Price Elasticity of Sectoral Lending in Nepal

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Abstract

During 2015 to 2019, there was a significant upsurge observed in the lending rate in Nepalese credit market. Interestingly, the lending amount also went up significantly in this period showing an anomalous relationship between lending and lending rate. This paper is an attempt to analyse this observed anomaly. We have estimated and examined the degree of elasticity of sectoral lending with lending rate in Nepalese context undertaking panel regression analysis covering all 28 commercial banks in operation in Nepal till mid-July 2019.The results show a positive and inelastic relationship to exist between sectoral lending and lending rate during the study period despite decreasingHerfindahl-Hirschman index in the same period, which means that level of competition is increasing in Nepalese banking industry. Our scenario analysis indicates syphoning of funds, and the changed role of bankersas major causes for this anomalous relationship.

Key Words: Banks, credit, elasticity, lending rate, Nepal, sectoral lending

JEL Classification: E43, E51, G12, G21

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I. INTRODUCTION

In the recent past, commercial banks in Nepal literally jumped into 'interest rate war' against each other in order to attract fresh deposits, which has had significant effect on pushing the deposit rates up. Since the cost of fund is a significant component in the base rate calculation, the lending rate escalated significantly[1] after the interest rate war. This can be seen in the higher weighted average lending rate in the recent years (over 12 percent in 2019 and 2018). This rate was 11.4 percent in 2017 and 8.8 percent in 2016 (NRB, 2019). Upsurge in the lending rate obviously raises concerns over the causes that are driving it up. In the mean time, it also poses question on the efficiency of Nepalese bankers in managing funds. Interestingly, despite such a significant upsurge in the lending rate during this period, the lending amount also went up significantly (from NRs1.392 trillion in 2016 to NRs 2.497 trillion in 2019, NRB, 2019). As believers on the classical theory of interest, wehad expected a negative relationship to exist between them. That means, after upsurge in the lending rate, the lending amount should have fallen or have stalled. Butthis pattern was not seen in the nominal values of lending, which made usmull over other factorsthat might have affected the lending behaviour of commercial banks in Nepal. There are some recent empirical works analysing the lending behaviour of commercial banks in Nepal though viz. Bhattarai (2019), Bajracharya (2018), Puri et al. (2018), Timsina (2016a & 2016b), Bhattarai (2016), etc.but explanation of this observed anomalous behaviour in credit lending has not occupied place into their analyses. Thus, we saw a clear gap in literature in context of Nepal that motivated us to estimate the degree of elasticityof sectoral lending with lending rate (also known as price elasticity) and use the estimated price elasticity to analyse the anomalous relationship observed between them. The rest of this paper has been organised as follows. Section two presents the recent status of sectoral credit lending while section three presents research methodology that we have undertaken in this work.

[1] The Himalayan Times (17 August 2018) reported that 21 out of 28 banks have had base rate above 10 percent. The news is available at: https://thehimalayantimes.com/business/base-rate-of-21-banks-above-10pc/ , accessed on 29 December 2019.

Section four presents the empirical findings of the work which is followed by the discussion and concluding remarks in section five.

II. RECENT STATUS OF SECTORAL CREDITS

Commercial banks in Nepal float loans over 16 key areas of economic activities, also known as sectors. As on mid-July 2019, the total credit lending of commercial banks grew by 18.3 percent to reach NRs 2.497 trillion from NRs 2.112 trillion in mid-July 2018, mainly led by NIC bank, Rastriya Banijya bank, Nabil bank, Nepal Investment bank and Global bank that together share 27.1 percent of total lending. Meanwhile, lending pattern has continued to concentrate on FOUR[2] major sectors, viz. (i) wholesale and retail; (ii) non-food production related; (iii) construction; and (iv) finance, insurance, and real estate sharing about 54 percent together (Figure 1). Interestingly, in those four concentrated sectors, larger banks of Nepal (defined as the banks that have asset shares larger than the average value of 4 percent of the aggregate assets of the commercial banks) viz. Agriculture Development bank, Everest bank, Global bank, Nabil bank, Nepal Investment bank, NIC bank, and Rastriya Banijya bank (indicated by asterisks in Figure 1) have major chunks in lending. Among those quoted banks as above, Agriculture Development bank, Nabil bank, and Rastriya Banijya bank have higher concentration risk in their sectoral portfolios along with Standard Chartered bank, NMB bank, and Nepal SBI bank, each has HH index above 1500 score. Other 22 banks have had HH index below 1500 (Figure 2, & Appendix B).

[2] In fact, the 'others (12.3 percent)' sector comprises of third largest share in the total lending, however, as the components of this sector are not known, we have excluded it from discussion.

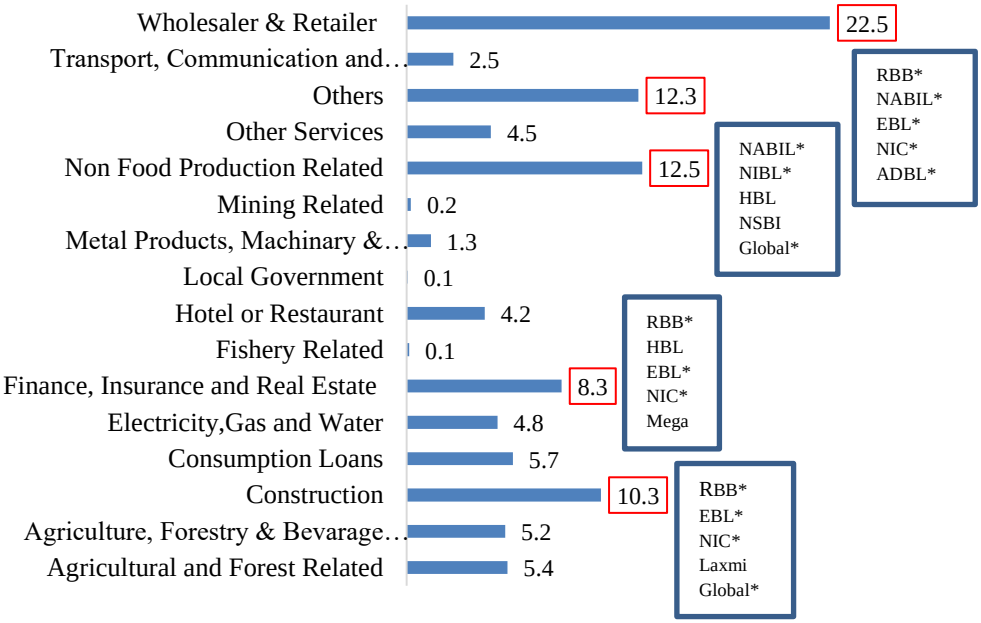

Figure. 1: Commercial banks' sector-wise lending, 2019

Data source: NRB (2019)

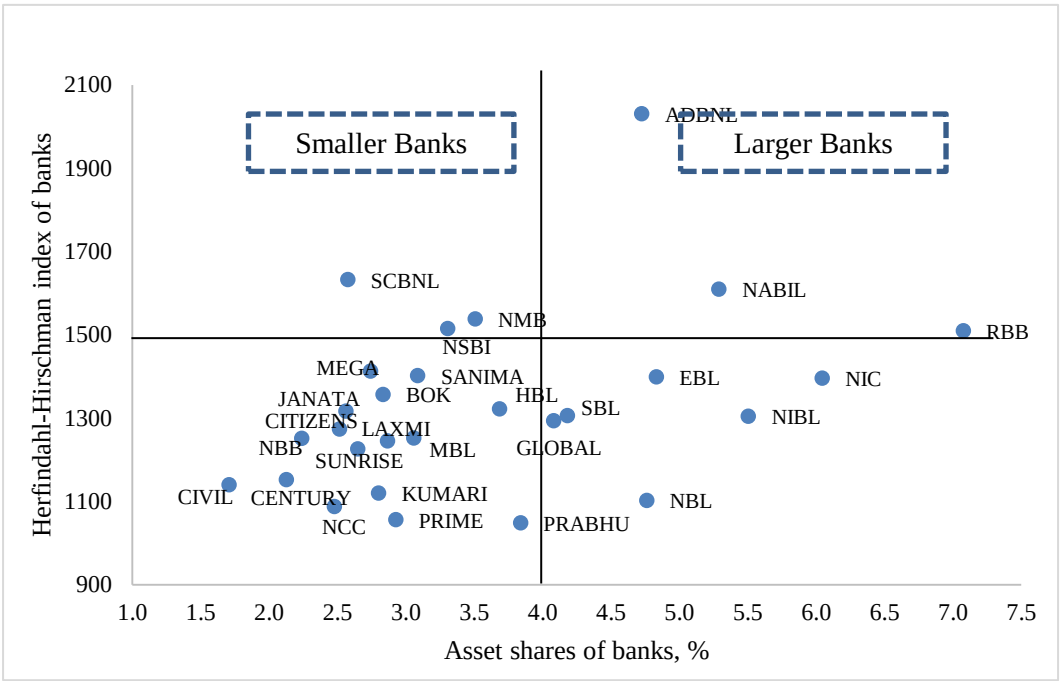

Figure 2: Banks' size and sectoral portfolio concentration, 2019

Data source: NRB (2019) and researchers' estimate (2020)

Thus, banks have shown a mix of moderate to low levels of concentration in their sectoral lending portfolios. Literature shows varying consequences of having high concentration in lending portfolios. For instance, Ben-Zekry (2007) argues that high concentration levels will increase profits for the dominant banks within the industry, which will insulate them from economic shocks. Acharya et al. (2006) and Tabak et al. (2010) argue that banks by focusing lending to certain sectors acquire expertise in those sectors and thus improve the loan quality, which reduces the risk of credit default. Moreover, Beck et al. (2003) found that high concentration leads to high stability in the banking industry. However, negative effects of higher concentration have also been reported- higher level of bank concentration in only a few sectors may cause higher interest rates in those sectors which may harm investors. In addition, large banks will focus on the most profitable niches and may neglect less profitable ones (Ben-Zekry, 2007) very similar to the airline industry where large airlines company normally prefer to fly to the most profitable sectors. High sectoral concentration also exposes a bank to credit risk due to higher default correlations within those sectors.

So far, none of the commercial banks in Nepal have revealed their stances on any of these arguments, either profitability or efficiency or stability is the driving factor to exposing to high level of concentration in their lending portfolios. Nonetheless, NRB in its recent financial stability report has stated that '… concentration of lending to a few sectors would expose bank to credit risk' (NRB, 2018: p. 20), which is very similar to the conventional view in banking. Such stance of NRB implies that the regulator is more concerned about 'credit default and bank failure aspects' of introducing high concentration in lending portfolios. Surprisingly, there is no explanation in place whether such concentration exists because of'supply driven factors' or 'demand drivenfactors' or 'capricious ones'- neither from the central bank nor the commercial banks.

When we applied the 'sectoral concentration measure (SCM)'[3] in order to measure the 'sectoral concentration' of a bank in its sectoral lending portfolio, and filter them based on top 5 highest SCM score, the findings justified why the

[3] See appendix A for details.

sectoral lending is concentrated to only four sectors. All 28 banks have prioritised wholesale and retail sector for the lending followed by non-food production related (25 banks), construction (20 banks) and finance, insurance and real estate (19 banks) (Figure 3). Of those sectors, the 'wholesale and retail' falls under highly concentrated sector (SCM - 2898), andthe 'non-food production related' falls under moderately concentrated sector (SCM - 1513) (Appendix C).

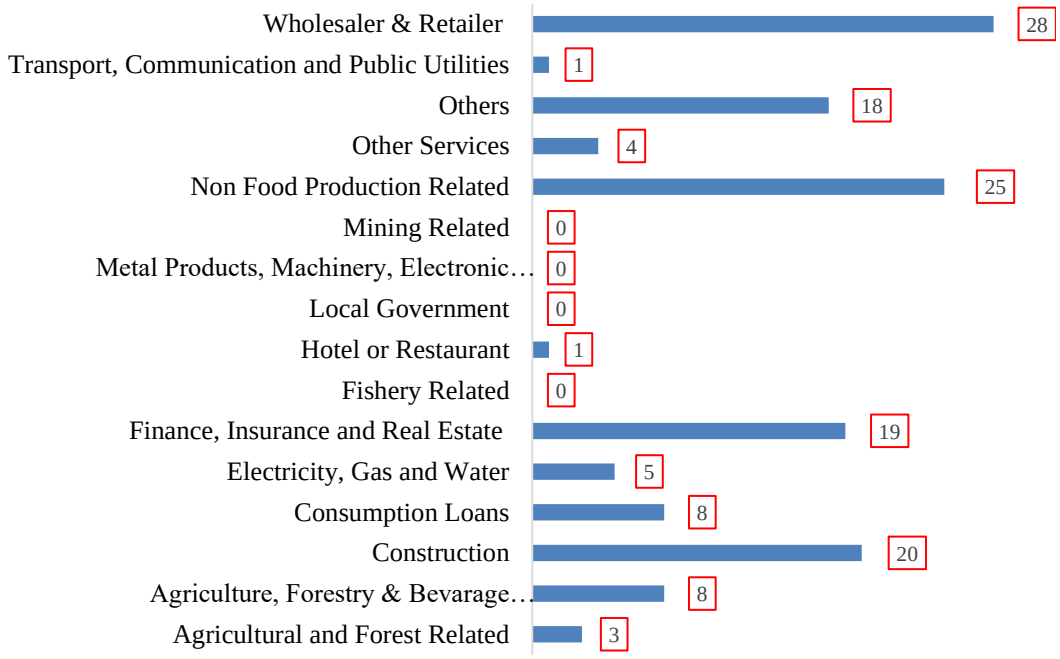

Figure 3: Number of banks based on their priorities for sectoral lending, 2019

Source: Researchers' estimate (2020)

Therefore, there are severalrelevantside questionsthat also seek answers viz. (a) why remaining sectors do not fall in the priority lending of commercial banks? (b) Is there less demand for credit in remaining sectors? (c) Is there higher profit margin for banks in those concentrated sectors? (d) Are lessconcentrated sectors highly elastic to lending rate? (e) Are concentrated sectors less elastic to lending rate? etc. Nonetheless, in this work, we have focussed on the discussion relevant to price elasticity of sectoral lending and have skipped questions (a) to (c). We have answered questions (d) and (e) in section four based on our empirical estimates.

III. METHODOLOGY

To propose a suitable model, it was necessary to identify and understand explanatory variables besides lending rate that may well describe the lending behaviour of banks. In context of Nepal, we came across five main research works viz. Bhattarai (2019), Bajracharya (2018), Puri et al. (2018), Timsina (2016a & 2016b) and Bhattarai (2016) that have analysed the lending behaviour of commercial banks in Nepal employing quantitative approaches. Those researchers have used a range of explanatory variables to examine the lending behaviour of banks (Table 1). Selection of those explanatory variables are consistent with many other empirical works, a few to quote areMalede (2014), Obamuyi (2013), Imran and Nishat (2013), Olusanya et al. (2012), Constant and Ngomsi (2012), Olokoyo (2011), Kashyap et al. (1993), etc.

Table 1: Summary of empirical works on determination of lending behaviour of commercial banks in Nepal

Researchers	Explanatory variables used	Most significant explanatory variables to explain changes in lending
Timsina (2016a)	volume of deposits, interest rate, cash reserve ratio, liquidity ratio, inflation, exchange rate, gross domestic product	gross domestic product, liquidity ratio
Timsina (2016b)	cash reserve ratio, open market operations, bank rate, assets, capital, liquidity	assets, liquidity, capital, open market operations, cash reserve ratio
Bhattarai (2016)	bank size, liquidity, investment portfolio, cash reserve ratio and deposit to capital ratio	bank size, liquidity, investment portfolio, cash reserve ratio
Bajracharya (2018)	bank size, volume of deposit and cash reserve requirement ratio liquidity ratio Inflation rate GDP	bank size, volume of deposit, cash reserve ratio
Puri et al. (2018)	banksize, volume of deposits, cash reserve ratio, liquidity ratio, lending rate, non-performing loans, grossdomestic product, inflation rate	bank size, lending rate, volume of deposits, liquidity ratio
Bhattarai (2019)	Interest rate spread, statutory liquidity ratio, inflation, exchange rate	Statutory liquidity ratio, interest rate spread, exchange rate

Source: Researchers' contribution (2020)

The list of explanatory variables used in those works include internal variables of the banks such as liquidity ratio, assets, bank size, etc. as well as external variables such as GDP, exchange rate, inflation, and regulatory instruments. Since we have had panel data of all 28 commercial banks in Nepal in operation till mid-July of 2019, we believed that the distinguished variables associated with individual banks would matter more than the external common factors in examining the lending behaviour and estimating the elasticities of explanatory variables. And, also in the light of works mentioned above we considered interest rate, liquid funds, volume of deposits, capital, and total assets into our proposed model (supply-side variables). In the meantime, we also kept into our consideration that the robustness of the model should not get compromised because of employing too many explanatory variables into the model. Therefore, we combined liquid fund and volume of deposit to construct 'liquidity ratio'. Likewise, we combined capital and total assets to construct 'capital to asset ratio'. These ratios have been interpreted in the sub-section (3.1). Interest rate, which is basically the weighted average of interest rates of all types and maturity of loans granted in specific years, has been used intact.

3.1 Model

We have proposed the following semi-log model to estimate price elasticity of sectoral lending and to examine the observed anomaly in the lending-lending raterelationship:

$$LOG(LEND\_SN_{i,t}) = \alpha + \beta_1 * WALR\_SN_{i,t} + \beta_2 * LIQ\_RATIO_{i,t} + \beta_3 * CTA_{i,t} + \varepsilon_{i,t}$$

Where LEND_SN is credit lending amount (in millions NRs) for sector N; WALR_SN isweighted average lending rate (in percent) for sector N; LIQ_RATIO is liquidity ratio defined as the ratio of liquidity funds to total deposits (in percent); and CTA is the capital to asset ratio (in percent) of commercial banks as on the point of time into consideration (mid-July). (i,t) indicates identity for individual bank and year into consideration.

Of those explanatory variables, the lending rate (WALR_SN) is considered as the price of lending and the expected sign for its coefficient is negative.[4] This expectation is based on general perception. Nonetheless, Hense (2015) argues that '… occasionally during the times of strong economic growth or recession or in the short run, lending and lending rate may move in same direction, hence the coefficient may be positive because of counteracting supply or demand factors.'

Another explanatory variable, liquidity ratio (LIQ_RATIO) refers to the amount that banks need to maintain in liquid form to meet their immediate financial obligation. Hence higher liquidity ratio means lower funds available for lending, hence the sign of its coefficient is expected to be negative. The third explanatory variable, capital to asset ratio (CTA) measures sufficiency of capital with the bank. Higher the CTA value, higher lending is expected, thus its coefficient is expected to have positive sign, other things remaining unchanged.

We have applied the proposed model to 14 equations, 13 are among the 16 sectors (except fishery related, mining related and local government as their shares in total lending are very small, hence excluded from analysis) while one is the aggregate value.

3.2 Data and Methods

This study is based on panelregression analysis of the data obtained for 28 commercial banks in Nepal that were in operation till mid-July 2019. The dataset covers the annual values of four variables as discussed into section (3.1) for the period of mid-July 2015 to mid-July 2019, thus total of 140 observations for each variable. The datasetof most variables has been extracted from the 'Banking and Financial Statistics'(various issues) reports published by Banks and Financial

[4] This relationship has been considered from demand side based on assumption that banks' sectoral lending equals effective sectoral demand for it. Because of existence of diligent procedures and regulations in place to be followed by both banks and potential borrowers to make lending transactions happen, existence of overdemand for borrowing will not affect the lending rate. That means, a potential borrower has no control over interest rate, instead s/he/it can respond to the existing lending rate through adjustment in her/his/its demand for borrowing.

Institution Regulation Department of Nepal Rastra Bank (BFIRD-NRB). However, we found that BFIRD-NRB has discontinued publishing data on weighted average lending rates by banks inthe study period. Hence, we requested for it and upon our request, BFIRD-NRB agreed to provide the dataset for this variable for the purpose of undertaking this research work only.

Once panel dataset for all variables into consideration was obtained, we examined three models viz. (i) random effect model, (ii) fixed effect model, and (iii) pooled OLS regression model; and found that the fixed effect model is the best suited in our undertaking.While undertaking the panel data analysis, the first step was to choose between random effect model and fixed effect model. For this, we estimated random effect model first and then applied Hausman test to determine suitability of one of these two models depending upon the significance of 'Hausman chi-square statistic'. In this test, the null hypothesis is 'random effect model is appropriate', and the decision criterion is to reject null hypothesis if the 'Hausman chi-square statistic' is found significant at accepted level of significance. Otherwise, accept the null hypothesis. The alternate hypothesis in this test is 'fixed effect model is appropriate'. The Hausman test validated suitability of fixed effect model except for 'sector 16 - others' for which random effect model is suitable.

In case fixed effect model is appropriate as above, the next step was to choose between fixed effect model and pooled OLS regression model, for which we undertook Wald test on pooled OLS estimates introducing 27 dummy variables on banks (one dummy variable was excluded to avoid perfect multicollinearity). In Wald test, the null hypothesis is 'pooled OLS regression model is appropriate (i.e. all dummy variables equal zero)' and the alternate hypothesis is 'fixed effect model is appropriate (i.e. all dummy variables do not equal zero)'. In our undertaking, the probability of 'Wald test Chi-square value' was found significant at1 percent, thus rejecting the null hypothesis. In this way, we have validated the suitability of fixed effect model in our work.

IV. EMPIRICAL FINDINGS

The estimates of the panel regression analysis for the 14 equations as mentioned above have been presented in Table 2. The chi-square statisticsfor Hausman test are found significant within 5 percent except for 'sector 12' which is significant at 10 percent, while 'sector 16' is found to be insignificant. If we consider, the case of sector 12 a bit loosely, the fixed effect model is appropriate for all the sectors into consideration except sector 16 for which random effect model is appropriate. Moreover, for those sectors to which fixed effect model is appropriate, chi-square statistics for Wald test are found strongly significant at 1 percent, thus validating the acceptance of fixed effect model.

4.1 Discussion on Estimated Coefficients

There are nine cases in which the coefficients of lending rate have been found significant within 5 percent level of significance, and one case (eq.5) within 10 percent level of significance. The remaining four cases (equations 2, 4, 6, & 7) are found not significant within 10 percent level of significance. Nonetheless, sign of all coefficients is positive which are not as expected and thus requires appropriate justification. The absolute value of coefficients among the significant cases ranges from 0.04 (for 'non-food production' sector) up to 0.16 (for 'agriculture and forestry' sector) which can be interpreted as 'one percent rise (fall) in weighted average lending rate would cause 0.04 percent rise (fall) in the lending of 'non-food production' sector and 0.16 percent rise (fall) in the lending of 'agriculture and forestry' sector. We consider it a low response of sectoral lending to sectoral lending rate. In terms of elasticity, the lending rate elasticity (or price elasticity) of 'non-food production' sector is 0.04 while that of 'agriculture and forestry' sector is 0.16. The price elasticities of other sectors lie in between these two values. The price elasticity of aggregate sector is 0.11 (Table 2). Such low values of sectoral and aggregate price elasticityare not consistent with the finding of Herfindahl-Hirschman (HH) index which shows the level of competition is increasing in Nepalese banking industry (as the value of HH index is well below 1500 and falling since 2016) (Appendix B2). We have analysed this anomaly in section five.

The coefficients of liquidity ratio and capital to asset ratio for 'non-food production' and 'agriculture and forestry' sectors are (-0.02 & 0.04) and (-0.03 & 0.09) respectively (Table 2). The signs of these coefficients are as expected and supported by our explanation in sub-section (3.1). These coefficients can be interpreted in a similar fashion as above.[5] Once again, 'agriculture and forestry' sector lending is more responsive to liquidity ratio and capital to asset ratio in comparison to 'non-food production' sector lending, though not very high. Nonetheless, the highest liquidity ratio elasticity is 0.05 for 'hotel and restaurant' sector, while that of the capital ratio is 0.12 for 'electricity, gas and water' sector.

Now we are able to answer the two questions (d) and (e) that we raised earlier in section two about concentration of loans and price elasticity. The price elasticity of highly concentrated sectors (sector 5, 6, 10, 11 & 16) ranges from 0.03 to 0.07 while that of less concentrated sectors ranges from 0.02 to 0.16. Most of them have elasticities above that of the concentrated sectors. Hence, we can conclude that price elasticity varies across the sectors, and concentrated sectors are less elastic than less concentrated sectors.

4.2 Discussion on Validity of Estimated Equations

Out of 14 estimated equations, there are sixequations (equations 1, 3, 8, 10, 11 & 14) in which coefficients of all three explanatory variables are found significant within 5 percent level of significance, while in two equations (equations 5 & 12) the coefficients of interest rate or liquidity ratio respectively, are found significant within 10 percent level of significance. Thus, there are eight equations that can be considered valid based on significance of coefficients. The F-statistics for all those equations are found highly significant at one percent level of significance, thus confirming the appropriateness of relation among variables. The adjusted R-square values for those equations are above 0.555 up to 0.775, which can be interpreted as the explanatory power of the explanatory variables for the changes

[5] One percent rise (fall) in liquidity ratio would cause a fall (rise) of 0.02 percent in the lending of 'non-food production' sector and 0.03 percent in the lending of 'agriculture and forestry' sector. Likewise, one percent rise (fall) in capital to asset ratio would cause a rise (fall) of 0.04 percent in the lending of 'non-food production' sector and 0.09 percent in the lending of 'agriculture and forestry' sector.

in the dependent variable. For instance, the adjusted R-square value for 'agriculture and forestry' sector (equation 1) is 0.555, which means 55.5 percent changes in the lending in this sector can be explained by those three employed variables. Such explanatory power of these explanatory variables is 77.5 percent in 'other services' sector. The Durbin-Watson (DW) statistics are fairly above 1.5 and below 2.0 in seven equations other than equation (10) for which DW statistic is 1.40 (Table 2). Thus, except equation (10), in other seven equations DW statistics are acceptable to conclude absence of autocorrelation in the residuals. In equation (10), there may be little concern over presence of autocorrelation.

Thus, in the light of significance of individual coefficients of explanatory variables, F-statistics, adjusted R-square values and DW statistics, there are seven equations (equations 1, 3, 5, 8, 11, 12 & 14) that are found appropriate in terms of explaining the sectoral lending behaviour of commercial banks in Nepal. These equations represent the lending behaviour of the following sectors respectively: (i) agriculture and forestry, (ii) non-food production, (iii) electricity, gas and water, (iv) wholesaler and retailer, (v) other services, (vi) consumption loans, and (vii) aggregated lending.

Table 2: Panel Regression Estimates

Eq.	Dep. Variable (log form)	Coefficients				F statistic	Adj. R^2	DW stat.	Hausman Test (Chi-Sq. stat.)	Wald Test (Chi-Sq. stat.)	Selection of model
		Constant	WALR_SN$_i$	LIQ_RATIO	CTA						
1	LEND_S01	5.1635*** (0.5033)	0.1677*** (0.0374)	-0.0320** (0.0153)	0.0989*** (0.0310)	6.7101***	0.555	1.67	21.3794***	167.7149***	FEM is appropriate.
2	LEND_S04	7.7753*** (0.3625)	0.0257 (0.0277)	-0.0297** (0.0115)	0.0471* (0.0240)	5.5040***	0.496	1.57	20.1175***	153.3688***	FEM is appropriate.
3	LEND_S05	8.1760*** (0.2367)	0.0472** (0.0185)	-0.0230*** (0.0077)	0.0487*** (0.0164)	9.1317***	0.640	1.65	14.6937***	226.7160***	FEM is appropriate.
4	LEND_S06	7.2065*** (0.5585)	0.0357 (0.0362)	-0.0112 (0.0168)	0.1087*** (0.0315)	5.3038***	0.485	1.66	23.7832***	155.5936***	FEM is appropriate.
5	LEND_S07	5.2678*** (0.7484)	0.1314* (0.0671)	-0.0359** (0.0169)	0.1281*** (0.0338)	9.9103***	0.661	1.69	15.1152***	203.3634***	FEM is appropriate.
6	LEND_S08	4.4587*** (0.6406)	0.0671 (0.0482)	-0.0119 (0.0190)	0.1263*** (0.0391)	6.1405***	0.529	1.54	17.1010***	176.2280***	FEM is appropriate.
7	LEND_S09	6.2299*** (0.5192)	0.0130 (0.0413)	-0.0204 (0.0148)	0.1013*** (0.0315)	9.1099***	0.639	1.87	13.5849***	240.5229***	FEM is appropriate.
8	LEND_S10	8.4952*** (0.2892)	0.0705*** (0.0225)	-0.0244*** (0.0089)	0.0519*** (0.0191)	9.5183***	0.650	1.73	22.9431***	251.9445***	FEM is appropriate.
9	LEND_S11	7.3742*** (0.4069)	0.0774*** (0.0269)	-0.0223 (0.0145)	0.0522* (0.0302)	6.5214***	0.547	1.80	16.7378***	159.1343***	FEM is appropriate.
10	LEND_S12	5.7025*** (0.5789)	0.1391*** (0.0466)	-0.0563*** (0.0165)	0.0935*** (0.0338)	9.5186***	0.654	1.40	7.7108*	175.3849***	FEM is appropriate.
11	LEND_S13	5.8442*** (0.3438)	0.1579*** (0.0288)	-0.0189** (0.0094)	0.0394* (0.0200)	16.7761***	0.775	1.87	9.1127**	309.1134***	FEM is appropriate.
12	LEND_S14	6.4557*** (0.4653)	0.1144*** (0.0330)	-0.0230* (0.0136)	0.0648** (0.0271)	8.3394***	0.616	1.90	11.1754**	218.3341***	FEM is appropriate.
13	LEND_S16	7.5400*** (0.4741)	0.0702** (0.0306)	-0.0226 (0.0139)	0.0489* (0.0284)	7.5045****	0.123	1.18	5.6622	Not applicable	REM is appropriate.
14	LEND_TOT	9.5250*** (0.2307)	0.1085*** (0.0187)	-0.0181** (0.0069)	0.0496*** (0.0147)	11.3948***	0.691	1.85	48.6363***	265.7078***	FEM is appropriate.

***, ** & * indicate significance at 0.01, 0.05 and 0.1 level respectively. The number in parentheses represents standard error estimates. FEM stands for Fixed Effect Model and REM stands for Random Effect Model.Details of sectors are provided in appendix B1.

Source: Researchers' estimate (2020)

V. DISCUSSION AND CONCLUDING REMARKS

In our attempt to estimate price elasticity of sectoral lending with respect to lending rate, in combination with liquidity ratio and capital to asset ratio being other explanatory variables in the model, we found apositive and weak relationship between sectoral lending and lending rate during 2015 to 2019, the degree of price elasticity ranging from 0.04 to 0.16. Considering the fact that the level of competition is increasing in banking industry in Nepal as shown by decreasing value of HH index, the observed direction and degree of this relationshipdo not align with thenormal perception. Therefore, we need to answer firstly, what factor has caused them to move together in context of Nepal, and secondly, why price elasticity is low despite competitive banking industry. To understand the background of such anomaly, we attempted to dig further into some prominent literature such as Hense (2015), Reinhart and Rogoff (2009), Gambacorta (2004), Saunders and Schumacher (1997), Kashyap et al. (1993), Ho and Saunders (1981), etc.In the light of facts and arguments we came across, we have assessed following three scenarios:

(i) Perception of strong economic growth:

Hense (2015) and Kashyap et al. (1993) argue that in times of strong economic growth, there may be upsurge of profitable projects (expected net present value may be significantly positive) thus causing increase indemand for credit. The confidence and the prospects of attractive financial return overshadows the restraining effect of the higher cost of obtaining those returns, higher interest rates can actually even increase borrowing demand, a case of behavioural bias such as 'this time is different' as argued by Reinhart and Rogoff (2009). Keeping these arguments into consideration, we examined credit disbursement of Nepalese banks in production related activities.What we found that a significant amount has been disbursed to the packaging and processing activities, which normally do not add much value to the economy, instead generates some profits for packagers and processors because of prevalence of price differentials in geographically separated markets.Moreover, '… a borrower investing in a new project such as manufacturing product, development, energy investment, etc. and intending to

repay the loan out of cashflows of the project may be very sensitive to minor variations in interest rates' (Hense, 2015). However, in our context, the price elasticity is very low, hence, we are reluctant to accept that there is perception of strong economic growth in context of Nepal.

(ii) Syphoning of fund:

During the study period, significant lending has been disbursed to 'wholesale and retail' and 'others' sectors which are comparatively less regulated sectors. The swelling up of their shares in credit portfolio is an important indication of syphoning of fund. Bank Supervision Reports (NRB, 2016 & 2017) have also highlighted 'mismatch of loan types and purpose of loans and credits extended without proper assessment of financials' among the major observations of on-site examination, thus indicating existence of this possibility. This is very similar scenario as discussed by Hense (2015) that '…a borrower pushing for projects where expectations of asset or property price inflation are strongly embedded in the investment decision will potentially be less affected and respond far less sensitive by even quite large increases in interest rate.' Therefore, we strongly consider possibility of syphoning of fund from less regulated activities to highly regulated activities such as share market investment and real estate investment which are guided by speculation of investors.

(iii) Role of bankers as risk-averse dealers:

According tothe 'dealership model of interest margin'byHo and Saunders (1981),"banks if turn to become risk averse dealers may cause lending rate to be sticky-down."Prevalence of consistent high lending rate in Nepalese context is a strong indication that bankers might have turned to become risk averse dealers. This argument is reinforced by the event of the so called 'gentlemen's agreement' among the CEOs of Nepalese commercial banks, going against the market principle, and forming aninformal cartel.

In the light of our estimates, we conclude two things- firstly, highly concentrated sectors have less price elasticity in comparison to less concentrated sectors, and secondly, interest rate may have ambiguous link to lending in the short run. The

second conclusion is similar to that of Hence (2015), that a positive relationship between loans and lending rate may exist because of dominance of supply effects in the short run. Based on our assessment of the given scenarios, there are strong bases to believe that syphoning of fund, and the changed role of bankers should have played key roles to make the sectoral lending and lending rate relationship anomalous during the study period. Nonetheless, as our study covers a period of only five years, it is also likely that borrowers might have not been able to adjust their borrowing demand in response to increased rate.

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APPENDICES

Appendix A: Herfindahl-Hirschman Index

Herfindahl-Hirschman (HH) index is one of the most common and widely used approach to measure the portfolio concentration. Mathematically, HH index in sectoral portfolio context is defined as 'the sum of square of shares of individual sector within the sectoral credit portfolio of a given bank for a specific time-period.' Thus -

(Eq. A1) $$HH_p = \sum_{q=1}^{n} s_{p,q}^2$$

Where HH_pstands for Herfindahl-Hirschman index for a given bank p; q stands for the individual sector within the given sectoral credit portfolio (for instance q represents each of the individual 16 sectors in the 'sectoral credit' category), thus $s_{p,q}$stands for the share of q sector in the sectoral credit portfolio of bank p.

The interpretation of HH index has been done in accordance with the guideline provided by DoJ & FTC (2010)[6], hence (a) if HH index for a bank lies below 1500, the portfolio is less concentrated; (b) if HH index for a bank lies between 1500 and 2500, the portfolio is moderately concentrated; and (c) if HH index for a bank lies above 2500, the portfolio is highly concentrated.

However, HH index is better in showing a bank's concentration in a specific portfolio category and does not tell us about its degree of specialisation in any individual sector. Hence, we have deployed 'sectoral concentration measure' (henceforth SCM) in a similar fashion with the 'loan concentration measure (LCM)' as proposed by Regehr and Sengupta (2016)[7], in order to measure the 'sectoral concentration' of a bank in our context. Mathematically, SCM has been measured by multiplying the 'shares by sector in aggregate lending' of each bank by its respective HH index. Thus-

(Eq. A2) $$FCM_{p,q} = HH_p * ss_{p,q}$$

Where $FCM_{p,q}$ is the sectoral concentration of bank p in sector q, and $ss_{p,q}$ is the sector q's share of bank p in the sectoral aggregate lending.

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[6] DoJ & FTC. 2010. *Horizontal merger guidelines.* US Department of Justice and the Federal Trade Commission.

[7] Regehr, K. and R. Sengupta. 2016. "Sectoral Loan Concentration and Bank Performance (2001-2014)". *Research Working Paper* RWP 16-13, The Federal Reserve Bank of Kansas City.

Appendix B1: HH Index of Nepalese Banking Industry based on Aggregate Sectoral Lending Portfolio

Sectors	Sectoral lending share as on mid-July, %				
	2019	2018	2017	2016	2015
S01 - Agricultural and Forest Related	5.4	4.7	4.3	4.2	4.3
S02 - Fishery Related	0.1	0.1	0.1	0.1	0.1
S03 - Mining Related	0.2	0.2	0.2	0.2	0.2
S04 - Agriculture, Forestry &Beverage Production	5.2	5.8	6.3	6.4	6.5
S05 - Non-Food Production Related	12.5	11.6	11.6	11.8	13.3
S06 - Construction	10.3	10.3	10.4	10.2	10.3
S07 - Electricity, Gas and Water	4.8	4.0	3.5	2.8	2.4
S08 - Metal Products, Machinery & Electronic Equip. &Assemblage	1.3	1.4	1.3	1.2	1.0
S09 - Transport, Communication and Public Utilities	2.5	2.7	3.0	2.9	2.3
S10 - Wholesaler & Retailer	22.5	23.2	23.1	22.6	21.9
S11 - Finance, Insurance and Real Estate	8.3	8.8	8.7	8.0	7.8
S12 - Hotel or Restaurant	4.2	3.8	3.3	2.8	2.9
S13 - Other Services	4.5	4.5	4.6	4.2	4.6
S14 - Consumption Loans	5.7	6.9	7.8	7.1	7.2
S15 - Local Government	0.1	0.1	0.1	0.1	0.2
S16 - Others	12.3	12.0	11.9	15.4	14.9
S01 – S16 Total	100.0	100.0	100.0	100.0	100.0
Aggregate Herfindahl-Hirschman Index	1149	1162	1164	1208	1201

Source: Researchers' estimate (2020)

Appendix B2: HH Index of Commercial Banks based on their Sectoral Lending Portfolios

Commercial Banks	Herfindahl-Hirschman (HH) Index				
	2019	2018	2017	2016	2015
NBL - Nepal Bank Ltd	1102	1378	1331	1467	1548
RBB - Rastriya Banijya Bank	1509	1573	1554	1534	1506
NABIL - Nabil Bank	1609	-	1630	-	-
NIBL - Nepal Investment Bank Ltd	1304	1283	1396	1387	1561
SCBNL - Standard Chartered Bank Nepal	1632	1803	1636	1711	1686
HBL - Himalayan Bank Ltd	1322	1229	1271	1415	1399
NSBI - Nepal SBI Bank	1515	1726	1823	1742	1855
NBB - Nepal Bangladesh Bank	1251	1234	1431	1474	1586
EBL - Everest Bank Ltd.	1398	1341	1378	1385	1441
BOK - Bank of Kathmandu	1356	1309	1342	1534	1529
NCC - Nepal Credit & Commerce Bank	1087	1161	1130	1165	1169
NIC - Nepal Industrial & Commercial Bank	1395	1488	1531	1438	1392
MBL - Machhapuchhre Bank Ltd	1252	1242	1213	1133	1239
KUMARI - Kumari Bank	1120	1414	1318	1197	1339
LAXMI - Laxmi Bank	1245	1231	1276	1367	1407
SBL - Siddhartha Bank Ltd	1305	1290	1319	1328	1407
ADBNL - Agriculture Development Bank	2030	1963	1822	1389	1386
GLOBAL - Global Banks	1293	1326	1433	1581	1499
CITIZENS - Citizens Bank	1273	1353	1342	1474	1458
PRIME - Prime Bank	1056	1337	1493	1391	1377
SUNRISE - Sunrise Bank	1225	1265	1289	1333	1280
NMB - NMB Bank	1537	1455	1274	1438	1385
PRABHU - Prabhu Bank	1048	1112	1185	-	1203
JANATA - Janata Bank	1316	1333	1312	1104	1336
MEGA - Mega Bank	1412	1462	1494	1152	1178
CIVIL - Civil Bank	1139	1248	1384	1421	1401
CENTURY - Century Bank	1152	1165	1159	1684	1753
SANIMA - Sanima Bank	1401	1432	1368	1346	1437
Aggregate Herfindahl-Hirschman Index	1149	1162	1164	1208	1201

Source: Researchers' estimate (2020)

Appendix C: Sectorial Concentration Measure (SCM) of Banks

Banks	S01	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13	S14	S16
NBL	263	221	595	487	280	74	94	852	311	125	109	538	424
RBB	709	404	531	1031	260	136	220	2898	903	525	242	1134	153
NABIL	241	534	1513	74	524	67	50	2261	507	251	186	281	1782
NIBL	327	441	1351	395	524	42	189	1330	373	484	467	187	296
SCBNL	197	256	436	869	2	122	13	986	172	64	23	352	133
HBL	270	510	1136	232	66	117	185	915	631	216	211	194	230
NSBI	166	453	863	209	179	175	64	1226	330	222	92	80	1125
NBB	127	141	233	267	123	33	65	468	239	100	654	104	209
EBL	284	188	651	1101	264	115	150	1656	688	176	131	233	542
BOK	196	216	576	224	178	63	91	1133	448	177	307	405	119
NCC	150	171	410	369	141	66	119	472	179	98	126	79	440
NIC	639	262	492	1300	81	19	26	2058	781	542	253	659	1478
MBL	174	222	560	329	178	26	123	988	413	103	301	170	398
KUMARI	71	237	558	382	170	86	140	496	234	126	148	180	454
LAXMI	153	249	381	815	216	115	215	753	285	119	180	164	48
SBL	290	255	672	396	257	61	374	1171	410	207	181	226	1178
ADBNL	1682	235	383	526	557	34	93	2425	132	270	274	88	2558
GLOBAL	206	316	769	847	381	64	56	1436	330	263	313	323	750
CITIZENS	118	167	353	175	240	10	101	558	232	60	197	271	872
PRIME	152	68	392	458	322	19	79	381	451	169	138	351	292
SUNRISE	279	90	338	632	124	45	14	729	290	183	184	193	395
NMB	136	361	859	708	359	74	90	1778	451	121	165	192	284
PRABHU	238	85	443	564	187	18	129	633	397	264	321	264	279
JANATA	167	221	530	289	201	14	135	849	260	134	157	87	529
MEGA	126	269	433	191	119	28	59	1040	632	204	133	225	669
CIVIL	98	79	312	127	143	21	45	413	255	80	88	163	158
CENTURY	104	210	453	279	137	52	31	496	344	113	96	182	327
SANIMA	109	244	461	445	267	48	300	878	207	170	178	124	1228
Overall SCM	1682	534	1513	1300	557	175	374	2898	903	542	654	1134	2558

Note: Highlighted cells show the top 5 lending priority of the given bank among those sectors (read along a given row).

Source: Researchers' estimate (2020)

Appendix D: Shares in Total Sectoral Lending by Banks, as on mid-July 2019

Banks	TOT	S01	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13	S14	S16
NBL[big]	4.0	0.2	0.2	0.5	0.4	0.3	0.1	0.1	0.8	0.3	0.1	0.1	0.5	0.4
RBB[big]	6.1	0.5	0.3	0.4	0.7	0.2	0.1	0.1	1.9	0.6	0.3	0.2	0.8	0.1
NABIL[big]	5.1	0.1	0.3	0.9	0.0	0.3	0.0	0.0	1.4	0.3	0.2	0.1	0.2	1.1
NIBL[big]	4.9	0.3	0.3	1.0	0.3	0.4	0.0	0.1	1.0	0.3	0.4	0.4	0.1	0.2
SCBNL	2.2	0.1	0.2	0.3	0.5	0.0	0.1	0.0	0.6	0.1	0.0	0.0	0.2	0.1
HBL	3.7	0.2	0.4	0.9	0.2	0.1	0.1	0.1	0.7	0.5	0.2	0.2	0.1	0.2
NSBI	3.4	0.1	0.3	0.6	0.1	0.1	0.1	0.0	0.8	0.2	0.1	0.1	0.1	0.7
NBB	2.2	0.1	0.1	0.2	0.2	0.1	0.0	0.1	0.4	0.2	0.1	0.5	0.1	0.2
EBL[big]	4.4	0.2	0.1	0.5	0.8	0.2	0.1	0.1	1.2	0.5	0.1	0.1	0.2	0.4
BOK	3.1	0.1	0.2	0.4	0.2	0.1	0.0	0.1	0.8	0.3	0.1	0.2	0.3	0.1
NCC	2.6	0.1	0.2	0.4	0.3	0.1	0.1	0.1	0.4	0.2	0.1	0.1	0.1	0.4
NIC[big]	6.2	0.5	0.2	0.4	0.9	0.1	0.0	0.0	1.5	0.6	0.4	0.2	0.5	1.1
MBL	3.2	0.1	0.2	0.4	0.3	0.1	0.0	0.1	0.8	0.3	0.1	0.2	0.1	0.3
KUMARI	2.9	0.1	0.2	0.5	0.3	0.2	0.1	0.1	0.4	0.2	0.1	0.1	0.2	0.4
LAXMI	3.0	0.1	0.2	0.3	0.7	0.2	0.1	0.2	0.6	0.2	0.1	0.1	0.1	0.0
SBL[big]	4.4	0.2	0.2	0.5	0.3	0.2	0.0	0.3	0.9	0.3	0.2	0.1	0.2	0.9
ADBNL[big]	4.6	0.8	0.1	0.2	0.3	0.3	0.0	0.0	1.2	0.1	0.1	0.1	0.0	1.3
GLOBAL[big]	4.7	0.2	0.2	0.6	0.7	0.3	0.0	0.0	1.1	0.3	0.2	0.2	0.2	0.6
CITIZENS	2.7	0.1	0.1	0.3	0.1	0.2	0.0	0.1	0.4	0.2	0.0	0.2	0.2	0.7
PRIME	3.1	0.1	0.1	0.4	0.4	0.3	0.0	0.1	0.4	0.4	0.2	0.1	0.3	0.3
SUNRISE	2.9	0.2	0.1	0.3	0.5	0.1	0.0	0.0	0.6	0.2	0.1	0.1	0.2	0.3
NMB	3.6	0.1	0.2	0.6	0.5	0.2	0.0	0.1	1.2	0.3	0.1	0.1	0.1	0.2
PRABHU	3.6	0.2	0.1	0.4	0.5	0.2	0.0	0.1	0.6	0.4	0.3	0.3	0.3	0.3
JANATA	2.7	0.1	0.2	0.4	0.2	0.2	0.0	0.1	0.6	0.2	0.1	0.1	0.1	0.4
MEGA	2.9	0.1	0.2	0.3	0.1	0.1	0.0	0.0	0.7	0.4	0.1	0.1	0.2	0.5
CIVIL	1.7	0.1	0.1	0.3	0.1	0.1	0.0	0.0	0.4	0.2	0.1	0.1	0.1	0.1
CENTURY	2.5	0.1	0.2	0.4	0.2	0.1	0.0	0.0	0.4	0.3	0.1	0.1	0.2	0.3
SANIMA	3.4	0.1	0.2	0.3	0.3	0.2	0.0	0.2	0.6	0.1	0.1	0.1	0.1	0.9
Total	100.0	5.4	5.2	12.5	10.3	4.8	1.3	2.5	22.5	8.3	4.2	4.5	5.7	12.3
CV	31.0	81.6	43.0	45.6	59.6	51.2	62.6	71.3	46.9	44.1	59.5	62.3	74.5	75.2

Note: Highlighted cells show they are part of the top 5 lending shares for the given sector (read along a given column).

Source: Researchers' estimate (2020)