade in goods and services. However, Fowowe (2011) provides the evidence of negative impact on economic growth in Ghana by applying the distributed lag (ARDL) bounds test techniques with data from 1975 to 2017.

The study of Bosworth et al. (1999) examines the impact of FDI on economic growth by taking 58 countries of Africa, Latin America, and Asia. The results of the study show that all types of capital inflow half of the original amount accounted for the FDI which significantly contributes the domestic investment and economic growth. However, Adewumi (2006) argued that the contributing role of FDI varies from region to region and country to country. The economic policy, market structure, political system, and level of technology determined the role of FDI on economic growth. By using the vector error correction model (VECM), Peters and Kiabel (2011) explained the impact of tax incentives in the choice of FDI in Nigeria. The study results suggested that reliance on tax ought to be decreased and more consideration be focused on other incentive techniques which creates a favorable investment environment and stability. Likewise, Majavu and Kapingura (2016) investigate the determinants of FDI inflows into South African economies by using the VEC model. The study showed that exchange rate, inflation, market openness, and corporate tax system are the major determinants of FDI which have a significant impact on the long-term.

There is another aspect of analyzing foreign direct investment inflow from a macroeconomic perspective. An investment environment and stability only do not attract the FDI in the economy along with this technology advancement level, price level, and trade policy also play a crucial role. The study of Prasanna (2010) explored that the increase in domestic investment affects significantly the FDI inflow in India. The study had concluded that the impact of FDI on domestic investment is greater than the impact of domestic impact on FDI. Likewise, the study of Agosin and Machado (2005) also assessed the role of foreign direct investment in developing countries in crowds in or crowds out of the domestic investment. The study used panel data for the period 1971 to 2000 to develop the theoretical model for investment including an FDI variable. The study concluded that the effects of FDI on domestic investment are not always in favor. Therefore, it seems like FDI and DI have a different degree of impact depends upon the nature, level of international trade, exchange rate, and other macroeconomic indicators status which directly or indirectly impact the investment and economic growth in a particular economy.

The study of Mustafa (2019) examines the causal relationship between inflation and FDI in Sri Lanka. The study used the time series data from years 1978 to 2017. The Johansen co-integration test, Granger causality test, and residual analysis test have been performed to analyze the causal relationship between FDI and INF. Overall, the study results of Mustafa (2019) provide evidence of the significant role of FDI on inflation and helps to control the domestic price level in the domestic marketplace. Udoh and Egwaikhide (2008) analyze the role of inflation to attract FDI inflows in Nigeria by using the time series data from 1970 to 2005. The study has estimated exchange rate and inflation volatility by employing the GARCH model. The study results found that the exchange rate and inflation fluctuation and uncertainty have a significant negative impact on FDI inflow. Likewise, the study of Caves (1996); Okafor (2016); Ercakar (2011); and Memme et al (2021); Alfaro and Charlton (2009); and Buckely et al. (2007) have also conducted a study on foreign direct investment and trade liberalization related issues by using time-series data analysis approach in different countries.

From the existing theoretical and empirical literature reviews, there is an important role of trade openness, inflation, and economic growth to attract foreign direct investment in both developed and developing countries. The degree of impact is different in different economies and economic systems. Trade openness is the basic requirement for foreign investment to get access along with other macroeconomic variables such as inflation, economic growth, population size, political environment, technology, the policy of investment returns, and many more variables. The role of inflation and price level determines the volume of business and profitability. Likewise, economic growth indicates the future market's prosperity and level of market sustainability over the period. The foreign trade policy and investment return help to establish foreign ventures in the economy and provide an investment-friendly industrial environment. Therefore, each macroeconomic factors have its own role to analyze the FDI inflows in the economy. Based on the existing literature reviews and a general understanding of foreign direct investment, trade openness, inflation, and economic growth, the study has developed the following directional link framework among these variables.

***Figure 2.1*: Conceptual framework**
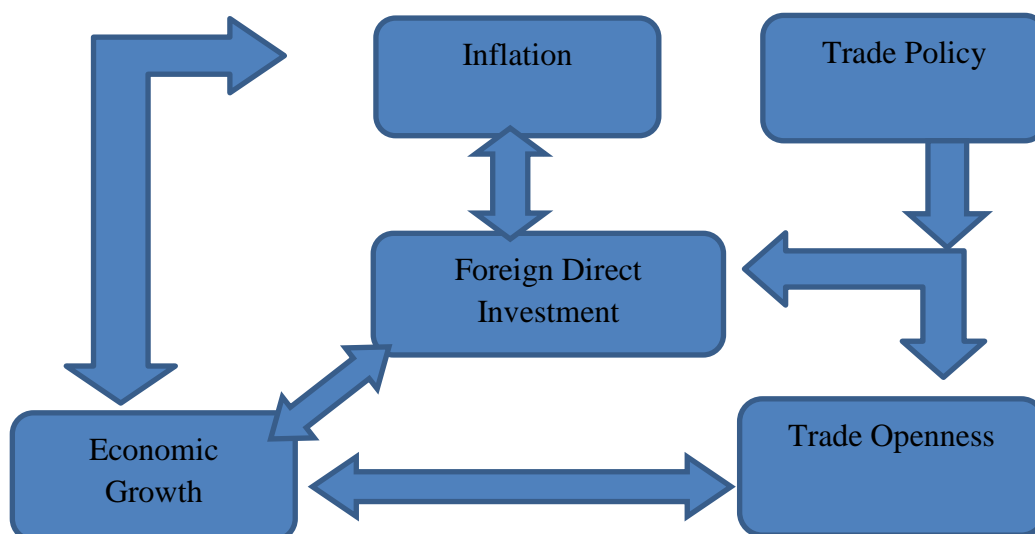
Source: Author's own development

III. DATA AND METHODOLOGIES

3.1 Data and data sources

This study has been employed time-series data for the period 1972 to 2019 which were collected from the World Bank database. The data series of foreign direct investment, trade openness index, and GDP per capita growth are presented in the given figure 1.1 and 1.2. The proxy indicator of economic growth, per capita investment, and trade openness have been calculated based on the World Bank Development Indicators.

3.2 Measures of proxy variables

Foreign direct investment

Foreign direct investment can be define as the flow of financial resources and technology to the another country through multinational enterprises, partnership firms or individual portfolio investment which are operating in another countries. FDIs are more actively utilized in an open market rather than controlled market economy. FDI generally includes participation in management, joint-venture, transfer of technology, and knowledge dissemination. Developing countries are more concerned to attract FDI in their country for the collection of financial resources and technology transfer through the FDI inflow. There are many studies used FDI as the driver of economic growth in developing economics such as Blomstoerm (1986); Borenstein et al. (1998); and Blomstoem and Persson (1983). They have suggested a strong contribution on economic development and growth in liberal economy. However, there is also another views which advocate the negative role in the economic growth especially for advance economics and they argued that FDI promotes crowding out the domestic capital. Giles and Williams (2000) argues that foreign exports have a negative relationship with economic growth. Thus, this study has used foreign direct investment as dependent factors as a proxy of external investment. The term data used in this study is the ratio of FID to GDP ratio of a particular year indicating t. Thus, mathematically, FDI data has been calculated by using the following simple formula.

$$FDI_t = \frac{total\ foreign\ direct\ investment\ in\ year\ t}{gross\ domestic\ products\ in\ year\ t} \qquad\qquad \text{.......... (3.1)}$$

The value of total foreign direct investment and gross domestic products are measures in current price of the United States' Dollars amounts.

Trade Liberalization

In this part of the study, trade openness index is a proxy of trade liberalization or trade openness and this variables is the main explanatory variable in the model. In general, trade openness can be defined as the degree to which an economy maintains its trade with the rest of the world. Empirically, trade openness is defined as the ratio of exports plus imports to GDP (Fujii, 2017). Most macroeconomic researcher uses trade ratio to GDP as the proxy of the trade openness index in macroeconomic studies such as Levine and Renelt (1992), Rodrik (1998), Harrison (1996), and Fujii (2015). However, aggregating overall trade data from different sectors, areas, and countries is very hard to find in a systematic way. Thus, for convenience, cross countries economic status analysis and trade openness's proxy is considered as the ratio of total trade to GDP of a particular year. Mathematically, the trade openness index and trade index growth are given by the following equation:

$$Trade\ Openness_t = \frac{Total\ imports_t + Total\ Exports_t}{Gross\ Domestic\ Products_t} \qquad \ldots\ldots\ldots (3.2)$$

Inflation rate

In macroeconomic analysis inflation is the key reflector of price level in the market. This is also a basic information for the cost-price analysis and financial planning. Interest rate, exchange rate and balance of payment also determined by the inflation in economy. Therefore, while talking about foreign direct investment and trade, inflation cannot be ignore fully. There are many studies which are used consumer price index and GDP deflator as a proxy of inflation such as Balduzzi (1995); Barro (2013); Khan and Nawaz (2010); and Rochon and Rossi (2006). Therefore, this study also use CPI as a proxy of inflation for this academic research purposed. The data used for the inflation is directly used as presented in the World Bank database. Thus, inflation does not need to calculate further.

Economic growth

The measures of economic growth are represented by gross domestic product (GDP) per capita growth. GDP per capita growth is an appropriate measure of economic growth. The classical, neo-classical and modern studies have been using GDP per capita growth as a proxy of economic growth. The study of Becsi and Wang (1997) used GDP per capita to measure economic growth and examine the impact of financial development on economic growth by using VAR analysis methods. Similarly, other studies of Khan (2001); Pagano (1998); Romer (1986); and Oli and Xie (2021) also used GDP per capita growth as a proxy of economic growth. Therefore, for the convenience, data availability, and academic society's acceptance of economic growth proxy, this study has also used GDP per capita growth as an economic growth variable. The GDP per capital is the ratio of total GDP divided by total population of particular year. Thus, the calculation GDP per capita growth is given from the following equation:

$$GDP\ Per\ Capita\ Growth_t = \frac{GDP\ Per\ Capita_{t+1} - GDP\ Per\ Capita_t}{GDP\ Per\ Capita_t} \qquad \ldots\ldots\ldots (3.3)$$

Where, GDP represents gross domestic products of a particular year t. While using in data analysis process, the GDP per capita growth will be presented in percentage point.

As per the structure of the Nepalese economy, investment and economic activities are more dependent on the international market. In another word, remittance, grants, and international

agencies' funding development programs are more concerned with sustainable economic growth.

3.3   Empirical analysis design

In order to achieve the objective of the research work, time-series data econometric techniques have been used in this study for the examination of a causal relationship between foreign direct investment and trade openness along with economic growth and inflation which are the key determinants of foreign direct investment inflow and international trade policy. Therefore, this work has been employed the time-series econometric analysis method using the general form of the model specified below:

Foreign direct investment = f (Trade openness, economic growth, inflation) ……. (3.4)

The above equation 3 .4 can be written in empirical linear equation forms as:

$$FDI_t = \alpha_0 + \alpha_1 TOI_t + \alpha_2 INF_t + \alpha_3 GDPPCG_t + \varepsilon_{it} \qquad\text{………. (3.5)}$$

$$TOI_t = \alpha_0 + \alpha_1 FDI_t + \alpha_2 INF_t + \alpha_3 GDPPCG_t + \varepsilon_{it}) \qquad\text{………. (3.6)}$$

$$INF_t = \alpha_0 + \alpha_1 FDI_t + \alpha_2 TOI_t + \alpha_3 GDPPCG_t + \varepsilon_{it} \qquad\text{………. (3.7)}$$

$$GDPPCG_t = \alpha_0 + \alpha_1 FDI + \alpha_2 TOI_t + \alpha_3 INF_t + \varepsilon_{it} \qquad\text{………. (3.8)}$$

Where, in the above equations, FDI, TOI, INF, and GDPPCG represent the foreign direct investment, trade openness index, inflation and gross domestic product per capita growth respectively. Alpha $\alpha 0$ is the intercept on each model and $\alpha 1$, $\alpha 2$ and $\alpha 3$ represent the coefficient parameters of trade openness, inflation and GDP per capita growth respectively and t in the parenthesis is the notation of time series of vector i variables and εit is denotes error terms in the models. To specifying the empirical mode further, it is necessary to test some statistical tools to understand the nature of the data as per the research objectives. Therefore, the following statistical test has been tested to specify the appropriate time-series statistical analysis methods.

Structural Stability Test

The time series analysis will begin with a stability test by using multiple regression and the CUSUM test at a 5 percent level of significance. The multiple regression analysis helps the researcher to control the different components that simultaneously impact the target variable. As suggested by Wooldridge (2006), addition of more factors that affect the dependent variables in the model better explained the dependent variable. Therefore, multiple regression analysis is helpful for setting a good model to explain the variation in the target variable.

The CUSUM test and coefficient recursive test at 5 percent level of significant results shows that both the estimate lies in between the upper bound and lower bound. From the CUMUM and coefficient recursive test results, the model does not require to go through the structural breaks during the observation period. Thus, the model will not use structural break in the time series analysis. The results of CUSUM test and coefficient recursive test at 5 percent level has given in the figures 4.2 and 4.3.

Testing for the Stationary

In traditional empirical analysis methods in econometrics are stand on the assumption that the time series variables are stationary. With the development of emerging econometric techniques, those stationary assumptions became invalid for economic growth studies using time series data and the research also found that most of the time-series data are non-stationary. According to Engle and Granger (1987) and Johansen (1989) argument, non-

stationary variables can cause spurious regression results and increase the confidence intervals for the estimated coefficient parameters. Therefore, this study has been used Augmented Dickey-Fuller (ADF) test equations for the stationary check on each variable. The ADF test hypothesis will be rejected if the probability value (P-value) is greater than five i.e. P>5 %. The null hypothesis H0: the series has the presence of unit root. The rejection of H0 indicates the data series is stationary at level. If the data series do not reject H0 at level based on Akaike Information Criterion (AIC) maximum lag difference, the test assumption can be included at level with intercept and time trend and also can apply the first difference at the given significance level.

H0: $\alpha = 0$, there is existence of unit root

H1: $\alpha < 0$, There is no unit root

Test for the Co-integration

Another test will be done to examine the co-integration between the variables. This econometric technique is used to find whether the variable has long-run time trend relations or not. The null hypothesis of H0: there is no co-integration (No long-run relationship between variables) is rejection indicates the variables have co-integration. If the p-value > 5, reject the H0. For the test of co-integration, there are two popular methods: the Engle-Granger estimation and Johansen estimation test. In this study, the Johansen Co-integration test applied for the test. If the co-integration test fails to reject H0, the analysis process can apply a simple VAR model for short-run dynamics. But if it is rejected, the process should estimate both the long-run and short-run model which is called Vector Error Correction Model or VECM Model.

H0: $\alpha = 0$, there no cointegration between variables

H1: $\alpha < 0$, There is cointegration between variables

After the time series model design investigation, this study has set the following time series data analysis research model to meet the research objective set.

Vector Error Correction (VEC) Model Estimate

As per the Johansen (1995) co-integration test results, if the null hypothesis (H0) is rejected, the suitable time series analysis model is the vector error correction model (VECM) which defined both long-run and short-run association between the series. Therefore, this study has been employing the multivariate regression model to test the long-run and short-run causal impact between endogenous variables. This study has set the following expanded model of equation 3.5 to 3.8 basic regression models.

$$\Delta FDI_t = \alpha + \sum_{i=1}^{p}\beta_{1i}\,\Delta FDI_{t-i} + \sum_{j=0}^{q}\beta_{2j}\,\Delta TOI_{t-j} + \sum_{k=0}^{r}\beta_{3k}\,\Delta INF_{t-k} +$$
$$\sum_{k=0}^{r}\beta_{4l}\Delta GDPPCG_{t-l} + \delta_1 FDI_{t-1} + \delta_2 TOI_{t-1} + \delta_3 INF_{t-1} +$$
$$\delta_4 GDPPCG_{t-1} + \varepsilon_{it}$$

.... (3.9)

$$\Delta TOI_t = \alpha + \sum_{i=1}^{p}\beta_{1i}\,\Delta FDI_{t-i} + \sum_{j=0}^{q}\beta_{2j}\,\Delta TOI_{t-j} + \sum_{k=0}^{r}\beta_{3k}\,\Delta INF_{t-k} +$$
$$\sum_{k=0}^{r}\beta_{4l}\Delta GDPPCG_{t-l} + \delta_1 FDI_{t-1} + \delta_2 TOI_{t-1} + \delta_3 INF_{t-1} +$$
$$\delta_4 GDPPCG_{t-1} + \varepsilon_{it}$$

.... (3.10)

$$\Delta INF_t = \alpha + \sum_{i=1}^{p}\beta_{1i}\,\Delta FDI_{t-i} + \sum_{j=0}^{q}\beta_{2j}\,\Delta TOI_{t-j} + \sum_{k=0}^{r}\beta_{3k}\,\Delta INF_{t-k} +$$
$$\sum_{k=0}^{r}\beta_{4l}\Delta GDPPCG_{t-l} + \delta_1 FDI_{t-1} + \delta_2 TOI_{t-1} + \delta_3 INF_{t-1} +$$
$$\delta_4 GDPPCG_{t-1} + \varepsilon_{it}$$

.... (3.11)

$$\Delta GDPPCG_t = \alpha + \sum_{i=1}^{p} \beta_{1i} \Delta FDI_{t-i} + \sum_{j=0}^{q} \beta_{2j} \Delta TOI_{t-j} +$$
$$\sum_{k=0}^{r} \beta_{3k} \Delta INF_{t-k} + \sum_{k=0}^{r} \beta_{4l} \Delta GDPPCG_{t-l} + \delta_1 FDI_{t-1} + \delta_2 TOI_{t-1} +$$
$$\delta_3 INF_{t-1} + \delta_4 GDPPCG_{t-1} + \varepsilon_{it}$$

………. (3.12)

Where, α represent the intercept of the model and β and δ represents the coefficient parameter in short-run dynamics and long-run coefficient in the models. Likewise, Δ indicates the lag difference operator to adjust short-run dynamics in the models. Symbol ε indicates the white noise error presence in the co-integrated estimation equations.

The following Vector Error Correction Model (VECM) has been set for the analysis of long-run and short-run causality and speed of adjustment for the equilibrium. The values (p, q, r, t) are the selected number of lags for the co-integrating equations based on AIC. As suggested by Engle and Granger (1987), the short-run dynamic model can be written as an error correction model (ECM) of the following equations:

$$\Delta FDI_t = \alpha + \sum_{i=1}^{p} \beta_{1i} \Delta FDI_{t-i} + \sum_{j=0}^{q} \beta_{2j} \Delta TOI_{t-j} + \sum_{k=0}^{r} \beta_{3k} \Delta INF_{t-k} +$$
$$\sum_{k=0}^{t} \beta_{4l} \Delta GDPPCG_{t-l} + \gamma_1 ECT_{t-1} + \varepsilon_{it}$$

………. (3.13)

$$\Delta TOI_t = \alpha + \sum_{i=1}^{p} \beta_{1i} \Delta FDI_{t-i} + \sum_{j=0}^{q} \beta_{2j} \Delta TOI_{t-j} + \sum_{k=0}^{r} \beta_{3k} \Delta INF_{t-k} +$$
$$\sum_{k=0}^{t} \beta_{4l} \Delta GDPPCG_{t-l} + \gamma_1 ECT_{t-1} + \varepsilon_{it}$$

………. (3.14)

$$\Delta INF_t = \alpha + \sum_{i=1}^{p} \beta_{1i} \Delta FDI_{t-i} + \sum_{j=0}^{q} \beta_{2j} \Delta TOI_{t-j} + \sum_{k=0}^{r} \beta_{3k} \Delta INF_{t-k} +$$
$$\sum_{k=0}^{t} \beta_{4l} \Delta GDPPCG_{t-l} + \gamma_1 ECT_{t-1} + \varepsilon_{it}$$

………. (3.15)

$$\Delta GDPPCG_t = \alpha + \sum_{i=1}^{p} \beta_{1i} \Delta FDI_{t-i} + \sum_{j=0}^{q} \beta_{2j} \Delta TOI_{t-j} + \sum_{k=0}^{r} \beta_{3k} \Delta INF_{t-k} +$$
$$\sum_{k=0}^{t} \beta_{4l} \Delta GDPPCG_{t-l} + \gamma_1 ECT_{t-1} + \varepsilon_{it}$$

………. (3.16)

ECT is the error correction term produced from the OLS residuals through the following long-run co-integrating regression estimates. The rest of the parameters included in the estimate equations defines as in previous equations.

$$\Delta FDI_t = \alpha + \delta_1 \Delta FDI_{t-1} + \delta_2 \Delta TOI_{t-1} + \delta_3 \Delta INF_{t-1} + \delta_4 \Delta GDPPCG_{t-1} + \varepsilon_{it}$$ ………. (3.17)

$$\Delta TOI_t = \alpha + \delta_1 \Delta FDI_{t-1} + \delta_2 \Delta TOI_{t-1} + \delta_3 \Delta INF_{t-1} + \delta_4 \Delta GDPPCG_{t-1} + \varepsilon_{it}$$ ………. (3.18)

$$\Delta INF_t = \alpha + \delta_1 \Delta FDI_{t-1} + \delta_2 \Delta TOI_{t-1} + \delta_3 \Delta INF_{t-1} + \delta_4 \Delta GDPPCG_{t-1} + \varepsilon_{it}$$ ………. (3.19)

$$\Delta GDPPCG_t = \alpha + \delta_1 \Delta FDI_{t-1} + \delta_2 \Delta TOI_{t-1} + \delta_3 \Delta INF_{t-1} + \delta_4 \Delta GDPPCG_{t-1} + \varepsilon_{it}$$ …. (3.20)

Empirically the error correction term (ECT) is defined as:

$$ECT_{t-1} = \Delta FDI_{t-1} - \alpha - \delta_2 \Delta TOI_{t-1} - \delta_3 \Delta INF_{t-1} - \delta_4 \Delta GDPPCG_{t-1}$$ ………. (3.21)

$$ECT_{t-1} = \Delta TOI_{t-1} - \alpha - \delta_2 \Delta FDI_{t-1} - \delta_3 \Delta INF_{t-1} - \delta_4 \Delta GDPPCG_{t-1}$$ ………. (3.22)

$$ECT_{t-1} = \Delta INF_{t-1} - \alpha - \delta_2 \Delta FDI_{t-1} - \delta_3 \Delta INF_{t-1} - \delta_4 \Delta GDPPCG_{t-1}$$ ………. (3.23)

$$ECT_{t-1} = \Delta INF_{t-1} - \alpha - \delta_2 \Delta FDI_{t-1} - \delta_3 \Delta INF_{t-1} - \delta_4 \Delta GDPPCG_{t-1}$$ ………. (3.24)

To find the causal relationship between foreign direct investment, trade openness, inflation and economic growth in Nepal, the study will try to provide the empirical evidence from various tests based on VECM estimated results. The additional test for residual serial correlations LM test, residual normality test, Heteroskedasticity test, and CUSUM test for the model stability over the study period. The CUSUM test was also performed based on initial OLS for the structural break existence in the procedure. But base on VECM estimates results

will give overall model stability and also helps to justify regression results produced by the estimated research design and model.

IV.   EMPIRICAL ANALYSIS RESULTS AND DISCUSSION

4.1   Test for the stationary

The presence of unit root is tested by using the Augmented Dickey-Fuller (ADF) test equations. The result of ADF unit root tests has been done at the level and first difference to confirm the presence of unit root in the data series which is reported in table 4.1.

Table 4.1: ADF Unit Root Test Results for the FDI, TOI, INF and GDPPCG.

Variables	At level		At first difference	
	Intercept	**Intercept and Trend**	**Intercept**	**Intercept and Trend**
FDI	0.3016	0.0028**	0.0000***	0.0001***
TOI	0.3100	0.6496	0.0000***	0.0001***
INF	0.0201	0.0000***	0.0000***	0.0000***
GDPPCG	0.7117	0.0000***	0.0000***	0.0000***

Null hypothesis H0: The series has the presence of unit root and the P-values reported at level and first difference are Mackinnon (1996) one-sided p-values. Asterisks: *** and ** represents the no presence of unit root at 0.01 and 0.05 level of significance.

Source: The results reported are the author's own calculation by using E-views software.

The Augmented Dickey-Fuller test's results at level have rejected the null hypothesis (H0) indicating that there is a presence of unit root for the series of FDI, TOI, FNF, and GDPPCG. However, the ADF test statistics p-value suggests that at level with intercept and trend have failed to reject the null hypothesis (H0) of the series of FDI, INF, and GDPPCG indicating that the series has no presence of unit root. But the series of TOI has rejected the null hypothesis (H0) which shows that the series of TOI has a presence of unit root. Thus, at level, there is a mixed result while testing the ADF unit root test and further analysis at first difference which provides the evidence of all series has no unit root at both cases of with constant and with constant and trend assumptions.

4.2   Johansen Co-integration Test

Using the VAR Lag selection information criterion for the optimal lag selection, a suitable lag length of 1 is selected based on LR, FPE, AIC, SC, and HQ. The results of lags length selection based on VAR lag order selection criteria of FDI, TOI, INF, and GPPCG has been presented in table 4.2.

**Table 4.2: The results of VAR lag selection criteria of series
FDI, TOI, INF, and GDPPCG**

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-175.5818	NA	0.041225	8.162772	8.324971	8.222923
1	-112.3864	112.0268*	0.004844*	6.017563*	6.828559*	6.318319*
2	-96.42391	25.39486	0.004948	6.019268	7.479960	6.560630
3	-82.61243	19.46162	0.005741	6.118747	8.227335	6.900713
4	-71.73767	13.34630	0.007982	6.351712	9.109096	7.374283

Source: The results reported are the author's own calculation by using E-views software

(Note: The asterisk (*) represents the suitable lag length for the analysis based upon different assumptions.)

Based on the VAR lags selection criteria test results presented in table 4.2 the analysis has been done using maximum lag value of 1. Further, analysis go with the test of co-integration estimation. The multivariate Johansen co-integration estimation results have been reported in table 4.3.

<div align="center">

Table 4.3: Johansen multivariate co-integration test results

</div>

Co-integration Rank Test (Trace)					
Hypothesized no of CEs	**Eigenvalue**	**Trace Statistic**	**0.05 Critical Value**	**P-Value**	**Remarks**
None*	0.651524	97.09573	47.85613	0.0000	Co-integration
At most 1*	0.572362	48.60315	29.79707	0.0001	Co-integration
At most 2	0.133571	9.527187	15.49471	0.3189	
At most 3	0.061749	2.931959	3.841465	0.0868	
Co-integration Rank Test (Maximum Eigenvalue)					
Hypothesized no of CEs	**Eigenvalue**	**Max-Eigen Statistics**	**0.05 Critical Value**	**P-Value**	**Remarks**
None*	0.651524	48.49259	27.58434	0.0000	Co-integration
At most 1*	0.572362	39.07596	21.13162	0.0001	Co-integration
At most 2	0.133571	6.595229	14.26460	0.5381	
At most 3	0.061749	2.931959	3.841465	0.0868	

Note: Foreign direct investment, trade openness index, inflation and GDP per capita growth are included in the co-integration equation. The trace test and Maximum Eigenvalue indicates 2 co-integrating equations based on linear deterministic trend assumption at 0.05 level. The model assumptions have taken from Akaike Information Criteria. * denotes rejection of the hypothesis at the 0.05 level. The probability value is based on Mackinnon-Haug-Michelis (1999). The null hypothesis is H0: There is no co-integration (No long-run relationship between variables). The data results are calculated by using E-views software.

Source: The results reported are the author's own calculation by using E-views software.

The hypothesized equations have been rejected null hypothesis i.e. H0: There is no co-integration or there is no long-run relationship between and the variables. It means there is a long-run relationship among the series and the time series analysis model should be estimated both long-run and short-run through the Vector Error Correction (VEC) models which are also supported by the Johansen normalization results. The results show that in the long run, TOI and INF have a positive and significant impact on FDI. However, there is a negatively significant impact of GDPPCG on GDI in long run as per the normalized co-integration coefficients estimation. Overall, the co-integration estimation results suggest that there exists a long-run relationship between the dependent and independent variables. Therefore, further analysis should be done considering both long-run and short-run estimations.

4.3 Vector Error Correction Model Results

As suggested by the Johansen co-integration test results, the null hypothesis of no co-integration between the variables has been rejected. The Johansen co-integration results show there exists a long-run relationship between the series. Therefore, the study has employed the Vector Error Correction Model (VECM) for the investigation of the long-run and short-run causal relationships between the endogenous variables. The results for the long-run co-integration between foreign direct investment (FDI) as a dependent variable and trade

openness index, inflation, and gross domestic product per capita growth as independent factors are presented in table 4.4.

Table 4.4.: Results of long-term impact analysis through Vector Error Correction Estimates with the observation from 1972 to 2019

Name of Variables	Coefficient	t-value
TOI (t-1)	3.286210	(4.00637)
INF(t-1)	0.148934	(7.12004)
GDPPCG(t-1)	-0.321821	(-5.75858)
Constant	-2.015557	

Source: The results reported are the author's own calculation by using E-views software. The dependent variable is foreign direct investment (FDI).

Table 4.4 shows the beta coefficient of TOI is significant positive impact of TOI in long-run with FID indicating that the trade liberalization has a long-run causal relationship between TOI and INF in Nepal. Similarly, inflation is also directly associated with FDI. However, FDI is inversely affected by GDPPCG as the beta coefficient of GDPPCG is negative and significant at 0.01 level of significance.

Table 4.5.: Results of short-term Vector Error Correction Estimates with the observation from 1972 to 2019

Error Correction:	ΔFDI	ΔTOI	ΔINF	ΔGDPPCG
Co-integrating Equation	-0.03868	0.003633	-6.304528	1.944241
	(-1.02219)	(0.48400)	(-5.79199)	(2.95817)
ΔFDI(t-1)	-0.318469	-0.015773	5.473034	-0.633435
	(-2.05633)	(-0.51351)	(1.22869)	(-0.23551)
ΔTOI(t-1)	0.249662	0.126120	-25.28198	-9.437228
	(0.32961)	(0.83953)	(-1.16051)	(-0.71743)
ΔINF(t-1)	0.000588	0.000333	0.161191	-0.219278
	(0.13642)	(0.39004)	(1.30031)	(-2.92954)
GDPPCG(t-1)	-0.017876	0.002813	-0.870604	-0.177061
	(-1.83770)	(1.45827)	(-3.11181)	(-1.04812)
Constants	0.014144	0.006990	0.503847	0.241195
	(0.52388)	(1.30536)	(0.64886)	(0.51442)
R-squared	0.230906	0.091705	0.512472	0.447616
F-statistics	2.401856	0.807708	8.409304	6.482676

Source: The results reported are the author's own calculation by using E-views software. The values in a parenthesis is t-value.

Table 4.5 presented error correction estimates and short-run model output. The major concern in this table is estimated VECM with the target variables. The coefficient of the co-integration equation is negative i.e. -0.038686. The error correction coefficient gives the speed of adjustments within which the model will restore its equilibrium point following any disturbances but the adjustment coefficient at the first difference of GDP is not significant. The EC coefficient -0.038686 means that the speed of disequilibrium adjustment is 3.87

percent. In another word, the previous year's deviation for the long-run equilibrium is corrected at the speed of 3.87 percent on an average.

Similarly, the coefficient of FDI at the first difference is -0.318469 and significant. The result indicates that there is a negative impact of time trends on FDI in the short run. The coefficient of the trade openness index is positive with the FDI, which indicates that trade liberalization has a positive impact on foreign direct investment in Nepal. The trade openness policy attracts inflow FDI in the country and this policy is the basic foundation of FDI inflow. However, trade openness policy has a strong impact in long run than in the short run as the long-run co-integration coefficient is significant but the short-run coefficient is not significant. As the objective of this analysis is to see the role of trade openness for FDI inflow in Nepal, the analysis results provide empirical evidence of significant impact in the long run.

Likewise, the coefficient of inflation is positively significant in long run with FDI. However, the coefficient of INF with FDI is not significant in the short run. The results show that the inflation rate highly influences FDI in long run. But the interesting result from this analysis is the relationship between FDI and GDPPCG. The coefficient of GDPPCG is negative with FDI in both the short-run and long-run. In long run, the coefficient is negatively significant indicating that the higher the GDPPCG lower would be the FDI inflow. In another word, when the country has a higher growth rate in GDP per capita, the inflow will be decline significantly ceteris paribus. The results also explain that advance and high-income economies may have a low level of foreign direct investment in comparison to low and middle-income countries.

Further, for the long-run and short-run causality, I have to perform VAR model estimation based upon the error correction model. Therefore, the vector error correction model estimates' output is presented in table 4.6.

Table 4.6: The results of causality test through VEM estimates

	Coefficients	Std. Error	t-Statistic	Probability
Dependent variable: GDP Per Capita Growth				
Long-run coefficient	-0.038686	0.037846	-1.022194	0.3128
Short-run coefficient	-0.318469	0.154873	-2.056328	0.0463
TOI	0.249662	0.757449	0.329609	0.7434
CPI	0.000588	0.004310	0.136418	0.8922
GDPPCG	-0.017876	0.009727	-1.837705	0.0735
Constant	0.014144	0.026999	0.523876	0.6033
R-squared	0.230906			
Adj. R-squared	0.134770			
F-statistics	2.401856			
Pro (F-statistic)	0.053783			

Source: The results reported are the author's own calculation by using E-views software.

Table 4.6 presents the least Squares (Gausss-Newton/Marquardt steps) output based on VEC model estimates. The long-run coefficient is negative but not significant. It indicates that there is no significant long-run causality between foreign direct investment and trade openness, inflation, and GDP per capita growth. The coefficient having a negative sign shows the ability to bounce back to the equilibrium position.

The short-run coefficient is negative 0.318469 which indicates that a one percent increase in itself will lead to a decline in FDI to GDP ratio by 0.3185 percent which is also significant at the five percent level of significance. Similarly, the coefficient of the trade openness index is 0.249662. It shows that the one-point increase in the trade openness index will lead to an increase in FDI by 0.24662 and vice-versa. The coefficient of inflation is 0.000588. The result shows that a one percent increase in inflation will lead to an increase in FDI by 0.000588 percent and vice-versa. However, the coefficient of inflation is not significant. The coefficients of GDP per capita growth which is negative but not significant at a 5 five percent level of significance. The coefficient is -0.017876 which indicates that a one percent increase in GDP per capita growth leads to decreasing FDI inflow by 0.017876 percent and vice-versa.

4.4   The Results of Wald Test

These estimates give the general idea about the long-run and short-run causality between the dependent and independent variable but more investigation is needed to justify the idea generated from the VECM estimated results in a given condition. Therefore, the study also performs the Wald test to ratify the conclusion from the VECM estimate result and the results are presented in table 4.7 and table 4.8 respectively.

Table 4.7: Wald test results after the restriction of INF and GDPPCG

Test Statistic	Value	DF	P-Value
F- statistic	1.862688	(2, 40)	0.1686
Chi-square	3.725377	2	0.1553

Source: The results reported are the author's own calculation by using E-views software.

Table 4.7 presents the results of the Wald test with the restriction of inflation and GDP per capita growth in the model at the same time. From the test results, the Chi-square probability value fails to reject the null hypothesis of $C(4)=C(5)=0$. This means the joint impact of inflation and GDPPCG on the FDI is significant. Similarly, a test also has done with restricting trade openness and the results are presented in Table 4.8.

### Table 4.8: Wald test results after the restriction of TOI

Test Statistic	Value	Df	P-Value
t- statistic	0.329609	40	0.7434
F-statistic	0.108642	(1,40)	0.7434
Chi-square	0.108642	1	0.7417

Source: The results reported are the author's own calculation by using E-views software.

Table 4.8 provides the Wald test result of coefficient restriction of trade openness. The p-value of chi-square is far greater than 0.05 which fails to reject the null hypothesis indicating that trade openness has a significant impact on FDI. Therefore, these coefficients diagnostic results provide empirical evidence of the impact of the trade openness, inflation, and GDP per capita in Nepal's case.

4.5   The results of normality test

For the VECM estimate residual test, the following figure 4.1 has been presented below.

Figure 4.1: Results of normality test from the VECM estimates
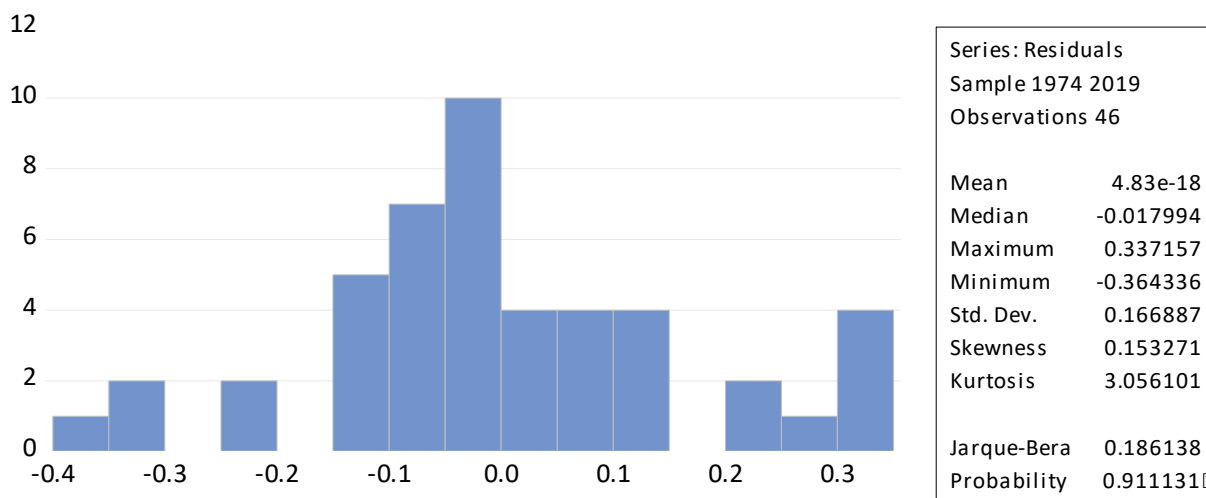
Source: The results reported are the author's own calculation and plots by using E-views software.

For the diagnostic test of residual distribution, normal histogram normality test methods have been employed with necessary information. The interest is in the value of the Jarque-Bera probability value in the figure. As a rule of thumb, if the p-value of JB is greater than five percent, we reject the hull hypothesis and accept the alternative hypothesis. In this case, the probability value if 0.911131 which is greater than 0.05. The result indicates that the residual distributions are normally distributed.

4.6   The results of serial correlation test

To test the presence of serial correlation test, the study performed the Breusch-Godfrey Serial Correlation LM Test and the result found there is no serial correlation in the model. As the null hypothesis H0: no serial correlation at up to 1 lag is accepted which means the model has no serial correlation. The Breusch-Godfrey serial correlation LM test result is presented in table 4.9.

Table 4.9: Results of serial correlation test

Test statistics	Results
F-statistics	0.540148
Obs*R-squared	0.628394
Probability of F(1,39)	0.4668
Probability of Ch-Square (1)	0.4279
Durbin-Watson statistic	2.030014

Source: The results reported are the author's own calculation by using E-views software.

Table 4.9 provides the result of the Breusch-Godfrey serial correlation LM test for the examination of whether the model is fit or not. The result shows that the probability value of Chi-square is greater than 0.05 which fails to reject the null hypothesis of no serial correlation at up to 1 lags. This result indicates that the series is free from the serial correlation. Hence, the estimated model is fit. The result of the Chi-square test is also supported by the Durbin-Watson statistic as the value of DW = 2.030014 which is almost equal to 2.0.

Another residual test has been done for the Heteroskedasticity test. The result of Heteroskedasticity fails to reject the null hypothesis of no Heteroskedasticity. The keen

interest in analysis the heteroskedasticity also in Durbin-Watson statistic value. The DW value is 1.992090 which is also about 2.0. Therefore, the analysis results concluded that there is no presence of any Heteroskedasticity in the data. On the other hand, if the probability of Chi-Square distribution is greater than 5 percent then we can say that there is no Heteroskedsticity in the data. In this way, with the help of this test, the study result can be concluded that the regression results of the model are not spurious.

4.7   The results of model stability test

The results will be valid and applicable only if the model is stable over the observation time period. Thus, for the model stability diagnostic purposed, the study used performed recursive estimation applying the CUSUM test and the test of the coefficient recursive method. The results of CUSUM and coefficient recursive rest are presented in figures 4.2 and 4.3 below.

Figure 4.2: The result of squares tests
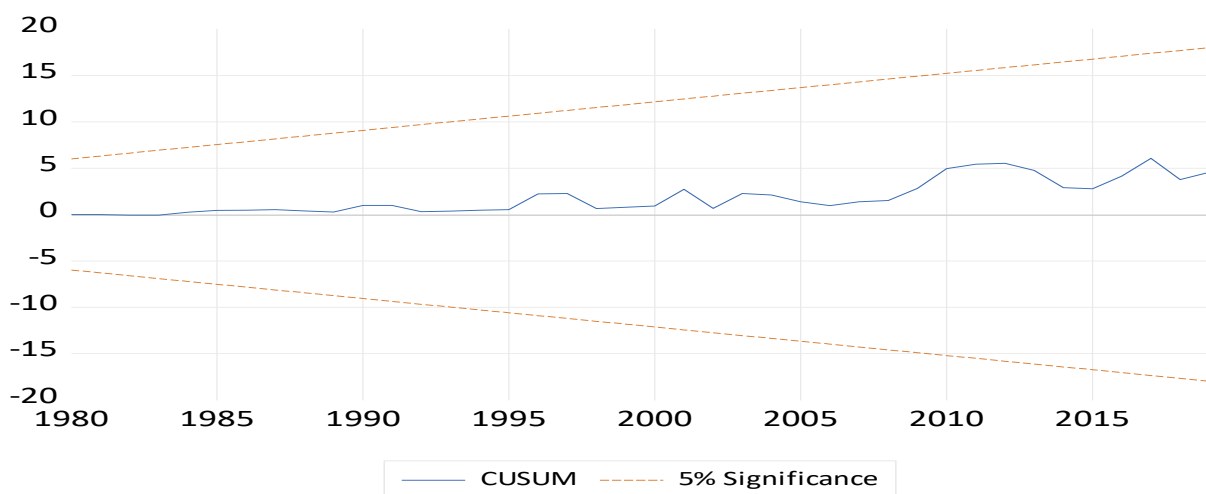
Source: The results reported are the author's own calculation and plots by using E-views software

The model stability test gives the fluctuation detection over the time period. The time series fluctuation is lies within the upper bound and lowers bound of critical value at a 5 percent level of significance. Figure 4.2 shows the CUSUM test is moving within the critical value indicating that the model is stable over the study period. This figure has also provided evidence of an appropriate model section without taking a structural break. This study has not used structural break for the empirical analysis based on the CUSUM test result.

The study has also been used another model stability test by using the coefficient recursive estimation and the test results are presented in figure 4.3.

***Figure 4.3*: The result of coefficient recursive rests**
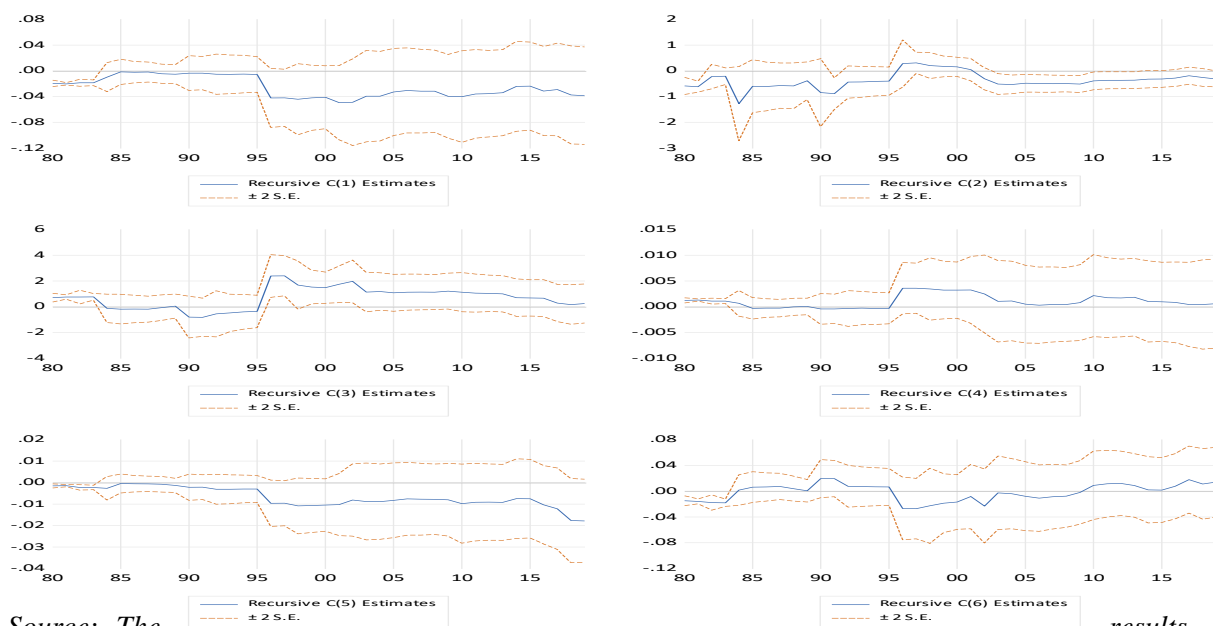
The model stability test by using coefficient recursive estimation has been presented in figure 4.3 which shows that the time series fluctuation lies within the upper bound and lower bound of critical value at a 5 percent level of significance. The coefficient recursive estimations are moving within the critical value which indicates the model is stable over the observation period. Both the stability test results provide evidence of stability in the model. Therefore, the empirical analysis results of this study are valid to be generalized.

V. SUMMARY AND CONCLUSION

This paper has examined the impact of the trade liberalization on foreign direct investment in Nepal by using time series data from the period 1972 to 2019. The time-series data of foreign direct investment, trade openness index, and inflation and GDP per capita growth has been used which were extracted from the World Bank Development Indicators. As the data has the presence of stationary at different levels in the original series, the study has used the Johansen co-integration test to confirm the long-run relationship between the variables. The results of the Johansen co-integration test reject the null hypothesis of no co-integration which indicates that there is a long-run relationship between the series. As suggested by Engle and Granger (1987), the co-integrated series has to go with the vector error correction model (VECM) for the long-run and short-run relationship analysis between the variables.

The VEC estimate supports that there is a significant relationship between trade openness, inflation, GDP per capita growth, and foreign direct investment flows in the long run. Similarly, the short-run coefficient is also significant at a 5% level of significance which indicates that there is a short-run causal relationship between trade openness, inflation, GDP per capita growth, and foreign direct investment flow in Nepal. The presence of causality was also tested by using the Wald test which also provides evidence of short-run causality of trade openness and joint impact of inflation and GDP per capita growth on foreign direct investment. The examination of residual distribution has been done using the Jarque-Bera test which shows the residuals are normally distributed. The Durbin-Watson statistics results found there are no autocorrelations and Heteroskedasticity presence in the data. Similarly, the CUSUM and coefficient recursive estimates test results also provide evidence of the model

stability during the observation period. Therefore, these robustness test results concluded that the analysis results are not spurious to the generalization and implementation of the study outcomes.

Overall, the analysis suggests that trade openness is important factor for the attraction and inflow of foreign direct investment in Nepal along with domestic inflation and GDP per capita growth. Therefore, the government of Nepal and the stakeholders: the National Planning Commission (NPC), Nepal Rastra Bank (NRB), Export-Import Promotion Centre (EIPC), the ministry of finance (MoF), Investment Board of Nepal (IBN), the Ministry of Industry, Commerce and Supplies (MoICS), etc. should be focused in promoting international trade and provide an easy way of return transfer to attract the foreign direct investment in Nepal. While making foreign and domestic investment policies, they have also need to keep in mind that the investors are attracted by the investment return, investment environment, and transfer policy of their investment return in the future.

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Greening the financial system of Nepal-
Why Green finance?

Dipti Dhungel *

Abstract

The topic of green finance has been the burning issue in the world when it is felt that the environment and ecology has been degrading. The Paris Agreement 2015 on climate change gave the boost for rising importance of green finance. The developed and developing country around the world started to take a green finance as an important tool to protect the environment; they started to integrate it into the policies of the country. China is the leader in green finance as of today in the world. Green finance has a wide variety of scope ranging from environmental protection to achieving sustainable development goals to increasing the firm performance. Green finance is not only related to climate finance but it has a wider scope for environmental finance like pollution control, waste management, renewable energy and many more. Since Nepal is one of the highly polluted country in the world and very vulnerable to climate change the need of green finance in the country is necessary to combat the pollution and climate change. The time has begun to green the financial system of the country and since the bank largely covers the financial system of Nepal, the banks have to play in a front role to green the financial system of the country.

Key Words: Green Finance, Sustainable, Environment, Financial system

JEL Classification: P18

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I. INTRODUCTION

Green finance is one of the controversial topics around the world. It is a hot topic which requires a serious and practical study rather than empirical research based on the theoretical background. Besides its importance and necessity in today's world, this has been neglected since many years. The green finance was in shadow for years until the rise of Paris Agreement 2015. Green finance is still in developing stage so there is no clear meaning of green finance. But generally the green finance is defined as any structural financial activity that has been developed for better environment. In other words, a product or service invented to have better environment outcome is defined as green finance. Green finance is blossoming slowly as the world has felt the necessity of green finance. Green finance generally includes but not limited to loans, debt mechanisms and investments that are used to encourage the development of green projects to minimize the impact of more regular projects. Green finance is a phenomenon that conglomerates the finance and business from the perspective of environment (Wang & Zhi, 2016).

Green finance means different to different people but the major objective is to preserve the environment with better integration of financial incentives. In comparison to traditional thoughts the green finance is more about ecology and environment protection. It is an arena for many stakeholders like investors, producers, consumers, governments, national and international organization at a large (Yu et al., 2021). Green finance is essential in financing renewable and green energy projects in order to reduce carbon emissions and its negative health impacts and ensure environmental sustainability. According to (Zhang, 2018), energy finance is categorized broadly into six themes: pricing mechanism, energy and financial markets (Zhang, 2018); pricing mechanism (Zavadska et al., 2018); energy corporate finance (Ghouma et al., 2018); green finance and investment (Sachs et al., 2019a); Taghizadeh-Hesary & Yoshino, 2019); energy derivative markets (Ji et al., 2020) and energy risk management (Zheng et al., 2021). Green finance integrates environmental protection with economic profits emphasizing two controversial issues "green'' and "finance". The study on green finance lacks detailed studies regarding to mechanism exploration, market research and policies.

Gilbert (2012): "Green finance is a broad term that can refer to financial investments flowing into sustainable development projects and initiatives, environmental products, and policies that encourage the development of a more sustainable economy. Green finance includes climate finance but is not limited to it. It also refers to a wider range of other environmental objectives, for example industrial pollution control, water sanitation, or biodiversity protection. Mitigation and adaptation finance is specifically related to climate change related activities: mitigation financial flows refer to investments in projects and programs that contribute to reducing or avoiding greenhouse gas emissions (GHGs) whereas adaptation financial flows refer to investments that contribute to reducing the vulnerability of goods and persons to the effects of climate change." Green investment mainly refers to investment in renewable energies, biodiversity, water sanitation, industrial pollution control, energy efficiency and many more. Green finance has been emerged as a new means of environmental governance and has been rapidly developing around the world.

Green finance is made up of two words "green" and "finance". The term finance is related with the financial system of the country. In developing country like Nepal the bank covers a large part of the financial system. Banks have a major role to play in achieving sustainability because they are the bridge between people with surplus and organization with shortages. Also the operational activities of the banks have an important effect in the environment (Peeters 2003). In past decades' new features have emerged putting more emphasis on environment. This feature seems no prominent in Nepalese banking industry. The government

policy is must to make green finance prominent in the country. The policy must be to use green channels while lending to eco-friendly enterprises. This policy allows to transmit the idea of sustainable development by lenders to the debtors forcing them to take eco-friendlier actions (Jeuken 2002). The banks have a greater role to play in mainstreaming the environment into economic development. The bank can take many initiatives like financing clean production, saving energy, reducing waste, eco innovations and environmental investments (Ryszawska & Zabawa, 2018).

The world we live in today is highly pollutant. The global temperature is rising, the ecological environment is changing, climate is changing unexpectedly due to high carbon emissions. The economic growth is not sustainable because the growth has been heavily skewed in favor of rich and has been environmentally destructive. The world's greatest environment threat is the climate change. (Sachs and Du Toit 2015) decisive action is yet to take if the governments have to keep global warming below 2ºC as per the agreement. Finance has been a powerful enabler of human progress after industrial evolution. The purpose of the financial system is to allocate funds from surplus unit and to deficit unit for the productive uses. When the financial system works properly then the GDP of the country rises which ultimately increase the living standard of the people but if does not work properly then the funds are channeled into real estate bubbles and harmful projects that exacerbate the human induces climate change (Sachs et al., 2019a). The finance which finance the climate change is generally considered as green finance but the green finance is not only limited to climate change finance but also covers a wide area of environmental finance. Green finance includes financial products that protect the environment from pollution, balanced ecology and unexpected nature change.

The role and function of the banks has been changing. Banks are going for sustainable economy because they are the main actors for supporting the sustainable economy. The concept of sustainable development has been emerged as an important objective for policy makers on the part of government and business levels. It is due to an increased awareness and acceptance of sustainable practices by corporations and shift towards expanding corporate goals from growth and profitability to sustainability. Banks will no longer be acting as an intermediary between investors and consumers. Banks are the active actors in both the economic and environmental and social processes. Banks are the highly trusted institutions and a major determinant in the areas related to CSR with particular emphasis on pro-environmental activities.

Nepal is a developing country with the growing economy. The economic development of any country depends on its financial system. For the developing country like Nepal the financial system has a huge role to play in the country economy. The financial system of Nepal is largely dominated by the banks. There has been a major change in the financial system around the world. The neighboring countries like India and Bangladesh have gone too far in embracing the green in their financial system. The main function of the bank is to collect funds form smaller units who have excess funds and lend to the big business houses who could actually generate huge profit. The operation and functions of the Nepalese banking is not integrated with environmental protection. The regulatory authority has set mandatory regulation for spending on Corporate Social Responsibility out of their profit but the CSR spending is not done on environmental protection. The banking of Nepal is conventional having no alignment with environmental risk management. This is due to the lack of practice and judgment and on the part of employees, decision maker and regulating authority.

II. GREEN FINANCE FOR ENVIRONMENT

The roots of green finance can be traced back to 1970s. The study and research on green finance dates back to 1991 but it took almost 20 years to grow and attract the researcher on

this discipline. The reason behind its steady growth is the awareness of the people towards the environment protection and climate change. The detailed negotiation of the Paris Agreement in the year 2018 gave a push for explosive growth for green finance (Xiobing Yu). The scholars around the world felt the sense of importance of green finance and start researching on this discipline. The quantity and quality both of green finance started to risen up. Green finance has been the matter of study for many countries around the world. In Bangladesh the private commercial bank is one of the highest contributor to green finance accounting for 78.12% of total green finance (Zheng et al., 2021). The green finance was popularized by Bangladesh when the Bangladesh bank set up green banking guidelines in 2011. There is much more to learn from China in transition to low carbon economy by the use of green finance.

There are altogether 76 countries round the world who have researched in the field of green finance as of today (Yu et al., 2021). The neighboring countries like India, Bangladesh and China have already started green finance in the year 2011. China took a leadership in the green finance after the ratification of the Paris Agreement. China has become one of the largest investor on renewable energy as it has taken green finance as a major strategy for supporting a low carbon emission. It depicts that the for protecting our environment and ecology huge investment is required which is possible only through green finance and greening the financial system. Instruments of green finance means the methods for financing green projects which includes green bonds, green banks and village funds etc. these instruments have huge potential to support clean energy development (Sachs et al., 2019). To make green finance work in real life the financial instruments play a very crucial role. Among the instruments listed above the green bond has an exponential growth. Green bonds are like an ordinary bond with just the addition of green on it. This implies that the fund raised from green bonds can only be spent on renewable and sustainable energy projects. The green bonds gain its momentum when for the first time the European Investment Bank (EIB) issued the first climate awareness bond for financing its renewable energy and energy efficiency improvement projects in the year 2007. The green bond started to take an initial growth and in 2013 it took rapid growth in the bond markets. It started from Europe initially but it has started to move to developing countries.

Green banks and green bonds have huge potential to finance clean energy development (Sachs et al., 2019). The advantages of green banks include offering better credit conditions for clean energy projects, the ability to aggregate small projects to achieve a commercially attractive scale, creation of innovative financial products, and market expansion through dissemination of information about the benefits of clean energy.

Green finance has led to the significant reduction of industrial gas emissions (Muganyi et al., 2021). Green finance has been expected to play an important role in the attainment of the climate change goals outline in the Paris Agreement. Huge upfront capital investment is required for the environment protection so the green finance is the one which helps in financing the protection of environment.

III.   GREEN FINANCE FOR SUSTAINABLE DEVELOPMENT GOALS

Green finance plays an important role in meeting the sustainable development goals of United Nations. They have started to work with public and private sector organization in order to align with the international financial systems to the agendas of sustainable development. Some of the activities UN Environment is involved include helping countries re-engineer their regulatory frameworks – so that green borrowing becomes compliant, for example – and helping steer public sector planning in a more environmentally friendly direction. Increasing

green finance, climate finance and low-carbon investments are directly and indirectly related to various SDGs (Sachs et al., 2019).

Table 1: Green Finance and SDG

Relationship	SDG Number	Definition
Direct	SDG 7	Affordable and clean energy
	SDG 11	Sustainable cities and communities
Indirect	SDG 13	Climate action
	SDG 3	Good health and well-being
	SDG 14	Life below water
	SDG 15	Life on land

Source: (Taghizadeh-Hesary & Yoshino, 2019)

There are two main reasons for Nepalese banking system not being sustainable is it systematically transfers resources from poor to rich and the paradigm of money must growth drives production to ever higher levels. Companies and societies have not care about the negative effects on environment and nature. They are concentrated only in generating profit.

Nepal as member of UN, the Sustainable Development has been its agenda since last two decades. United nation's sustainable development agenda become Nepal's socio-economic development goals for the nation's welfare and prosperity as per National Planning Commission 2015 after agreeing on UN general Assembly conference held in September 2014. The sustainable development goals are aligned with social, economic and environment aspirations which Nepal has set in its new constitution in order to achieve common development objectives. SDGs are the commitment shared by the Nepal and its people for the shared progress, not for achieving international milestone. Nepal has agreed to achieve sustainable development goals by 2030. To meet this agenda and to align with the Paris Agreement there must be a significant shift and scale up in green finance and investment. Large-scale private sector engagement and investment in developing countries will be needed to drive their transition to low-carbon and climate-resilient economies. The gap of green investment in Nepal is huge and the bridging of this gap is the major role to be played by the central bank of Nepal. To meet the agenda of 2030 sustainable development goals and 2015 sustainable development goals there is an immediate requirement of US\$ 1.5 trillion annually as per the Paris Climate Change Agreement (PCA) (Naidoo, 2020).

The focus of green finance should not be only energy financing such as natural gas, oil, wind power, solar energy and so on. There is need of more exploration on reducing the risk and cost associated with green financing for the support and development of renewable energy industry. The development of solar energy system is restricted by the lack of appropriate financing. The financing system should be such that it should promote the extensive use of renewable energy. The long term investment in for green energy projects is not as sufficient as it should be around the world because the private sector has not shown interest and the public sector cannot afford it. The financing of green energy projects that provide the environmental benefits must be scale up if we want to achieve the SDGs through various financial instruments and financial policies.

Public and private both investment is required for a green economy, to fight against poverty and to achieve the SDGs. The financial system should look for future market prices and policies rather than today. Financial leaders must play their vital role in sustainable development. Banks are reluctant to finance on green projects because they found it very risky

and also due to the restriction of Basel capital requirement being placed on. Green finance can be regarded as a vital financial instruments for improving the sustainability performance of an organization and the achievement of SDGs in a country. Green finance has emerged as key topic underpinning policy development for sustainable development and financial market development. Supporters of green bonds believe that they can provide long-term, reasonably priced capital to refinance a project once it has passed through the construction phase and is operating successfully (Natural Resources Defense Council 2016). The model of green bonds has been applied for raising finance for all 17 SDGs.

IV. GREEN FINANCE AND FINANCIAL PERFORMANCE

There are plenty of research around the world regarding the impact of green finance on the financial performance of the banks. Many studies have found that the green credit improve the financial performance of the banks (Rochlin et al. 2005; Cilliers 2012; Richardson 2014). (Zhang, 2018) found out that the green credit has positive impact on the financial performance of the banks. Green credit can actually enhance the social responsibility of the debtors which has a positive impact on its profitability. Most studies found that there is a positive correlation between environmental and economic performance at the firm level (Albertini, 2013). In developed countries the market pays a premium on share price for green firms rather than non-green firms.

The economic profitability of the banking has been considered as the most important element impacting green finance in the banking sector (Zheng et al., 2021). Financing on ecofriendly projects facilitates the long term economic progress of the country boosting the banks competitive edge (Zheng et al., 2021). The environmental friendly projects should be funded through sustainable banking if the bank is to strengthen the competitive advantage and generate more revenue. The future market value of the company and the future profitability depends on green practices of the firm (Stefan & Paul, 2008). The governments should be more supportive to the green organization. People in the developed country value and prioritize the firm which have green practices. This shows that the people around the world are getting more concerned about the green firm and projects. The day is no longer far away when the non-green firm may extinct from the city as the environmental degradation is rising at a higher speed. Therefore, in long term the firm which have finance its business through green credit is going to be more profitable and sustainable.

V. CONCLUSION

The relevance of green finance has been growing up over the past few years. Green finance is important and necessary to achieve the sustainable development goals of the country. Green finance is not only limited to climate finance but it covers other aspects like pollution control, waste management financing and so on. The rational market mechanism of green finance can guide the flow of funds and achieve effective management of environmental risk and optimal allocation of environmental resources and social resources (Wang & Zhi, 2016). The government and policy around the world has started to adopt various economic measures for expanding renewable energy sources and sustainable development, mitigate the climate change and to protect the ecology where we live in. The banking of Nepal is traditional which allocates the surplus funds to scarce ones. The banking of Nepal is found to be highly profit oriented without being responsibile to the environmental aspects. This is the high time when Nepal should start green financing as Nepal ranks the 9th most vulnerable country to climate change in the world as per the Global Climate vulnerability index 2020. Nepal has taken only a baby steps by adopting "Guidelines on Environmental and Social risk management for Banks and Financial Institutions" by the central bank of Nepal in 2018. This is not sufficient

for low carbon transition, protect our environment or combat climate change. The green finance has come into practice as this has not been yet started in our country. There is an immediate need of Nepal for greening the financial system as Nepal is supposed to reduce the carbon emissions. Nepal's financial system which is mostly dominated by banks seems to have make investment in agriculture, assets financing and real estate. This has posed a threat to high environmental risk and climate change. Nepalese banks have limited knowledge on environmental risk calculations which have made their investments highly risky. Banks have always shown a keen interest in profitable business only. The environmental responsibility of the banking seems to have been neglected. The whole financial system needs to participate in green finance.

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The impact of bank-specific factors on the banking sector development in Nepal

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Abstract

This study explored the impact of bank-specific factors on the banking sector development in Nepal using the ARDL approach technique with economic time series data ranging from 1995 to 2020. The study employed the Autoregressive Distributed Lag (ARDL) model to avoid the spurious regression problem in the construction of contemporary time series econometrics. The study depends on the co-integration analysis to find out the long-run equilibrium relationship among the variables of the model. Banking sector development is measured by the arithmetic average of the normalized values of banking depth, banking efficiency, and banking stability. This study reveals that banking trade has positive and significant influenced the banking sector development in line with theoretical predictions. Electronic banking and liquidity have a positive and statistically significant role to explain banking sector development in Nepal. In addition, it demonstrates that non-performing loans has a negatively and significantly influenced banking sector development whilst branch network has a marginally negative but insignificant impact on banking sector development. This study reveals some implications for policymakers as it sheds some light on the importance of raising deposits & lending policies and focused on electronic banking. The authorities of a financial institution should be implied to build systems and skills in liquidity management, assets and liability management, and branch networking management to enhance the banking sector's development. The study also confirms that the soundness of macroeconomic policies and institutional quality plays an important role in the banking sector development.

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I. INTRODUCTION

The concept of banking sector development is multi-dimensional, and it is difficult to establish a single description for it because it is an interconnected process that encompasses increases in the number and quality of financial services. Macroeconomic policy, savings mobilization, institutional quality, loan issuance, and risk management are some of these dimensions. Thus, a country's capacity to deliver these activities efficiently is a good indicator of its financial system's progress. To comprehend the role of institutional policy and banking sector development, policymakers must understand the long run and causal relationship between the banking system, economic growth, and financial development (Perotti and Volpin, 2007). The significance of this study stems from the banking sector's vital role in the economic development process, as well as its role in providing the necessary finance for investments, necessitating research into the drivers that influence the banking sector's development in Nepal.

The development of institutions and financial markets is critical to economic growth, according to a growing body of theoretical and empirical evidence (Levine 2005, Levine et al. 2000). Economists have long questioned the relationship between financial development and economic growth. The importance of paying more attention to institutional development has been highlighted in both theoretical and empirical studies, as institutions play a crucial role in the growth of the financial sector. Schumpeter (1911) is of the view that a well-developed banking or financial sector avails capital to firms, which they will use to produce innovative products and promote technological innovation and economic growth. Kaur et al. (2013) also observed that the banking sector development quickens the rate at which a host country benefits from foreign direct investment and remittance inflows through providing services such as loans and efficient capital allocation. It is clear from the literature that the positive role that the banking sector plays in the promotion of economic growth is no longer an unsettled issue. What is still unclear is what determines banking sector development in Nepal? Hence, the current study was undertaken to fill in that void.

This study analyzes the impact of bank-specific factors on banking sector development in Nepal. The study explains the relationship between banking sector development and financial structure, non-performing loans, bank network, banking trade, electronic banking, and liquidity were employed as proxy bank-specific indicators in the study. This study hypothesizes that bank-specific characteristics and banking sector development have a co-integrating relationship. The co-integrating relationship between bank-specific variables and banking sector development is explored using the Autoregressive Distributed Lag (ARDL) bounds testing approach. The last five portions of the paper have been separated. From an empirical literature review viewpoint, Section 2 addresses the bank-specific factors of banking sector development. Section 3 carries out a methodology that shows data and variables description, correlation, descriptive statistics, and model specification are described in this section. Section 4 explains the ARDL approach results in discussion and interpretation. Section 5 concludes the study.

II. LITERATURE REVIEW

Commercial bank characteristics that influence the banking sector development are known as bank-specific or internal factors. Internal decisions made by top management and the board of directors largely affect these elements. The following are the internal factors that were identified and examined in this study.

The term "financial structure" refers to a bank's capital or net value. It is used to protect customers' deposits, increase the soundness of banks, offer a stable resource to absorb losses,

and promote the stability and efficiency of global financial systems by minimizing the danger of banks going bankrupt. Rajan and Zingales (1998) found that financial structure was highly significant and positively related to banking sector development. A high level of financial structure promotes banking sector development whilst a low level of financial structure limits banking sector development (Law & Habibullah, 2009). According to Pranowo et al. (2010), the financial structure has a favorable and considerable impact on the development of the banking sector. Financial structure and banking sector development in developing countries has a positive and significant association (Lee and Hsieh, 2013).

Non-performing loans are one of the most important internal variables affecting a bank's performance. It was calculated by dividing the overall value of the loan portfolio by the value of non-performing loans (including nonperforming loans before the deduction of specific loan-loss provisions). Levine (2002) found a negative and significant role to explain banking sector development. Aluko and Michael (2018), Huang (2010), and Hartwell (2013) also found that non-performing loans have a negative and significant impact on banking sector development. Ozili (2017) concluded that Bank efficiency, loan loss coverage, banking competition, and banking system stability are inversely related to NPLs.

The branch network is measured by the total number of branches of commercial banks that were associated with banking sector development (Adelowotan & Oshadare, 2017; Mark & Mitchener, 2005; and Spieker, 2008). The Branch network has been boosting financial access in rural areas through initiatives that result in a greater number of branches. While the increased number of bank branches is promising, the majority of banking services are still limited to urban regions. Adelowotan and Oshadare (2017) found that there is a systematic relationship between branch network activities and banking depth and efficiency. According to Iqbal and Sami (2017), the number of bank branches and credit deposit ratio have a positive and considerable impact on the country's GDP.

Internet banking is a type of e-banking that allows bank customers to conduct financial transactions electronically over the internet using their personal computer, laptop, or mobile phone at any time that is convenient for them, rather than being limited to the hours that the bank is open (Salehi and Alipour, 2010). According to Salamah (2017), electronic banking has a good and significant impact on Nepal's banking sector development. These studies also indicated that customers' security is however a big concern for the use of e-banking services. Satisfaction has covertly influenced a customer's inclination towards electronic banking which has positively influenced the banking sector development in Nepal (Banstola, 2008).

Banking trade consists of money placed into banking institutions for safekeeping and lending to the risk-return projects. Cherif & Dreger (2016) found that there is a positive relationship between bank credits and banking sector development. The studies have suggested that implicit borrowing may provide one such source and use of funds. Saedi (2019) found that industries with higher dependence on trade size financing (measured by the ratio of deposits plus loans to GDP) exhibited higher rates of banking sector development. Elisha and Luca (2007) revealed that there is a positive relationship between deposit and loans indicators and the banking sector development in Turkey.

The ability of a bank to satisfy maturity liabilities and consumer demand for cash is referred to as liquidity. As a result, a bank with a high level of liquidity is likely to be less lucrative than one with a lower level of liquidity. Nabeel and Hussain (2017) found that liquidity has a positive relation with banking depth and efficiency in developing countries. Milic and Solesa (2017) revealed that there is a significant relationship between liquidity and banking performance. Mishra and Pradhan (2009) observed that there is a positive significant

relationship between the banking system and liquidity in the selected commercial banks in India.

III.   RESEARCH METHODOLOGY

3.1   Data description and variables

The study was based on secondary data, which was extracted from Nepal Rastra Bank from 1995 to 2020 with all commercial banks of Nepal. Using world development indicators, this study used three dimensions of banking sector development that were considered for the index construction banking depth (credit to private sector), banking efficiency (net interest margin), and banking stability (capital adequacy ratio) as a dependent variable. The overall banking sector development (BSD) was obtained by the arithmetic average of the normalized values of these three variables. The literature identified several determinants from both a theoretical and empirical perspective, which affects banking sector development. The study was used financial structure, non-performing loans, branch network, electronic banking, banking trade, and liquidity as are explanatory variables.

Table 1: Variables, their proxies, and symbols

Symbols	Variables	Proxies
BSD	Banking depth	Credit to private sector/GDP
	Banking stability	Total capital funds/Risk-weighted assets
	Banking efficiency	Net interest margin
Explanatory variables		
FS	Financial Structure	Equity/Total assets
NPL	NPLs ratio	Non-performing loans/Total loans
BN	Branch Network	No. of branches of Commercial banks
BT	Banking Trade	[Deposit + Equity]/GDP
EB	Electronic Banking	Average of the internet banking, card services, and mobile banking
LIQ	Liquidity ratio	Liquid assets/Total deposits

3.2   Pre-estimation diagnostics

Descriptive statistics have been used to describe the characteristics of banking sector development and banks specific variables during the study period. The descriptive statistics used in the study consist of mean, median, minimum, maximum, standard deviation, skewness, and kurtosis values associated with variables under consideration. Table 3.2 summarizes the descriptive statistics of bank-specific variables used in this study during the period 1995 through 2020 associated with economic time series data.

Table 2: Descriptive statistics with dependent and independent variables, 1995-2020

	BSD	FS	NPL	BN	BT	EB	LIQ
Mean	27.791	6.738	13.143	1168.4	90.141	1358742	35.833
Median	26.080	6.495	10.485	553.5	82.690	150068	40.150
Maximum	40.660	12.040	25.780	4436	153.080	6059884	45.000
Minimum	17.040	2.880	2.040	375	49.260	6338	9.600
Std. Dev.	7.166	3.411	8.409	1093.2	28.592	1820193	10.925
Skewness	0.421	0.252	0.219	1.620	0.759	1.330	-1.716
Kurtosis	2.029	1.529	1.485	4.838	2.713	3.751	4.314

Sources: EViews 10 output result outcomes

Table 2 shows the descriptive statistics of bank-specific variables from 1995 to 2020. The table shows the difference between the minimum and maximum values is large across the variables under study, a sign of the presence of extreme values. The data for all the variables are positively skewed except liquidity. The kurtosis values for all the variables are not around three and are not normally distributed. This is proof that data for the variables used is not normally distributed. In order to ensure that the quality and reliability of the final results are not compromised, the issue of data not normally distributed, abnormal and extreme values was addressed by transforming all the data sets into natural logarithms and making stationarity before using it for main data analysis.

Table 3: Correlation analysis with dependent and independent variables, 1995-2020

	lnFS	lnNPL	lnBN	lnBT	lnEB	lnLIQ
lnFS	1					
lnNPL	-0.1283	1				
lnBN	0.5316	-0.2542	1			
lnBT	0.4007	-0.3104	0.3809	1		
lnEB	0.6094	-0.0988	0.4861	0.3825	1	
lnLIQ	-0.3421	0.1467	-0.2169	-0.2384	-0.4705	1
VIF	4.281	1.982	3.816	2.075	2.521	3.749

Source: Eviews 10 output result outcome

Table 3 shows the correlation matrix for all explanatory variables. Correlation analysis has been adopted to identify the direction and magnitude of the relationship between different pairs of variables. It shows how two variables move together and also shows the degree of association between them. The relationship between the two variables is explained by using the bivariate Pearson correlation coefficient. The table presents results on the relationship among the explanatory variables.

Similarly, Table 3 shows the correlation between the independent variables by using the variance inflation factor (VIF). The VIF results indicate that there is no concern with multicollinearity among the independent variables. The VIF values are all less than six, indicating that there is no multicollinearity amongst the independent variables in this study.

3.3   ARDL model specification

The study examines the co-integrating link between bank-specific determinants and banking sector development, by using the Autoregressive Distributed Lag (ARDL) bounds testing method. In the first stage of the ARDL technique, the stationarity of the variables is tested using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. The lags of the ARDL approach are automatically selected in the second step using Eviews software based on AIC. In the third step, the ARDL bound test is used to examine the co-integrating relationship between bank-specific factors and banking sector development. The long-run and short-run models have been calculated when variables are found to be co-integrated in the next stage. Finally, for diagnostic tests, normality, serial correlation, and heteroscedasticity are assessed, and model stability is guaranteed using CUSUM statistics. Banking sector development is the dependent variable in this study, with bank-specific factors such as financial structure (FS), non-performing loans (NPL), branch network (BN), banking trade (BT), electronic banking (EB), and liquidity (LIQ) serving as explanatory variables.

The ARDL model has revealed a co-integrating relationship between bank-specific variables and banking sector development. To begin, Error Correction Model (ECM) in Equation 1 derives the ARDL bounds test.

$$
\begin{aligned}
\Delta lnBSD_t ={}& \alpha_0 + \sum_{i=0}^{q} b_i \Delta lnBSD_{t-i} + \sum_{i=0}^{q} c_i \Delta lnFS_{t-i} + \\
& \sum_{i=0}^{q} d_i \Delta lnNPL_{t-i} + \sum_{i=0}^{q} e_i \Delta lnBN_{t-i} + \sum_{i=0}^{q} f_i \Delta lnBT_{t-i} + \\
& \sum_{i=0}^{q} g_i \Delta lnEB_{t-i} + \sum_{i=0}^{q} h_i \Delta lnLIQ_{t-i} + \mu_1 lnBSD_{t-1} + \mu_2 lnFS_{t-1} + \\
& \mu_3 lnNPL_{t-1} + \mu_4 lnBN_{t-1} + \mu_5 lnBT_{t-1} + \mu_6 lnEB_{t-1} + \\
& + \mu_7 lnLIQ_{t-1} + \varepsilon_t
\end{aligned}
$$

………. (1)

Here, all variables are as defined previously: $\mu1$, $\mu2$, $\mu3$, $\mu4$, $\mu5$, $\mu6$, and $\mu7$ are long-run coefficients, whereas bj, cj, dj, ej, fj, gj, and hj are short-run dynamics, and ε represent a random disturbance term. The order of the lags in the ARDL model is determined by either the Akaike Information Criterion (AIC) or the Schwarz Bayesian Criterion (SBC) (Narayan, 2004). In the majority of the studies, however, the SBC criterion is used in lag selection since ARDL-SBC estimators perform somewhat better than ARDL-AIC estimators (Pesaran and Shin, 1999).

The long-run relationship between bank-specific variables and banking sector development has been estimated after detecting the co-integrating relationship between bank-specific variables and banking sector development using the ARDL bounds test. Finally, the Error Correction Model of Equation 2 was used to evaluate the short-run link between bank-specific variables and banking sector development and speed of adjustment.

$$
\begin{aligned}
\Delta lnBSD_t ={}& \alpha_0 + \sum_{i=0}^{q} \delta_1 \Delta lnBSD_{t-i} + \sum_{i=0}^{q} \delta_2 \Delta lnFS_{t-i} + \\
& \sum_{i=0}^{q} \delta_3 \Delta lnNPL_{t-i} + \sum_{i=0}^{q} \delta_4 \Delta lnBT_{t-i} + \sum_{i=0}^{q} \delta_5 \Delta lnBN_{t-i} + \\
& \sum_{i=0}^{q} \delta_6 \Delta lnEB_{t-i} + \sum_{i=0}^{q} \delta_7 \Delta lnLIQ_{t-i} + \delta_8 EMC_{vt}
\end{aligned}
$$

………. (2)

The estimation of dynamic error correction will be done with the help of equations (2). The short-run dynamics of the model are represented by the coefficients $\delta1$, $\delta2$, $\delta3$, $\delta4$, $\delta5$, $\delta6$, and $\delta7$, while the divergence or convergence towards the long-run equilibrium is represented by the coefficient 8. Divergence is shown by a positive coefficient, while convergence is indicated by a negative coefficient.

IV. RESULTS AND DISCUSSION

4.1 Unit Root tests

Before executing any test in time series analysis, variables must be checked for stationarity. The ARDL approach further requires that variables have no unit root problem and that only one of the variables' integration orders is I(0) or I(1). Using unit root tests, this study was able to determine the order of integration of all variables. This study has used the ADF and PP tests for this purpose. The results of the Phillips and Perron test at the level and first difference are shown in Table 4. Similarly, figure 1 displays the trend with stationary.

Table 4: Unit root test at the level and first difference in time-series data

This table shows all variables are stationary or non-stationary in levels and first difference respectively at 1 and 5 percent level of significance in time series data from 1995 to 2020.

Variables	Level		First difference		Order of integration
	Augmented Dickey-Fuller	Philips-Person	Augmented Dickey-Fuller	Philips-Person	
ln_BSD	-3.2388	-3.2172	-6.0241 *	-6.1319*	I(1)
ln_FS	-2.8070	-2.2169	-4.0612*	-4.0528*	I(1)
ln_NPL	-2.9712	-2.9712	-5.4580 *	-5.4580*	I(1)
ln_BN	-1.8496	-2.0369	-5.9187*	-5.9819*	I(1)
ln_BT	-2.3405	-2.5405	-5.7025*	-5.7806*	I(1)
ln_EB	-2.3768	-2.4768	-4.8164*	-4.8237*	I(1)
ln_LIQ	-1.3786	-1.2494	-4.8411*	-4.8555*	I(1)

Note: * indicates rejection of the null hypothesis of non-stationary at 1 percent.

Source: Eviews 10 output result outcome

The results of the Augmented Dickey-Fuller and Phillips-Perron tests are shown in Table 4. All variables are not steady in their level data, as shown. However, at a 1% level of significance, all variables are the stationery in the first difference. Thus, Table 4.1 demonstrates that no variable has a unit root problem and is stationary at the first level difference, i.e. all variables are stationary at I(1). As a result of the unit root test's findings, the ARDL model can be used to determine the co-integrating relationship between the variables.

The ARDL model for bank-specific variables and banking sector development has been estimated after confirming that in the first level difference, all variables are stationary, i.e. I(1). The Akaike Information Criterion is used to choose the best amount of lags while estimating the ARDL model (AIC). Heteroskedasticity and normality should be considered while selecting lags in the ARDL model serial correlation (Pesaran et. al., 2001). As a result, all of these variables were addressed in this study, and the optimal lag length was determined.

Table 5: Optimal lag length test

The table shows the AIC and SBC used for the determination of optimal lag length which verifies the macroeconomic variables are co-integrated using the bound test technique.

Lag length	Akaike Information Criteria	Schwarz Bayesian Criterion
2	-4.490571	-3.847525
1	-4.859923	-4.167412

Source: Eviews 10 (ARDL Model) output result outcome

The AIC and SBC results of these experiments are shown in Table 5. The lag length with the minimum critical value for both criteria must be chosen when using the AIC and SBC to determine the ideal lag length. The table shows that for bank-specific variables, lag 1 has the least AIC and BIC criteria. With the lag duration now known, the bound test technique may be used to determine if the variables are co-integrated.

4.2.   Bound testing for co-integration analysis

The results of the co-integration test revealed that the variables have a long-term association. The computed F-statistics is 13.473, which is higher than the upper bounds critical values of 4.154, 5.018, and 7.063 at 10%, 5%, and 1% respectively from the table Narayan (2005). Thus, the study suggests that bank-specific characteristics and the banking sector development are co-integrated. This study examined the long-run link between bank-specific characteristics and banking sector development after verifying that the variables are co-integrated.

4.3   Long-run relationship between banks-specific factors and BSD

After verifying that the variables are co-integrated, the ARDL model's long-run coefficients should be estimated to determine the long-term impact of bank-specific factors on banking sector development. Thus, the long-run coefficients of the variables in the ARDL model were computed in this study. Table 6 shows the outcome of the long-run link between bank-specific variables and banking sector development in Nepal.

Table 6: Estimated Long- run coefficients by using the ARDL Approach

The estimated long-run model of the corresponding ARDL (1, 1, 1, 1, 1, 1, 1) is selected based on Schwarz Bayesian Criterion. ARDL coefficients for the long-run relationship of bank-specific variables and banking sector development from 1995 to 2020.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
dln_FS	0.183546	0.099902	1.837262	0.1400
dln_NPL	-0.160812	0.054323	-2.960316	0.0415
dln_BN	-0.167805	0.101815	-1.648143	0.1747
dln_BT	0.894903	0.179335	4.990132	0.0075
dln_EB	0.195390	0.247542	4.425064	0.0115
dln_LIQ	0.110960	0.038525	2.880222	0.0450
Constant	-2.499948	0.848077	-2.947783	0.0421

Source: Eviews 10 (ARDL Model) output result outcome

Table 6 indicates that the influence of non-performing loans, banking trade, electronic banking, and liquidity on banking sector development was studied. The findings suggest that the 1-period lag has a long-term positive and significant influence. The long-run analysis reveals that a 1% rise in banking trade results in a 0.894 percent gain in banking sector development, whereas a 1% increase in electronic banking results in a 0.195 percent increase in banking sector development. The findings also show that boosting liquidity by 1% results in a 0.111 percent rise in banking sector development. However, due to a 1% decline in non-performing loans held by commercial banks in Nepal, banking sector development increased by 0.161 percent. This positive and significant impact is coherent with the findings by Mishra and Pradhan (2009), Cherif & Dreger (2016), Salamah (2017), Aluko & Michael (2018). This, therefore, means there is a long-run relationship between bank-specific variables and banking

sector development. However, the branch network had a negative but insignificant result in banking sector development.

4.4 Error Correction Model

After establishing the long-run correlation between bank-specific variables and banking sector development, the ARDL error correction model (ECM) was used to determine the short-run relationship and check the reliability of the long-run coefficient. Table 7 shows the outcome of the error correction model (ECM).

Table 7: Estimated short-run coefficients by using the ARDL Approach

The estimated short-run model of the corresponding ARDL (1, 1, 1, 1, 1, 1, 1) is selected based on Schwarz Bayesian Criterion. ARDL coefficients for the short-run relationship of bank-specific variables on banking sector development from 1995 to 2020.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Δ lnFS	0.046070	0.033180	1.388487	0.2373
Δ lnNPL	-0.005565	0.014591	-0.381398	0.7223
Δ lnBN	-0.167805	0.022497	-7.458952	0.0017
Δ lnBT	0.623498	0.049026	12.71763	0.0002
Δ lnEB	0.040342	0.007318	5.512745	0.0053
Δ lnLIQ	0.055103	0.014728	3.741499	0.0201
ECM(-1)	-0.280731	0.18515	-10.2744	0.000

$R^2 = 0.80924$, Adj. $R^2 = 0.76826$, F-statistic = 13.8313 [0.000], D/W statistic = 1.9405,

Source: Eviews 10 (ARDL Model) output result outcome

Table 7 shows that the error correction term, ECM(-1), has a value of -0.2807 and a t-value of -10.2774, both of which are significant at a 1% level of significance. The negative and significant value of ECM(-1) of -0.2807 implies that in the long run, the short-run disequilibrium is corrected at a rate of 28.07 percent each year. This suggests that a deviation from the long-run equilibrium of banking sector development in one year is corrected by the bank-specific factors under consideration by 27.07 percent the following year. The fragility of Nepal's financial system is explained by the divergence of results in the short-run and long run equilibrium. The system is unable to quickly adjust to shocks in the short term, owing to the banking sector's dominance, which is over liquid, and the system's information efficiency.

Furthermore, the coefficient of banking trade, electronic banking, and liquidity has a significant positive impact on BSD, which is similar to the result obtained in the result of long-term relationship on BSD. However, the coefficient of non-performing loans and branch network has a negative but insignificant result in the banking sector development of Nepal in the short run. In addition, Table 4.4 shows the value of adjusted R2 0.7682 and F-statistics of 87.8313 (p=0.000). The adjusted R2 value indicates that the explanatory variables explain 76.82 percent of the banking sector development in the short run, and the F-statistics value of 87.8313 is significant at the 1% level, indicating that the overall model of this study is the best-fitted model. The Durbin-Watson value of 1.9405 indicates that there is no problem with autocorrelation.

4.5 Diagnostic tests for ARDL model

Serial correlation, heteroscedasticity, normality, and model stability are among the diagnostic tests used in this work to assess the reliability of the estimated ARDL model. The Breusch-

Godfrey Serial Correlation LM test, Breusch-Pagan-Godfrey of Heteroscedasticity test, Jarque-Bera test statistics, and Recursive CUSUM test were used to examine serial correlation, heteroscedasticity, normalcy, and stability of the derived ARDL model. Table 4.5 shows the results of serial correlation and heteroscedasticity, while Figures 2 and 3 show the results of normality and model stability, respectively.

Table 8: Diagnostic tests on ARDL Approach

|	F-version		LM-version	
	Statistics	**P-Value**	**Statistics**	**P-Value.**
A: Serial Correlation	$F(1,18) = 1.167$	0.289	$\chi^2(1) = 1.354$	0.429
B: Functional Form	$F(1,20) = 0.572$	0.455	$\chi^2(1) = 0.677$	0.411
C: Normality	N/A		$\chi^2(2) = 4.424$	0.109
D: Heteroscedasticity	$F(2,18) = 0.874$	0.787	$\chi^2(2) = 0.197$	0.218

Source: Eviews 10 (ARDL Model) output result outcome

Table 8 shows that the probability value of F-statistics and the probability value of Chi-Square for the Breusch-Godfrey Serial Correlation LM test and the probability value of F-statistics and the probability value of Chi-Square for the Heteroskedasticity test are both greater than 0.05, indicating that the estimated ARDL model is free of serial correlation and heteroskedasticity. Similarly, the Jarque-Bera statistics are used to determine the normality of the residual terms in the model.

Figure 1: **Normality test**
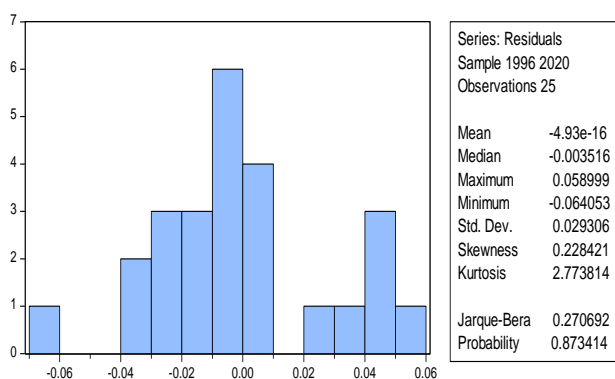
Figure 2: **CUSUM square stability test**
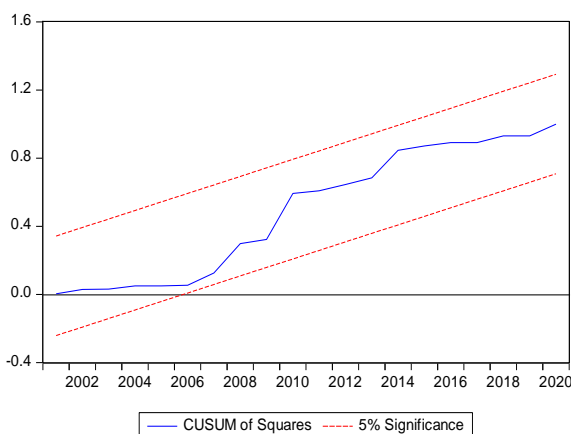
The Jarque-Bera test statistic of 0.2706 (p=0.8734>0.05) is shown in Figure 1. Thus, the value of Jarque-Bera test statistics is insufficient to reject the null hypothesis that the residual series from the model is normally distributed. Therefore, the normality of the calculated ARDL model has been validated. Finally, the CUSUM square stability test is employed to ensure the model's long-term stability. At a 5% level of significance, Figure 2 demonstrates the CUSUM of the square test together with the line of critical boundaries. The straight lines represent the critical boundaries at the 5% significance level. At a 5% level of significance, the plots of the CUSUM of the square test are inside the critical boundaries, as shown in Figure 2. As a result, the calculated model has been confirmed to be stable across the study period. This indicates that the model is stable, allowing it to be applied for causality, bound tests, and long-run associations.

V.   CONCLUSION

This study explored the impact of the bank-specific factors on banking sector development in Nepal using the ARDL estimation technique with economic time series data ranging from 1995 to 2020. The major conclusion of the study is that there is a long-term equilibrium relationship between bank-specific variables and banking sector development. This study reveals that banking trade, electronic banking, and liquidity have a positive and significant effect on banking sector development in Nepal. It implies that the higher the banking trade, the higher would be banking sector development. Therefore, the financial institution managers should endeavor to raise deposits and lending if they wish to enhance banking sector development. Moreover, the study observed that electronic banking has a positive and significant impact on banking sector development. It implies that the higher users of electronic banking, the higher would be of banking sector development. Hence, to achieve higher banking sector development, attention should be focused on electronic banking.

Similarly, the study discovered that liquidity has a significant and positive impact on the development of the banking sector. It indicates that the authorities of financial institutions should be required to develop systems and abilities in liquidity management, asset and liability management, and foreign exchange management. Non-performing loans, on the other hand, have a significant negative impact on the banking sector's development. Therefore, the study recommends that internal policymakers work to cut operational costs because this reduces their profit margin, resulting in poor financial performance. This can be accomplished through establishing suitable accountability structures and mechanisms, as well as utilizing technology. Further research on the determinants of banking sector development, particularly those relating to macroeconomic, political, and legislative issues, as well as those relevant to banking sector characteristics, is recommended by the study.

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Financing Disaster Risks in Nepal: Theory to Practice

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Abstract

Third generation of disaster discourse, disaster response to disaster risk reduction and disaster risk finance is an emerging concept to address the fiscal impact of climate and disaster risks. Disaster risk financing is a systematic arrangement of financial system in advance (ex-ante), in the aftermath of the disaster occurrence (ex-post), and based on specific needs. Multiple disaster risk financing mechanism, primarily ex-ante risk investment approaches are ought to be brought, but poorly practiced in Nepal. Although Nepal has a wide number of public financial and planning bodies; but haven't institutionalized their disaster investment from disaster risk financing framework. Integrating multiple disaster risk financing instruments into three tier developmental and financial planning bodies is necessary to mainstream climate and disaster risk reduction in Nepal.

Key Words: DRR, Budgeting, National Budget, Risk Transfer, Disaster Risk Finance, Banking and Insurance

JEL Classification: H5, H6, G22, H77

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I. CONTEXT

Though it has been four decades, aimed to formally address disaster with first disaster policy issued at 1982, Nepal still lags robust framework to address disaster risks. Recent flood of October, which had damaged paddy around NRs 8.26 billion suggest that neither both public agencies and private bodies and nor farmers are prepared to mitigate and minimize such risks. Despite promoting alternative disaster risk financing instruments/tools to minimize addition burden to government, Government of Nepal (GoN) is providing financial compensation to affected farmers. Risk transfer in the form of micro-insurance, catastrophic bond to ensure mega scale losses and other retention and contingency financing policies are well discussed in policy debate and poorly introduced at local level to minimize risks vulnerable farmers and communities.

Nepal has tried to institutionalized climate public finance, while public finance for disaster risk reduction and management (DRRM) is a domain to be strengthened. Also, in view of transition to federalism, disaster risk finance (DRF) is to be understood. The paper provides the overview of the DRF instruments and their use in different tier of government. Based on the analysis of fiscal disaster budget and different DRF instruments used under the Nepal's federal system, the study identifies the enablers and barriers (policies, institutions and practices), and which is basis to develop an integrated framework and strategy of climate and disaster risk financing in Nepal.

II. DISASTER FINANCING FRAMEWORK AND INSTRUMENTS

Multiple disaster risk financing tools are adopted in international arena to minimize and address disaster risks. It is more about how government arranges public and private finances. It includes both ex-ante risk and ex-post financial instruments. It is already evident that ex-post intervention is far more expensive to risk informed ex-ante investment (ADB, 2019). However, Nepal is often criticized for ex-post financing; as it is unable to minimize the increasing amount of budget allocation/spending of fiscal budget for post-disaster emergency response and recovery (MoF, 2017; COLARP & Practical Action Nepal, 2020). Multiple disaster risk financing mechanism, primarily ex-ante risk investment approaches are ought to be brought in practice with notion that not a single financing instrument can avert, minimize and address disaster risks.

2.1 Ex-ante Disaster Risk Financing Tools

Ex-ante risk financing instruments are applied before disasters occur, but can be used both for disaster risk control and recovery. In Nepal, ex-ante financial instrument are largely utilized for disaster response and recovery. Contingency Funds such as Prime Minister Relief Fund, Central National Disaster Relief Fund, Provincial and Local Disaster Management Fund are being developed to avoid and minimize disaster risks and manage contingent liabilities. However, it is not started in all Provinces. In addition, irregular budget can go to the districts according to the magnitude of disaster event at the local area. Similarly, disaster reserve fund at municipal level varies with size and type of Municipality. The disaster funds at sub national level (province, district and local) are mostly used for post disaster response and early recovery. There is no any specific decision on what portion of the fund can be utilize for avoidance of disaster risks or after the occurrence of disaster.

GoN allocates **Regular Line Agencies Funding** for DRRM. In case of DRRM budget of Ministry of Home Affairs (MoHA), it is distinct, and can be separated with specific budget code in RED book (Fiscal Budget Book), whereas in other Ministries, DRRM looks cross-cutting issue, and can only be segregated if they are operated as specific project. There might be huge budget allocation for reconstruction related interventions, but reflected as

development related activities in regular budget. Also, regularly allocated of budget are frequently transferred to other project activities during implementing phase. This makes even complicated to segregate of disaster related budget on basis of expenditure.

In aftermath of any disasters, **Contingent Credit** is necessary to overcome short term liquidity constrains (Clarke and Mahul, 2011). In Nepal, there is no clarity in policy provisions for contingent credit. During earthquake of 2015, it took more than eight month to bring National Reconstruction Act 2015, and to initiate reconstruction related interventions through post-disaster loan burrowing and pledged resources from international arena. The pre-fund budget allocation or reserved funds was very minimum to maintain liquidity during disasters. Also, use of risk transfer instruments for high severe risks such as earthquake and monsoon induced landslides and flood disasters are not promoted as it should be. Either with reinsurance or declaration of emergency, liquidity could be maintained. Contingent credit agreement prior to any disasters would increase credibility of the State. Also, it helps to take optimal strategy for financing post disaster liquidity needs based on combination of reserves, contingent and risk transfer instruments.

Insurance Linked Securities are practiced for high severity and low probability disaster events. These policies are grouped by their assessed risk and then re-insured by insurers. In case of Nepal, Earthquake of 2015 was beyond general anticipation of citizens. Nepal could have minimized such huge damage with issuing CAT bonds. Their risk of CAT bond could be transferred to another insurer. Currently, there is no availability of catastrophe bond (ADB, 2019).

Insurance of Public Assets and Micro-Insurance is almost not in practice in Nepal. The very few public buildings like Tribhuvan International Airport, public hospitals and Hydropower have been insured their public assets. MoF have not prioritized and allocated sufficient budget for insurance of public assets. Currently, third party insurance in public vehicle is mandatory, and budget is allocated for such insurance. Micro-insurance in agriculture system was formally introduced after formulation of Agriculture and Livestock Directives 2013. Government of Nepal provided 75 percent of subsidy in premium amount to encourage farmers to join agri-insurance policies. However, farmers are reluctant towards to joining agri-insurance policies due to administrative hurdles and delay in providing compensation (World Bank, 2020).

2.2   Ex-post Disaster Risk Financing Tools

Ex-post financing instrument are used after disasters for emergency response and recovery. In federal level, ex-post financing instruments are largely governed practiced in different forms.

Post-disaster Budget Reallocation is provision of "Budget Transfer Mechanism" which allows to reallocate the regular development budget in recovery and reconstruction for the same sector (MoHA, 2018). This is very common practices in other line-ministries, where regular budget for disaster events are not allocated.

Borrowing (National and International) has bleak picture of disaster budget gap in Nepal. In fact, it is even hard to quantify total budget require to mitigate, minimize and respond in Nepalese context. During times of disaster, there looks huge budget deficit. GoN relies on bilateral, multilateral assistance and loan.

GoN doesn't have any **Tax and Concession** of increasing tax for revenue generation to cope the disaster event. However there is Provision of "Tax Relief" to business affected by disaster (Agrawal, 2020). It is not explicitly stated, but in order to cope the impact of Covid-19, Government increased import tax in luxury items. Though looks contradictory to national interest, but government increased import tax on electric vehicles in 2020.

Grant and Subsidies/Loan: Under the Disaster Risk Reduction and Management Act 2017 and Disaster Risk Reduction and Management Regulation 2020, there is a separate guideline for relief and compensation distribution. Similarly, there was provision of special grant and subsidized loan of reconstruction of house for earthquake affected families. Central Bank of Nepal, Nepal Rastra Bank (NRB) recently had third amendments of Integrated Guideline of Subsidies, Loan and Interest 2075. This policy allows and guides to other commercial bank to provide subsidies loan to revive their business during crisis of disasters.

Donor Assistance: Disaster risk reduction projects are co-financed from multilateral and bilateral agencies. During the period 2003-2019, GoN received NPR 18.5 billion grant assistances, where NPR12.14 billion was multilateral assistance and NPR 6.36 billion as bilateral assistance. Similarly, USD 422.72 million was received through I/NGOs where USD 309.6 million was grant and USD 113.12 million was technical assistance. Recently, GoN and World Bank signed loan and grant agreement ($ 6.1 million as grant and 17.9 as concession loan) for establishing and strengthening forest-based small and medium enterprises. This is expected to improve forest based traditional safety nets during times of crisis of Covid-19 era (World Bank, 2021).

III. DRR AND BUDGETING

In federalized context, all three tier government (Federal, Provincial and Municipal) are liable for financial planning and budgeting. Provincial and Local Govt. are allowed to have their own taxation and revenue policies for fiscal planning and budgeting. They can allocate and spend their budget on disaster risk reduction. Currently, they are in process of localizing the DRR Strategic Plan of Action 2018-2030, and in formulation of their DRF plan for short-term, mid-term and long-term. Line Ministries Budget Information System (LMBIS) is a mandatory online based financial management system down on the Department and Ministry level for budget proposal submission. Similarly, local governments use Sub-national Treasure Regulatory Application (SuTRA) for budget planning and reporting. However, there is no separate disaster budgeting mechanism. DRRM projects are prioritized based on annual disaster occurrence and its associated impact in a particular geographical region. Thus, disaster budget is merged with the overall public financing and budgeting processes.

3.1   DRF at Local Level

- **Hazard based Disaster Fund:** Specific hazard-based disaster funds can help to respond to multiple hazards at the same time through pre-planned allocation of resources. In case of Gauriganga Municipality, whole disaster budget was spent for responding Covid-19.

- **Inadequate Risk Transfer Mechanism:** Few municipalities are providing subsidies in premium in collaboration with development project. However, insurance of public and private infrastructure is very low.

- **Less Use in Risk Control and Mitigation:** It seems that ex-ante risk financing tools are well practiced in both in federal and local level, but use of such fund is highly concentrated in post disaster relief and response.

- **Transparency and Accountability of DRRM Fund:** There is also no as such practices to track public expenditure on disaster.

- **Practices in Municipal Level:** Though municipalities have tried multiple ex-ante tools, but largely spend their resources on post-disaster activities.

- **Unit-based allocation of Reserve Funds:** Dhangadhi sub-metropolitan city has allocated disaster funds from municipal to community level from the perspective of better governance (timeliness and responsive).

- **Local Disaster Climate Resilient Plan (LDCRP) Integration in Municipal Annual Budget:** Chure Municipality has mainstreamed almost all LDCRP activities in the municipal annual programs. But still fund are not enough for the activities. The fund prediction for LDCRP activities are less than in actual budgeting due to additional administrative and increased material costs.

Table 1: LDCRP Budget inChure Municipality 2019

Sectors	Budget 2019	Activities Included
Livelihood and Food Security	100	All
Forest and Environment Protection	71	One Third
Water and Electricity	100	All
Health and WASH	100	All
Shelter and Infrastructure	90	Almost All
Education	90	Almost All
Information, Communication and Coordination and Management	100	All
Search and Rescue	50	Almost All

Source: LDCRP 2019 and Municipal 2019 of Chure Rural Municipality

IV. PUBLIC AGENCIES IN DRF

Public agencies in Disaster Risk Finance have overlapping roles, but can be broadly categorized in () Public financial and planning bodies, (ii) DRRM policy making and planning, and (iii) DRRM mainstreaming and implementing bodies.

Beside Ministry of Finance (MoF) which is primarily responsible for fiscal budget, public financial and planning bodies include number of other public agencies that are directly connected in disaster risk financing. Nepal Rastra Bank (NRB) is directly responsible for in issues of subsidies and grant. Similarly, Insurance board and Insurance companies are instrumental in risk transfer mechanisms. Banking and Financial Institutions (BFIs) are also crucial in contingent financing and credit. Thus, this looks complex, and requires wider lens of framing in disaster sensitive public financial management and planning.

Nepal's current DRR law and institutional arrangement are response-centric as more attention is given to rescue and relief rather than prevention, mitigation and preparedness. DRRM policy and planning agencies have tried to progressively mainstream DRR into development planning. However, integrating climate and DRR into three tire development planning is still challenging due to inadequate technical skills and a lack of willingness to shift towards risk-informed evidence-based DRRM planning. Hence, disaster events have repeatedly impacted every sector in Nepal.

DRR mainstreaming and implementing bodies have limited resources and capacities. Local levels, primarily responsible in mainstreaming and implementation have to bear the additional pressure. Due to the autonomous nature, coordination among the province and local government is still a challenging issue. As a result, DRR activities are hard to harmonize in sub-national level. Also, the overlapping roles and responsibility among the province, district, and local level on DRR planning and implementation has created confusion, and often ended with criticizing each other. This has also created the dilemma to measures the DRRM

integration and mainstreaming in sectoral plans and commitments. Further, due to a lack of technical understanding of and frequent job transfer of government officers, DRR is less proactively used both at the federal and province level.

V.   SUPPORTING ROLES IN RE-FINANCING AND RISK TRANSFER

While public agencies in DRFI have crucial roles, Banking and Financial Institutions (BFIs) and Insurance bodies have instrumental role in re-financing and risk transfer. BFIs in Nepal are increasing in number and scale. Currently, 28 commercial banks, 36 development banks, 25 finance companies and 64 microfinance companies have received licenses from the Nepal Rastra Bank. BFIs provide grant and subsidized loan aftermath of disaster, when specific policies/guidelines are formulated. As per disaster context, NRB are suggested to bring subsidy and loan policy. For instance, integrated guideline of subsidies loan and interest was amended third time in 2018. This policy allows and guides to other commercial bank to provide subsidies loan to revive their business during crisis of disasters. However, Nepal hasn't developed a separate and sovereign policy provision formulated to disaster risk reduction and management.

Similarly, risk transfer and insurance is growing sector (40 insurance companies, including 19 life insurance, 20 non-lif insurance and 1 re-insurance company) in Nepal. Insurance Board is the regulatory body, which provides guidelines regarding tariff. However, it is under-staff and should be capacitated to diversify different policy products to minimize disaster context. In general, the insurance policies are adopting a blanket approach–irrespective of the risk associated with the insured, the claim amount is the same. It means there is a need for making the policies flexible and adaptive of the local context of the insured, which will be beneficial for both the insurer and the insured. The use of insurance as process of risk transfer should be mainstreamed in DRRM.

VI.   ENABLERS AND BARRIERS TO INCLUSIVE CLIMATE AND DRF

The key enablers to inclusive climate and DFF policies, institutions and practices are inter-connected. Both enablers and barriers of climate and disaster risk financing are discussed to highlight existing practices and gaps, pertaining to DFRI framework and instrument, and re-financing and risk insurance.

Table 2: Enablers and Barriers to Inclusive Climate and DRF

Issues	Enablers	Barriers
DRF related policies	DRR National Strategic Plan of Action 2018-2030 has incorporated financial and strategies.	Yet to localize in all provinces and local government.
	DRF strategy of Nepal is already developed.	With less rigorous studies on cost-benefit, and of using multiple disaster risk financing tools.
Institution/Agencies	Formation of NDRRMA and disaster management committees.	DRF is directly associated with MoF, but NDRRMA is a nodal body for DRRM, and MoFE for CC
	Guideline is prepared for line agencies and Local Government to mainstream DRRM.	Lack of dedicated human resources at Provincial and Local level.
	Line agencies have DRR focal point	Extra duties for them, and sometime seems burden.

Issues	Enablers	Barriers
	PMR fund, CDMF, and other reserve funds at provincial and local level	Poor orientation and capacity to dedicated human resources on DRF
	Increment in number of BFIs and Insurance companies	Private sectors roles have not been properly defined and well utilized.
Climate and disaster budget Tagging	With slight modification in LMBIS and PLMBIS software, disaster budget can be tracked.	Rarely decoded for further analysis, and to revise current year fiscal budget and next year planning
	In SuTRA (local), there is a provision of creating DRRM sub-section.	Poor human resources and lack of technical competency
	Expenditures on climate change and be determined.	Don't have practice of disseminating such expenditures based on climate induced disaster
	Integration of LMBIS, PLMBIS and SuTRA is possible, pre-requisite for national accounting of DRRM.	Limited integration of SuTRA (local), LMBIS and PLMBIS.
Existing Local Practices	Unit-based allocation at each ward level	less capacitated to understand complex nature of disaster risk financing strategies
	For risk transfer, LGs are willing to allocate funds. Also allocated budget for agri-insurance	LDCRP is not mandatory document for LGs

VII. CONCLUSION AND WAY FORWARD

Nepal, having risks of multi-hazards, should integrate multiple ex-ante and ex-post disaster financing tools for cost efficient and effective disaster risk financing. The combination of reserves funds, contingent credit and risk transfer instruments will support to maintain liquidity crisis, and to ensure the timely disbursement of funds.

Currently, NDRRMA/MoHA is only responsible for emergency response and relief, and other policy formulations and coordination. Climate and disaster risk financing is more inter-agency task and demands for integrated and cross-scale assessment and management. As far possible, disaster DRRM Act should be amended with adding new Section, which explicitly state on use of various financial instruments and mandatory provision in role of different public and private agencies.

NDRRMA should be capacitated, and able to train other DRR focal persons working in all tier of government for using combination of multiple disaster risk financing tools. The roles of public and private sectors, BFIs and insurance companies should be explicitly stated for the optimal use of budgetary instruments, contingent financing and market based instruments.

Currently, LMBIS and PLMBIS have function based tagging such as gender, climate, pro-poor and SDG. Additional coding is necessary for disaster. Also, to improve financial governance, software like SuTRA at local, and LMBIS and PLMBIS at Federal and Provincial level should be integrated. This should be integral part of DRRM planning and investment. Disaster based budget should be analyzed based on expenditure framework.

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Efficiency measurement of Nepalese commercial banks using CAMEL rating

Janardan Subedi[*]

Abstract

This study examines the impact of CAMEL variables on the performance of Nepalese commercial banks. Return on assets and return on equity are the dependent variables. The independent variables are capital adequacy ratio, assets quality, management efficiency, earning quality and liquidity position. The study is based on secondary data of 28 commercial banks with 224 observations for the period from 2011/12 to 2018/19. The data are collected from Banking and Financial Statistics published by Nepal Rastra Bank and annual reports of Nepalese commercial banks. The regression models are estimated to test the impact of CAMEL variables on the performance of Nepalese commercial banks.

The study showed that capital adequacy ratio has a positive impact on return on assets and return on equity. It indicates that increase in capital adequacy ratio leads to increase in return on assets and return on equity. Likewise, net interest margin has a positive impact on return on assets and return on equity. It indicates that higher the net interest margin, higher would be the return on assets and return on equity. In addition, the study showed that cash ratio has a positive impact on return on assets. It reveals that higher the cash ratio, higher would be the return on assets. However, the study showed that non-performing loan has a negative impact on return on assets and return on equity. It indicates that higher the non-performing loans, lower would be the return on assets and return on equity. Moreover, the study also showed that loan loss provision has a negative impact on return on assets and return on equity. It indicates that higher the loan loss provision, lower would be the return on assets and return on equity. Similarly, operating efficiency ratio has a positive impact on return on assets and return on equity. It reveals that higher the operating efficiency ratio, higher would be the return on assets and return on equity.

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I. INTRODUCTION

A sound financial health of the bank is the guarantee not only to its depositors but is equally significant for the shareholders, employees and whole economy as well. Many efforts have been made from time to time to measure the financial position of each bank and manage it efficiently and effectively. CAMEL analysis is a part of risk measurement to predict the calculation of financial distress happened in past, present or future time from the annual report to increase the profitability for internal and external management in making decisions on banking performance. The CAMEL acronym stands for capital adequacy, asset quality, management, earnings and liquidity (Rose and Hudgins, 2010). The purpose of CAMEL ratings is to determine a bank's overall condition and to identify its strengths and weaknesses in financial, operational and managerial aspects. Despite the use of CAMEL model by regulators to assess financial performance of banks, inefficiencies in performance have been experienced. The banking and financial institution plays a significant role in the development of the country economy and financial inclusion as well financial development. Strong financial institutions are critical for increased investment, economic growth, employment and poverty alleviation. Banks facilitate the internal and external trade and the movement of money and capital (Saini and Sindhu, 2014). The financial system based on banks provides information related to the investment opportunities and it directs resources to productivity channels which results in facilitating the process of the economic growth.

Bank performance and insolvency have been given much attention both at the local and international level. Financial ratios are often used to measure the overall financial soundness of a bank and the quality of its management. Banks' regulators use financial ratios to evaluate a bank performance as part of the CAMEL system. Despite continuous use of ratios analysis in banks performance appraisal by regulators, opponents to it still thrive. The firm always assess profitability in their business performance including the assessment of business activity undertaken by banks (Becerra, 2009). The changing nature of the banking industry has made such evaluations even more difficult, gingering the need for more flexible alternative forms of financial analysis. Salem (2013) stated that the purpose of CAMEL analysis on banking performance is to analyze and supervise both external and internal risks of the unit business or the entire management in banking. CAMEL framework system looks at five major aspects of a financial institution such as capital adequacy, asset quality, management soundness, earnings, liquidity, and an additional sixth aspect on sensitivity to market risk (Hilbers et al., 2000).

Basher et al. (2017) revealed that higher capital requirement increases the bank capital and increasing capital induces bank to invest in riskier assets. It indicates that higher the bank capital, higher would be the portfolio risk of the bank. Olweny and Shipho (2011) confirmed that there is a negative relationship between bank profitability and non-performing loan to total loan ratio (NPL). Similarly, Rosman et al. (2014) also revealed that increase in non-performing loans decreases banks profitability. Moreover, Madishetti and Rwechungura (2013) revealed that increase in non-performing loans reduces profitability of commercial banks in Tanzania.

Bank profitability (ROA) is strongly positively related to bank capital. Hence, banks seem to rely strongly on retained earnings in order to increase capital (Ding and Sickles, 2018). Similarly, Munteanu (2012) showed that bank stability, Z-score and return on assets have a significant influence on bank liquidity in the crisis years. The study also concluded that loan loss provision and credit risk rate have positive and significant impact on bank liquidity in both pre-crisis and crisis period of Romanian banking industry. Similarly, Ayaydin and Karakaya (2014) revealed that there is a positive relation between the capital and profitability.

The study concluded that there is negative and significant relationship between bank liquidity and net interest margin.

Ahmad and Rasool (2017) investigated the determinants of commercial banks liquidity from listed commercial banks with State Bank of Pakistan. The study found that ROE and INF have statistically insignificant but positive relationship with bank liquidity. A well-managed liquidity function will include liquidity contingency plan, liquid asset buffers and setting liquidity policies and limits in tune with level of risk that the management believes is acceptable and manageable (Kosmidou et al., 2004). Holding liquid assets is costly, given that they provide lower returns than illiquid assets. Moreover, holding a liquidity buffer may also be inefficient, as it limits banks' ability to provide liquidity to entrepreneurs and consumers. Hence, even though banks have some incentives to hold a fraction of liquid assets (in the form of cash, short term assets or government bonds, for instance), these buffers will hardly ever be sufficient to fully insure against a bank run or a sudden dry up in wholesale markets.

Trenca and Cociuba (2015) showed that the risk level, earnings, liquidity, solvency, the level of loans and deposits, and economic crisis affect the profitability of banks. Primus (2017) assessed the determinants of surplus liquidity and found that credit risks, high rate of funding, cash preferences and instability of deposit holders are basic determinants of surplus liquidity in commercial banks. Adequacy of banks' capital is one of the most important topics for regulatory authorities and banks' management as it represents a safety value for banks' clients and shareholders to reduce risk exposure. Moreover, capital adequacy determines and affects the level of bank's performance. Furthermore, capital serves as a cushion for operational loss absorption and creates shareholders' confidence in the bank. Additionally, it represents the bank's ability to finance its long-term projects and capital expenditures (Olarewaju and Akanda, 2016). Adequate capital provides an ultimate protection against insolvency culminating from the unavoidable market risk in the banking sector. Alajmi and Alqasem (2015) found that bank size and return on assets (ROA) have significant negative relationship with CAR. However, loan to deposit ratio showed a significant positive relationship with CAR.

According to Williams (2003), there is a positive relationship between return on assets and net interest margin of banks. Furthermore, Saksonova (2014) concluded that there is a positive impact of net interest margin in maintaining the stability of the bank. The study also revealed that there is a positive relationship between net interest margin and bank efficiency. Likewise, Banker et al. (2010) concluded that the non-performing loans ratio is negatively associated with bank efficiency. Similarly, Ali and Puah (2019) indicated that there is a positive association between capital adequacy and banks' profitability. The study also found that there is no significant impact of capital adequacy on the banks' profitability in Philippines. Finally, Jahan (2020) revealed that there is a positive relationship among capital adequacy, solvency, credit risk and stability. Similarly, Belas et al. (2019) found that there is a positive and insignificant relationship between efficiency (cost to income ratio) and net interest margin of banks. The study revealed that more efficient banks exhibit lower margins and do not compensate themselves with higher fees.

In the context of Nepal, Pant (2017) found that bank size has a positive and significant impact on bank risk. In addition, Bhattarai (2016) observed that non-performing loan ratio has a negative effect on overall bank profitability (ROA). However, non-performing loan ratio has a positive effect on shareholders' return (ROE). Moreover, the study stated that bank size has significant positive effect on bank profitability (ROA, ROE). The study showed that higher the portfolio risk and bank size, lower would be the profitability of the Nepalese government banks (Gyawali, 2018).

Kunwar (2018) found that non-performing loans has negative impact on bank profitability. However, bank profitability is positively related to credit ratio market share and GDP. Gautam (2018) stated that there is a positive relationship of return on assets with capital adequacy ratio, management efficiency and gross domestic product whereas negative relationship with assets quality and liquidity management.

The above discussion reveals that there is no consistency in the findings of various studies concerning the relationship between CAMEL rating and performance of commercial banks.

The main objective of this study is to analyze the relationship between CAMEL rating and performance in the context of Nepalese commercial banks. More specifically, it examines the impact of capital adequacy ratio, assets quality, management efficiency, earning quality and liquidity on the performance of Nepalese commercial banks.

The remainder of this study is organized as follows: Section two describes the sample, data and methodology. Section three presents the empirical results and the final section draws conclusion and discusses the implications of the study findings.

II. METHODOLOGICAL ASPECTS

The study is based on the secondary data which were gathered from 28 commercial banks in Nepal with 224 observations for the period from 2011/12 to 2018/19. The main sources of data include Banking and Financial Statistics published by Nepal Rastra Bank and annual reports of the selected commercial banks. Table 1 shows the number of commercial banks selected for the study along with the study period and number of observations.

Table 1: List of Nepalese commercial banks for the study along with the study period and number of observations

S. N.	Name of the banks	Study period	Observations
1	Agricultural Development Bank Limited	2011/12-2018/19	8
2	Bank of Kathmandu Limited	2011/12-2018/19	8
3	Century Commercial Bank Limited	2011/12-2018/19	8
4	Citizens Bank International Limited	2011/12-2018/19	8
5	Civil Bank Limited	2011/12-2018/19	8
6	Everest Bank Limited	2011/12-2018/19	8
7	Global IME Bank Limited	2011/12-2018/19	8
8	Himalayan Bank Limited	2011/12-2018/19	8
9	Janata Bank Nepal Limited	2011/12-2018/19	8
10	Kumari Bank Limited	2011/12-2018/19	8
11	Laxmi Bank Limited	2011/12-2018/19	8
12	Machhapuchchhre Bank Limited	2011/12-2018/19	8
13	Mega Bank Nepal Limited	2011/12-2018/19	8
14	Nabil Bank Limited	2011/12-2018/19	8
15	Nepal Bangladesh Bank Limited	2011/12-2018/19	8
16	Nepal Bank Limited	2011/12-2018/19	8
17	Nepal Credit and Commerce Bank Limited	2011/12-2018/19	8
18	Nepal Investment Bank Limited	2011/12-2018/19	8
19	Nepal SBI Bank Limited	2011/12-2018/19	8

20	NIC Asia Bank Limited	2011/12-2018/19	8
21	NMB Bank Limited	2011/12-2018/19	8
22	Prabhu Bank Limited	2011/12-2018/19	8
23	Prime Commercial Bank Limited	2011/12-2018/19	8
24	Rastriya Banijya Bank Limited	2011/12-2018/19	8
25	Sanima Bank Limited	2011/12-2018/19	8
26	Siddhartha Bank Limited	2011/12-2018/19	8
27	Standard Chartered Bank Nepal Limited	2011/12-2018/19	8
28	Sunrise Bank Limited	2011/12-2018/19	8
Total number of observations			**224**

Thus, the study is based on the 224 observations.

2.1 The model

The model used in this study tries to analyze the impact of capital adequacy, assets quality, management efficiency, earning quality and liquidity on the performance of Nepalese commercial banks. The selected dependent variables are return on assets and return on equity. Therefore, the following model equation is designed to test the hypothesis.

$$ROA = \beta_0 + \beta_1\, CA1 + \beta_2\, AQ1 + \beta_3\, AQ2 + \beta_4\, AQ3 + \beta_5\, ME1 + \beta_6\, EQ1 + \beta_7\, EQ2 + \beta_8\, LQ1 + \beta_9\, LQ2 + \varepsilon$$

$$ROE = \beta_0 + \beta_1\, CA1 + \beta_2\, AQ1 + \beta_3\, AQ2 + \beta_4\, AQ3 + \beta_5\, ME1 + \beta_6\, EQ1 + \beta_7\, EQ2 + \beta_8\, LQ1 + \beta_9\, LQ2 + \varepsilon$$

Where,

ROA = Return on assets is measured as the ratio of net income to total assets, in percentage.

ROE=Return on equity is measured as the ratio of net income to total shareholders' equity, in percentage

CA1 = Capital adequacy is measured as the ratio of tier1 capital plus tier 2 capital to risk weighted assets in percentage.

AQ1 = NPL ratio is measured as the ratio of non-performing loan to total loan, in percentage.

AQ2= Loan loss provision ratio is measured as the ratio of loan loss provision to total loan, in percentage.

AQ3= Loan to total assets ratio is measured as the ratio of total loans and advances to total assets, in percentage.

MC1= Operating efficiency ratio is measured as the ratio of total operating income to total operating expenses, in percentage.

EQ1= Net interest margin ratio is measured as the ratio of net interest income to total assets, in percentage.

EQ2 = Operating profit ratio is measured as the ratio of operating income to total profit, in percentage.

LQ1 = Cash ratio is measured as the ratio of cash and cash equivalent to total assets in percentage.

LQ2 = Loan to deposit ratio is measured as the ratio of total loan to total deposit, in percentage.

The following section describes the dependent and independent variables used in this study

2.2 Capital adequacy ratio (CA1)

Capital adequacy ratio is measured as a ratio of total capital to total risk weighted assets. Ghosh (2016) explained that banks are required to hold capital equal to a certain percentage of the total risk-weighted assets to meet the time liabilities and other risks such as credit risk, operational risk etc. Almazari (2014) stated that capital adequacy has a negative relationship with ROA and ROE. Similarly, Antwi (2019) found that capital adequacy is negatively related to performance measured by return on assets (ROA) and return on equity (ROE). Moreover, capital adequacy as a determinant of profitability of banks showed that a high capital adequacy ratio should signify a bank that is operating over-cautiously and ignoring potentially profitable trading opportunities. It implies a negative relationship between equity to asset ratio and bank performance (Goddard et al., 2004). Based on it, this study develops the following hypothesis:

H1: There is a negative relationship between capital adequacy ratio and bank performance.

2.3 Loan to assets ratio (AQ1)

Loan to assets ratio is measured as ratio of total loan and advances to total assets. Dembel (2020) examined the determinants of profitability of U.S. commercial banks. The study found a positive relationship between loan to assets and bank profitability. Similarly, Chirwa (2017) found a positive and significant relationship of loan to assets ratio with profitability in the long-run and short-run. Likewise, Ben and Naceur (2003) found a positive impact of loan to total assets ratio on profitability. Further, Abreu and Mendes (2016) found that loan to assets ratio has a positive impact on profitability. Based on it, this study develops the following hypothesis:

H2: There is a positive relationship of loan to total assets ratio with bank performance.

2.4 Non-performing loan ratio (AQ2)

Non-performing loan ratio is measured as a ratio of non-performing loan to gross loan and advances. Kiran and Jones (2016) also found a negative relationship between non-performing loan ratio and performance. Joseph et al. (2010) stated a negative relationship between non-performing loan ratio and bank efficiency. Likewise, Bace (2016) found a negative relationship between NPL ratio and profitability. Similarly, Subaru et al. (2011) revealed that there is a negative relationship between impaired loan and performance efficiency. Likewise, Mohammed (2012) revealed a negative impact of non-performing loan on Based on it, this Study develops the following hypothesis:

H3: There is a negative relationship of non-performing loan ratio with bank performance.

2.5 Loan loss provision ratio (AQ3)

Loan loss provisions is measured as a ratio of new loan loss provisions made by banks in the current period to total loans. Muhmad and Hasim (2015) found a negative and significant relationship between the loan loss provision to total assets and bank performance (ROA and ROE). Similarly, Akani and Lucky (2015) found that increase in loan loss provision decreases the profitability whereas increase in total loan and advances increase profitability. Similarly, Alemu and Aweke (2017) found a negative relationship between loan loss provision to total loans and performance measured by ROA and ROE. Based on it, this study develops the following hypothesis.

H4: There is a negative relationship of loan loss provision with bank performance.

2.6   Income to expenses ratio (ME1)

Income to expenses ratio is measured as the ratio of total operating income to total operating expenses. A high operational efficiency ratio reflects a bank's ability to effectively manage its operating expenses and thus is likely to affect profitability positively (Mulualem, 2015). Alemu and Aweke (2017) found a positive relationship of operating efficiency and bank performance (ROA and ROE). Similarly, Getahun (2020) revealed a positive relationship of operating efficiency and profitability because if the operating efficiency is high then it gives the assurance of increment in profitability. Davydenko (2010) also found a positive relationship between operating efficiency measured by income to expenses ratio and profitability. Based on it, this study develops the following hypothesis:

H5: There is a positive relationship of income to expenses ratio with bank performance.

2.7   Net interest margin (EQ1)

Net interest margin is measured as the ratio of annual net interest income that is interest income less interest expense, to total assets. Aguenaou et al. (2019) found a positive relationship between net interest margin and performance measured by ROA and ROE. Likewise, Gabriel (2012) stated that higher the net interest margin, higher would be the bank profitability. Likewise, Jha and Hui (2012) found a positive relationship between net interest margin and profitability. Based on it, this study develops the following hypothesis:

H6: There is a positive relationship of net interest margin with bank performance.

2.8   Operating profit ratio (EQ2)

Operating profit ratio is measured as a ratio of operating profit to total profit. Rahman (2019) analyzed the performance of commercial banks in Bangladesh. The study found that the ratio of operating profit to total profit is positively related to performance of commercial banks. Similarly, Bawaneh and Dahiyat (2019) evaluated the performance of commercial banks in Indonesia. The study found that ratio of operating profit to total profit is positively related to bank performance. Sangmi and Nazir (2010) found a positive impact of earning on firm performance. Similarly, Gabriel (2012) found that operating profit to total profit indicating earning is positively related to firm performance Based on it, this study develops the following hypothesis:

H7: There is a positive relationship of operating profit ratio with bank performance.

2.9   Cash ratio (LQ1)

Cash ratio is defined as the ratio of cash and cash equivalents to total assets. Ifeacho and Ngalawa (2014) found a positive effect of liquidity on both performance indicators such as ROA and ROE. However, Al Nimer et al. (2015) found a negative relationship between cash ratio and performance of commercial banks. Similarly, Ayele (2012) found that there is a significant negative relationship between the firm's profitability and liquidity when it is measured by cash ratio. High liquidity would influence profitability adversely. Likewise, Alshatti (2015) found that cash ratio has a negative impact on profitability of the Jordanian commercial banks Based on it, this study develops the following hypothesis:

H8: There is a negative relationship of cash ratio with bank performance.

2.10   Loan to deposit ratio (LQ2)

Haidary and Abbey (2018) found a positive relationship between loan to deposit ratio and performances in Ethiopia. Similarly, Khan and Ali (2016) found that total loan to total deposit is positive correlated to return on assets and negatively correlated to return on equity. Likewise, Muhmad and Hashim (2015) found a positive impact of loan to deposit ratio on

bank performance measured by ROA and ROE. Based on it, this study develops the following hypothesis:

H9: There is a positive relationship of loan to deposit ratio with bank performance.

III. RESULTS AND DISCUSSION

3.1 Descriptive statistics

Table 2 presents the descriptive statistics of selected dependent and independent variables during the period 2011/12 to 2018/19.

Table 2: Descriptive statistics

This table shows the descriptive statistics of dependent and independent variables of 28 Nepalese commercial banks for the study period of 2011/12 to 2018/19. The dependent variables are ROA (Return on assets is measured as the ratio of net income to total assets, in percentage) and ROE (Return on equity is measured as the ratio of net income to total shareholders' equity, in percentage). The dependent variables are CA1 (Capital adequacy is measured as the ratio of tier1 capital plus tier 2 capital to risk weighted assets in percentage), AQ1 (NPL ratio is measured as the ratio of non-performing loan to total loan, in percentage), AQ2 (Loan loss provision ratio is measured as the ratio of loan loss provision to total loan, in percentage), AQ3 (Loan to total assets ratio is measured as the ratio of total loans and advances to total assets, in percentage), ME1 (Operating efficiency ratio is measured as the ratio of total operating income to total operating expenses, in percentage), EQ1 (Net interest margin ratio is measured as the ratio of net interest income to total assets, in percentage), EQ2 (Operating profit ratio is measured as the ratio of operating income to total profit, in percentage), LQ1 (Cash ratio is measured as the ratio of cash and cash equivalent to total assets in percentage) and LQ2 (Loan to deposit ratio is measured as the ratio of total loan to total deposit, in percentage).

Variables	Minimum	Maximum	Mean	S. D.
ROA	-3.44	4.01	1.56	0.73
ROE	-55.94	55.31	14.89	8.71
CA1	-18.73	41.82	12.75	4.28
AQ1	0.00	24.29	2.03	2.33
AQ2	0.04	13.24	0.96	1.22
AQ3	40.22	81.54	67.01	7.55
ME1	0.99	6.66	2.56	0.87
EQ1	1.74	5.76	3.23	0.71
EQ2	-0.12	2.86	1.29	0.44
LQ1	46.08	105.72	80.36	10.61
LQ2	1.22	28.58	5.76	4.30

3.2 Correlation analysis

Having indicated the descriptive statistics, Pearson's correlation coefficients are computed and the results are presented in Table 3.

Table 3: Pearson's correlation coefficients matrix

This table shows the bivariate Pearson's correlation coefficients of dependent and independent variables of 28 Nepalese commercial banks for the study period of 2011/12 to 2018/19. The dependent variables are ROA (Return on assets is measured as the ratio of net income to total assets, in percentage) and ROE (Return on equity is measured as the ratio of net income to total shareholders' equity, in percentage). The dependent variables are CA1 (Capital adequacy is measured as the ratio of tier1 capital plus tier 2 capital to risk weighted assets in percentage), AQ1 (NPL ratio is measured as the ratio of non-performing loan to total loan, in percentage), AQ2 (Loan loss provision ratio is measured as the ratio of loan loss provision to total loan, in percentage), AQ3 (Loan to total assets ratio is measured as the ratio of total loans and advances to total assets, in percentage), ME1 (Operating efficiency ratio is measured as the ratio of total operating income to total operating expenses, in percentage), EQ1 (Net interest margin ratio is measured as the ratio of net interest income to total assets, in percentage), EQ2 (Operating profit ratio is measured as the ratio of operating income to total profit, in percentage), LQ1 (Cash ratio is measured as the ratio of cash and cash equivalent to total assets in percentage) and LQ2 (Loan to deposit ratio is measured as the ratio of total loan to total deposit, in percentage).

Variables	ROA	ROE	CA1	AQ1	AQ2	AQ3	ME1	EQ1	EQ2	LQ1	LQ2
ROA	1										
ROE	0.763**	1									
CA1	0.103	-0.088	1								
AQ1	-0.322**	-0.353**	-0.335**	1							
AQ2	-0.458**	-0.523**	-0.098	0.736**	1						
AQ3	-0.136*	-0.215**	0.307**	-0.310**	-.170*	1					
ME1	0.104	0.096	0.117	-0.339**	-0.155*	0.163*	1				
EQ1	0.437**	0.169*	0.101	0.234**	0.258**	-0.133*	-0.138*	1			
EQ2	-0.030	-0.069	0.287**	-0.221**	-0.139*	0.153*	0.196**	-0.004	1		
LQ1	0.015	-0.223**	0.431**	-0.271**	-0.177**	0.838**	0.100	0.049	0.104	1	
LQ2	0.075	0.032	-0.083	0.068	-0.044	-0.341**	-0.168*	0.154*	-0.034	-0.225**	1

Note: The asterisk signs (**) and (*) indicate that the results are significant at one percent and five percent levels respectively.

Table 3 shows that capital adequacy ratio is positively correlated to return on assets. It indicates that increase in capital adequacy ratio leads to increase in return on assets. Likewise, net interest margin has a positive relationship with return on assets. It indicates that higher the net interest margin, higher would be the return on assets. In addition, the study shows that cash ratio is positively related to return on assets. It reveals that higher the cash ratio, higher would be the return on assets. Likewise, the study also shows that non-performing loan is also negatively related to return on assets. It indicates that higher the non-performing loans, lower would be the return on assets. Moreover, the study also shows that loan loss provision is also negatively related to return on assets. It indicates that higher the loan loss provision, lower would be the return on assets. Similarly, operating efficiency ratio has a positive relationship with return on assets. It reveals that higher the operating efficiency ratio, higher would be the return on assets.

On the other hand, the results show that capital adequacy ratio is positively correlated to return on equity. It indicates that increase in capital adequacy ratio leads to increase in return on equity. Likewise, net interest margin has a positive relationship with return on equity. It indicates that higher the net interest margin, higher would be the return on equity. In addition,

the study shows that loan to deposit ratio is positively related to return on equity. It reveals that higher the loan to deposit ratio, higher would be the return on equity. Likewise, the study also shows that non-performing loan is also negatively related to return on equity. It indicates that higher the non-performing loans, lower would be the return on equity. Moreover, the study also shows that loan loss provision is also negatively related to return on equity. It indicates that higher the loan loss provision, lower would be the return on equity. Similarly, operating efficiency ratio has a positive relationship with return on equity. It reveals that higher the operating efficiency ratio, higher would be the return on equity.

3.3   Regression analysis

Having indicated the Pearson's correlation coefficients, the regression analysis has been computed and results are presented in Table 4. More specifically, it shows the regression results of capital adequacy ratio, assets quality, management efficiency, earning quality and liquidity position on the return on assets of Nepalese commercial banks.

Table 4: Estimated regression results of capital adequacy, assets quality, management efficiency, earning quality and liquidity on return on assets of Nepalese commercial banks

The results are based on panel data of 28 commercial banks with 224 observations for the period of 2011/12-2018/19 by using the linear regression model and the model is $ROA = \beta_0 + \beta_1 CA1 + \beta_2 AQ1 + \beta_3 AQ2 + \beta_4 AQ3 + \beta_5 ME1 + \beta_6 EQ1 + \beta_7 EQ2 + \beta_8 LQ1 + \beta_9 LQ2 + e$ where, the dependent variable is ROA (Return on assets is measured as the ratio of net income to total assets, in percentage). The dependent variables are CA1 (Capital adequacy is measured as the ratio of tier1 capital plus tier 2 capital to risk weighted assets in percentage), AQ1 (NPL ratio is measured as the ratio of non-performing loan to total loan, in percentage), AQ2 (Loan loss provision ratio is measured as the ratio of loan loss provision to total loan, in percentage), AQ3 (Loan to total assets ratio is measured as the ratio of total loans and advances to total assets, in percentage), ME1 (Operating efficiency ratio is measured as the ratio of total operating income to total operating expenses, in percentage), EQ1 (Net interest margin ratio is measured as the ratio of net interest income to total assets, in percentage), EQ2 (Operating profit ratio is measured as the ratio of operating income to total profit, in percentage), LQ1 (Cash ratio is measured as the ratio of cash and cash equivalent to total assets in percentage) and LQ2 (Loan to deposit ratio is measured as the ratio of total loan to total deposit, in percentage).

Model	Intercept	Regression coefficients of									Adj. R_bar2	SEE	F-value
		CA1	AQ1	AQ2	AQ3	ME1	EQ1	EQ2	LQ1	LQ2			
1	1.332 (8.689)**	0.018 (1.541)									0.006	0.728	2.378
2	1.762 (28.620)**		-0.101 (5.072)**								0.100	0.639	25.720
3	1.821 (32.829)**			-0.275 (7.681)**							0.206	0.651	58.995
4	2.436 (5.618)**				-0.013 (2.041)*						0.014	0.725	4.167
5	1.332 (8.781)**					0.088 (1.565)					0.006	0.728	2.448
6	0.111 (0.544)						0.447 (7.241)**				0.187	0.659	52.431
7	1.621 (10.631)**							-0.050 (0.449)			0.004	0.732	0.202
8	1.473 (3.932)**								0.001 (0.226)		0.004	0.732	0.051
9	1.483 (18.158)**									-0.013 (1.121)	0.001	0.730	1.256
10	3.223 (7.778)**	0.023 (2.120)*	0.002 (0.062)	0.296 (5.636)**	-0.025 (4.168)**						0.260	0.628	20.598
11	3.238 (7.508)**		-0.010 (0.354)	-0.278 (5.340)**	-0.023 (3.819)**	0.050 (0.950)					0.248	0.634	19.388
12	0.839 (2.556)*			-0.028 (13.527)**	-0.018 (4.050)**	0.100 (2.638)*	0.603 (12.903)**				0.573	0.478	75.574
13	0.179 (0.432)						0.446 (7.066)**	-0.047 (0.457)	0.001 (0.030)	0.001 (0.099)	0.177	0.663	13.002
14	1.296 (3.486)**			-0.390 (14.182)**	-0.020 (4.292)**	0.106 (2.807)*	0.624 (13.484)**	-0.193 (2.606)**		-0.017 (2.118)*	0.590	0.468	54.561
15	0.941 (2.514)*	-0.007 (0.707)	-0.162 (8.491)**			0.043 (0.922)	0.588 (10.568)**	-0.211 (2.298)*	-0.009 (2.175)*		0.404	0.564	26.235
16	1.403 (3.588)**	0.009 (1.1023)	-0.013 (0.561)	-0.372 (9.295)**	-0.021 (4.511)**	0.098 (2.469)*	0.617 (13.097)**	-0.217 (2.848)**		-0.017 (2.108)*	0.590	0.468	41.153
17	1.424 (3.604)**	0.007 (0.812)	-0.014 (2.931)**	-0.369 (9.050)**	-0.024 (2.846)**	0.098 (2.468)*	0.611 (12.487)**	-0.213 (2.751)**	0.003 (0.413)	-0.017 (2.217)*	0.650	0.469	36.458

Notes:

Figures in parenthesis are t-values.

The asterisk signs (**) and (*) indicate that the results are significant at one percent and five percent level respectively.

Return on assets is the dependent variable.

Table 4 shows that the beta coefficients for capital adequacy are positive with return on assets. It indicates that the capital adequacy has a positive impact on return on assets. This finding is consistent with the findings of Abreu and Mandes (2016). Similarly, the beta coefficients for non-performing loan ratio are negative with return on assets. It indicates that the non-performing loan ratio has a negative impact on return on assets. This finding is consistent with the findings of Kiran and Jones (2016). Likewise, the beta coefficients for loan loss provision ratio are negative with return on assets. It indicates that the loan loss provision ratio has a negative impact on return on assets. This finding is consistent with the findings of Muhmad and Hasim (2015). Similarly, the beta coefficients for operating efficiency ratio are positive with return on assets. It indicates that the operating income to operating expenses has a positive impact on return on assets. This finding is consistent with the findings of Alemu and Aweke (2017). Similarly, the beta coefficient for net interest margin are positive with return on assets. It indicates that the net interest margin has a positive impact on return on assets. This finding is consistent with the finding of Aguenaou et al. (2019).

Table 5 shows the regression results of capital adequacy ratio, assets quality, management efficiency, earning quality and liquidity position on the return on equity of Nepalese commercial banks.

Table 5: Estimated regression results of capital adequacy, assets quality, management efficiency, earning quality and liquidity on return on equity

The results are based on panel data of 28 commercial banks with 224 observations for the period of 2011/12-2018/19 by using the linear regression model and the model is ROE = β0+ β1CA1+ β2 AQ1+ β3 AQ2+ β4 AQ3+ β5 ME1+ β6 EQ1+ β7 EQ2+ β8 LQ1+ β9 LQ2 + e where, the dependent variable is ROE (Return on equity is measured as the ratio of net income to total shareholders' equity, in percentage). The dependent variables are CA1 (Capital adequacy is measured as the ratio of tier1 capital plus tier 2 capital to risk weighted assets in percentage), AQ1 (NPL ratio is measured as the ratio of non-performing loan to total loan, in percentage), AQ2 (Loan loss provision ratio is measured as the ratio of loan loss provision to total loan, in percentage), AQ3 (Loan to total assets ratio is measured as the ratio of total loans and advances to total assets, in percentage), ME1 (Operating efficiency ratio is measured as the ratio of total operating income to total operating expenses, in percentage), EQ1 (Net interest margin ratio is measured as the ratio of net interest income to total assets, in percentage), EQ2 (Operating profit ratio is measured as the ratio of operating income to total profit, in percentage), LQ1 (Cash ratio is measured as the ratio of cash and cash equivalent to total assets in percentage) and LQ2 (Loan to deposit ratio is measured as the ratio of total loan to total deposit, in percentage).

Model	Intercept	Regression coefficients of									Adj. R_bar2	SEE	F-value
		CA1	AQ1	AQ2	AQ3	ME1	EQ1	EQ2	LQ1	LQ2			
1	17.182 (9.388)**	-0.179 (1.318)									0.003	8.690	1.737
2	17.582 (24.239)**		-1.321 (5.620)**								0.121	8.165	31.590
3	18.491 (29.159)**			-3.734 (9.133)**							0.270	7.440	83.404
4	31.467 (6.176)**				-0.247 (3.273)**						0.042	8.523	10.731
5	12.439 (6.875)**					0.961 (1.433)					0.005	8.686	2.055
6	8.227 (3.082)**						2.063 (2.558)*				0.024	8.600	6.542
7	16.676 (9.192)**							-1.382 (1.036)			0.005	8.710	1.074
8	29.574 (6.769)**								-0.183 (3.402)**		0.045	8.507	11.575
9	14.512 (14.878)**									0.066 (0.483)	0.003	8.722	0.233
10	44.962 (9.811)**	-0.156 (1.282)	-0.373 (1.143)	-3.638 (6.268)**	-0.365 (5.337)**						0.363	6.950	32.727
11	44.445 (9.485)**		-1.784 (7.342)**			0.047 (0.075)		-2.771 (2.299)*	-0.277 (5.548)**		0.239	7.596	18.498
12	32.308 (8.631)**		-5.007 (13.992)**				4.784 (7.863)**		-0.328 (8.037)**	0.301 (3.007)**	0.508	6.110	58.514
13	28.794 (5.743)**		-0.170 (0.564)	-4.343 (8.050)**	-0.350 (5.743)**	0.780 (1.445)	3.740 (5.894)**				0.446	6.482	36.860
14	30.800 (6.173)**		-0.257 (0.861)	-4.342 (8.174)**	-0.336 (5.569)**	0.974 (1.816)	3.852 (6.151)**	-2.840 (2.791)**			0.462	6.384	32.972
15	31.905 (6.620)**	-0.018 (0.165)		-5.075 (14.20)**	-0.038 (0.351)	0.586 (1.755)	4.449 (7.972)**	-2.935 (2.959)**	-0.341 (4.356)**	0.275 (2.684)**	0.524	6.001	31.651
16	33.459 (6.602)**	-0.058 (0.498)	-0.297 (0.992)	-4.697 (8.987)**	-0.019 (0.173)	0.711 (1.397)	5.025 (8.007)**	-2.943 (2.967)**	-0.332 (4.204)**	0.274 (2.678)**	0.524	6.009	28.241

Notes:

Figures in parenthesis are t-values.

The asterisk signs (**) and (*) indicate that the results are significant at one percent and five percent level respectively.

Return on equity is the dependent variable.

Table 5 shows that the beta coefficients for non-performing loan ratio are negative with return on equity. It indicates that the non-performing loan ratio has a negative impact on return on equity. This finding is consistent with the findings of Bace (2016). Likewise, the beta coefficients for loan loss provision ratio are negative with return on equity. It indicates that the loan loss provision ratio has a negative impact on return on equity. This finding is consistent with the findings of Akani and Lucky (2015). Similarly, the beta coefficients for operating efficiency ratio are positive with return on equity. It indicates that the operating income to operating expenses has a positive impact on return on equity. This finding is consistent with the findings of Sangmi and Nazir (2010). In addition, the beta coefficient for net interest margin are positive with return on equity. It indicates that the net interest margin has a positive impact on return on equity. This finding is consistent with the finding of Jha and Hui (2012). Moreover, the beta coefficient for loan to deposit ratio are positive with return on equity. It indicates that the loan to deposit ratio has a positive impact on return on equity. This finding is consistent with the finding of Khan and Ali (2016).

IV. SUMMARY AND CONCLUSION

Banks helps in proper utilization of financial resources because they serve as a backbone of the financial sector. In order to maintain the financial soundness and efficiency, authorities impose regulations on banks to ensure safeness and soundness of the banking system. CAMEL model is universally applied framework for measuring efficiency of financial system. The impact of capital adequacy ratio, assets quality, management efficiency, earning quality and liquidity have the great importance in determining the overall efficiency of the commercial banks.

This study attempts to examine the impact of CAMEL variables on the performance of Nepalese commercial banks. This study is based on secondary data of 28 commercial banks with 224 observations for the period from 2011/12 to 2018/19.

The study showed that capital adequacy ratio, operating efficiency, cash ratio, net interest margin ratio and loan to deposit ratio have positive impact on return on assets. Similarly, the study also showed that loan to total assets ratio, non-performing loans, loan loss provision and operating profit ratio have negative impact on return on assets. However, capital adequacy ratio, cash ratio, loan to total assets ratio, non-performing loans, loan loss provision ratio and operating profit ratio have negative impact on return on equity. In addition, operating efficiency, net interest margin and loan to deposit ratio have a positive impact on return on equity. The study concluded that loan loss provision followed by net interest margin and non-performing loans are the most influencing factor that explains the changes in the return on assets. Likewise, the most dominant factor that determines the return on equity is loan loss provision followed by non-performing loans in the context of Nepalese commercial banks.

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Closing Session

During the closing session of the conference, the Executive Director of Economic Research Department, Dr. Prakash Kumar Shrestha presented the summary of the conference. He outlined that there were more than 100 participants and 16 papers on a range of subjects related to macroeconomic management and the financial sector were presented during the three parallel sessions of the conference. He also mentioned about the importance of the conference to foster constructive discussion on the various dimensions of the financial sector, economic growth, and development.

He believed that the conference has provided insight to the participants regarding the issues related to financial sector development, poverty alleviation, and policy response for addressing challenges of the external sector.

At the end of the event, the Director of Economic Research Department, Mr. Laxmi Prasad Prasai delivered a vote of thanks. He thanked all the distinguished guests, organizers, and participants for their valuable presence to make the event successful.

In the closing remarks of the conference, Deputy Governor Mr. Bam Bahadur Mishra highlighted the need for the development of payment system and institutional reforms to reduce vulnerability to economic stresses and urged all to work collectively to ensure better access to financial services. Mr. Mishra also emphasized that the conference has provided an opportunity for the researchers to have an in-depth discussion on the problems, challenges, and possibilities of the economy.

Moreover, Deputy Governor Mr. Mishra has also noted that the deliberations and discussions on findings presented during the sessions of the conference will motivate policymakers and researchers to further explore and refine the research work in the coming days. He further mentioned that such conference will help to provide comprehensive policy responses to stop the depletion of the country's foreign exchange reserve and manage the soaring balance of payments deficits proactively.