

The Variance Decomposition of GDP, Domestic Credit and Exports of Nepal: A VAR Approach

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ABSTRACT

The economic development is the main objective of the nation and variation of which due to shock or innovation in different economic variables throws insight vision to the policy makers and economists. This paper uses Nepal's annual data of economic growth, domestic credit and exports to other countries from 1975 to 2014. The primary focus of the paper is to examine the relationships between the variables under consideration employing vector autoregressive model and variance decomposition to abstract short run and the long run association among the variables. Results show that the influence of the shock or innovation of domestic credit to economic growth is almost doubled in the long run as compared to that of short run. The shocks of other variables remained almost same in the short run and long run. So, it may be suitable measure to increase domestic credit instead of other measures to accelerate the economic growth of the nation.

JEL Classification: F14, O40

Key Words: Co-integration, Variance Decomposition, Innovation or Shock, Domestic Credit

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I. INTRODUCTION

The economic growth is the main target and the sustainability of which is the desirable condition for the nations. The nations intend to accelerate the situation of high economic growth, employment generation, stabilization of the economic situations with the abundant use of available resources. Nepal, a developing country in the South Asia is experiencing large trade deficits in the last few years. The trade deficit stood at 28.9 percent in July 2014 with the average of last ten years remaining 22.8 percent. Similarly, the imports growth surged to 27.3 percent with the ten years' average of 18.2 percent and the exports' growth is 17.4 percent with the ten years' average growth of 5.6 percent (NRB, 2014).

Nepal, a developing country, has profound potential on information technology, which may solve the problem of land-lockedness and trade and tariff barrier. The opportunities on garments, carpets and other agriculture and service related productions and good access to herbal production and Ayurvedic medicines cannot be overlooked (Sharma & Bhandari, 2005).

The primary focus of the trade related policies are to reduce the excessive imports and expand the exports to other countries. For this purpose different policy measures have been introduced but their effects can hardly be observed. As Nepal entered in the globalization and in the process of liberalization early in the 1990s whose effects are expected that Nepal will be benefited from the global market place and competitiveness will be enhanced. But situation remained quite unfavorable in the context of international trade probably this is a challenging task to drag the positive impact in the economic activities through the global and competitive external markets. However, Nepal became a member of WTO in 2004 with the objective of improving the foreign trade and to take the advantages from it.

So, the short run and the long run situations of the exports, imports and economic growth should be analyzed before executing any type of trade related policy or growth accelerating policy. This paper aims to give some specific hints to make the interlinked policies in the coming days for the proper growth of economy with the focus of import management and exports promotion through which probably the high and sustained growth of the economy could be achieved.

Undoubting the economic growth is highly dependent on the many factors' growth rates and the domestic policies contribute to the success and failure of export-led growth strategies. Nevertheless, the inability of so many countries to fully emulate the rapid export led growth of the East Asian Countries and to withstand growing Chinese competition raises the possibility of what has come to be known as the 'fallacy of composition', that is, an adding-up constraint on the efforts of numerous developing countries to simultaneously export similar types of manufactured goods to the same industrialized country markets (Blecker and Razmi, 2009).

The export-led growth hypothesis (ELGH) postulates that export expansion is one of the main determinants of growth. It holds that the overall growth of countries can be generated not only by increasing the amounts of labour and capital within the economy, but also by expanding exports. According to its advocates, exports can perform as an “engine of growth” (Smith, 2001).

Over the last two decades there has been a dramatic shift in the stance of development policy. Through to the mid-1970s development policy rested on the import-substitution model which encouraged countries to build up their own domestic manufacturing capacity and substitute domestically produced goods for imports. In the period since policy has shifted in favor of the Export-led growth model which recommends the exact opposite. Rather than focusing on production for domestic markets, countries are now advised to focus on production for export (Palley, 2002).

In this scenario what type of policy is essential to promote the domestic production and export promotion? Are these activities really supportive for the economic growth of a nation? It is a great question of concern. So, economists and researchers are giving proper focus for this sector and recommend that the suitable policies which advocate the future benefit of the nation without harming the existing situations become essential. This paper uses the annual data of economic growth, domestic credit and exports to other countries published by central bank of Nepal and MoF. The main objectives of the study are: (a) to test the stationary properties of the data (b) to analyze the variance decomposition of economic growth, domestic credit and exports to other countries. The data are treated differently to make the required format by the methods like log, log difference etc. which may lose some important information of the variables. While estimating the vector error correction model some basic econometric techniques are employed and this may vary with the utilization of sophisticated techniques and methodologies which are the main limitations of the study.

The rest of the paper is organized as the Section two is related with the review of Literatures related to trade and economic growth nexus. Section three traces the Methodological Framework for the modeling of the data. Section four is related with the empirical analysis and section five presents the results, conclusions and recommendations.

II. REVIEW OF LITERATURE

The high and sustainable economic growth is the primary objective of every nations and it lures the attention of policy makers and researchers. So, some remarkable studies and research works have been done in these sectors. Some of the literatures are cited here.

Ondrich and Richardson (2004) made a study related to international trade and according to them mercantilists believed that trade surpluses enriched a country, and implicitly that its government should encourage exports and restrict imports. Adam Smith and David Ricardo

challenged mercantilism by arguing that overall openness is what matters nations grow more prosperous through imports as well as exports. Many modern developing countries have replaced their strategy of government-protected import substitution industrialization with an export oriented strategy. Therefore, the export is the primary strategy to make high and sustainable economic growth of the nation.

Berger and Martin (2011) examined the expansion of Chinese exports led to a decline in manufacturing share of the advanced economies, and in many cases a decline in manufacturing employment. According to the investigation it can be seen that Chinese exports can help account for a significant portion of U.S. job losses at the industry level, but that macroeconomic fundamentals explain the majority of the fall in U.S. manufacturing employment between 2000 and 2007. The expansion of export of Chinese product is the primary factor to boost the Chinese economic growth.

Ahmed (et.al. 2013) made as study to analyze the effects of exports and imports on GDP of Bangladesh using econometric tools with the annual data. The study reveals both export and import are moderately related to the growth of GDP. Exports contributes positively to the GDP whereas import's contribution in unenthusiastic.

It is a widely accepted view that among the driving factors of long-run growth, trade plays an important role in shaping economic and social performance. Policy recommendations based on export-led growth and trade liberalization have been at the heart of poverty reduction strategies for many years, and developing countries were encouraged to reduce trade barriers in order to allow for comparative advantages to develop. Theoretical foundations of the positive links between trade openness strategies, growth and poverty reduction come at least from two sources. On the one hand, the neoclassical approach explains the gains from trade liberalization by comparative advantages, be they in the form of resource endowment (as in the Hecksher-Ohlin model) or differences in technology (as shown by the Ricardian model). On the other hand, the endogenous growth literature asserts that trade openness positively affects per capita income and growth through economies of scale and technological diffusion between countries.

Daumal and Ozyurt (2001) explored through the theoretical literature the relationship between international trade and growth. Since the 1960s, the role of international trade as an "engine of growth" has been emphasized by academics (e.g., Nurkse, 1961; Krueger, 1978). International trade is expected to bring about both static and dynamic gains. Static gains from trade are closely linked to conventional trade theory (e.g., Ricardo's comparative advantages theory). This ultimately shows the importance of export in the economic growth of the nation.

Afonso (2001) said that the positive effects of International Trade (IT) on Economic Growth (EG) were first pointed out by Smith (1776). This idea prevailed until World War II (WWII),

although with relative hibernation during the ‘marginal revolutions’. After WWII, the introverted and protectionist EG experiments had some significance, especially in Latin America. From the 60’s on, owing to the failure of those experiments and to the association of quick EG with the opening of IT and the consequent international specialization in several countries, as well as to the results of many studies based on the neoclassical theories of EG and IT, a new decisive role was given to IT as EG’s driving force.

Medina-Smith (2001) examined the role of export in the economic growth and found that the late 1960s studies have been conducted to examine the role of export performance in the economic growth process. Although the empirical literature can be considered to be vast, its results are clearly contradictory for both DCs and industrialized economies, a feature that could explain why this topic is still at the top of the agenda for many economists. Their conclusion also shows the importance of exports in the economic growth.

Sultan (2008) examined that a country’s trade is closely related to its stage of development and degree of industrialization. As a nation advances economically, the structure of its foreign trade alters to correspond with a shifting pattern of resource endowment and comparative advantage. In most development planning exercises, the importance of exports to domestic growth has been approached in terms of the acquisition of foreign exchange for the import of goods and services. In other words, export growth is seen as a determinant of import capacity, which in turn is a determinant of the level of domestic activities.

Shan (2006) viewed the finance-led growth hypothesis which normally focuses on the role played by financial development in mobilizing domestic savings and investment through a more open and more liberalized financial system, and in promoting productivity via creating an efficient financial market. This concludes the financial development as the main accelerator for the economic growth.

J.H. & W.W. (2001) give the operational perspectives frameworks about VAR . According to them VARs are good at capturing co-movements of multiple time series. Granger-causality tests, impulse response functions and variance decompositions are well-accepted and widely used. Small VARs have become the benchmarks against which new forecasting systems are judged. Sims (1993) allows for time-varying parameters to capture important drifts in coefficients. Adding variables involves costs. A 9-variable, four lag VAR as 333 unknown coefficients (including intercepts). Estimation of all of these requires restrictions. Bayesian approaches have helped control the number of parameters in large VAR models.

Bhusal B.P. (2012) analyzed the impact of policy reforms on financial development and economic growth in Nepal. The study analyzes the impact of financial policies on the financial development which seemed ineffective due to the inadequate expansion of commercial banks and their branches in the rural non-monetized sector, non-performing loans that discouraged credit allocation and so on. Khanal D.R. (2007) made a comparative study

on banking and insurance services liberalization & development in Bangladesh, Nepal and Malaysia on which he had pointed out three challenges for financial sector development as : non-performing loans in government banks, the failure of insurance companies to undertake long-term investments and the continued limited access by the poor and small business to credit. The results from the econometric analysis suggest that there is a positive link between economic growth and financial deepening. They also show that there is causality from trade liberalization to financial deepening in Malaysia and Nepal. Kharel R.S & Pokharel D.R. (2012) analyzed the situation of financial structure of Nepal and the study concludes that the banking sector plays a pivotal role in promoting the economic growth or more growth enhancing relative to capital market in Nepal.

III. METHODOLOGICAL FRAMEWORK

3.1 Sample and Data Source

The sample data are taken from the annual publications of Ministry of Finance and Central Bank of Nepal, NRB. The sampled data are from 1975 to 2014 consisting of 40 observations.

3.2 Exploratory Data Analysis

3.2.1 Variables

The following variables are employed for the study.

Variables	Abbreviations	Unit and Source
Gross Domestic Product <small>(Nominal)</small>	GDP	NRs. Million, MOF Publications
Domestic Credit	DC	NRs. Million, NRB Publications
Other Country Exports (OCE)	OE	NRs. Million, NRB Publications

3.2.2 Stationary Test

The data are tested whether they are stationary or not. The method of exploratory data analysis is performed at first and then following statistical diagnostic tests are employed to confirm the stationary of the variables.

3.2.3 Correlogram or Ljung-Box

This is a test which is performed to test whether the data are stationary or not. As the Ljung Box compares the autocorrelation coefficient revealing that there exists stationary in the variables when the autocorrelation coefficients of the lag values gradually goes down. The spikes in the LB also indicate information about the stationary of the data. If the spikes are within the demarked lines the variables are probably the stationary.

Ljung-Box Q-Test

The sample autocorrelation function (ACF) and partial autocorrelation function (PACF) are useful qualitative tools to assess the presence of autocorrelation at individual lags. The Ljung-Box Q-test is a more quantitative way to test for autocorrelation at multiple lags jointly. The null hypothesis for this test is that the first m autocorrelations are jointly zero,

$$H_0 : \rho_1 = \rho_2 = \dots = \rho_m = 0.$$

The choice of m affects test performance. If N is the length of the observed time series, choosing $m = \ln(N)$ is recommended for power. The Ljung-Box test statistic is given by

$$Q(m) = N(N+2) \sum_{h=1}^m \frac{\rho_h^2}{N-h}.$$

The spikes of the level data of GDP, exports and imports remained outside the boarder lines. The first differences and second differences are tested whether the spikes fall within the boarder lines and it is found that the second differenced data fall within the range concluding that the data are stationary. Due to the fact that the information of the data will be lost in second differenced the process log and difference of log is followed. On doing so the data remained stationary. Augmented Dickey Fuller Test is also used in addition to the Ljung-Box test for the stationary test of the data.

3.3 Model Framework

3.3.1 VAR Model

A VAR model describes the evolution of a set of k variables (called *endogenous variables*) over the same sample period ($t = 1, \dots, T$) as a linear function of only their past values. The variables are collected in a $k \times 1$ vector y_t , which has as the i^{th} element, $y_{i,t}$, the time t observation of the i^{th} variable.

A p -th order VAR, denoted VAR (p), is

$$y_t = c + A_1 y_{t-1} + A_2 y_{t-2} + \dots + A_p y_{t-p} + e_t,$$

A vector Autoregressive (VAR) model is employed to see the joint effects of the lags of the variables. A 3*3 matrix form of the vector is represented as follows.

$$\begin{bmatrix} y_{1,t} \\ y_{2,t} \\ y_{3,t} \end{bmatrix} = \begin{bmatrix} c_1 \\ c_2 \\ c_3 \end{bmatrix} + \begin{bmatrix} A_{11} & A_{12} & A_{13} \\ A_{21} & A_{22} & A_{23} \\ A_{31} & A_{32} & A_{33} \end{bmatrix} \begin{bmatrix} y_{1,t-1} \\ y_{2,t-1} \\ y_{3,t-1} \end{bmatrix} + \begin{bmatrix} e_1 \\ e_2 \\ e_3 \end{bmatrix}$$

By solving the above matrix we get the following 3 equations.

$$y_{1,t} = \alpha_1 + A_{11}y_{1,t-1} + A_{12}y_{2,t-1} + A_{13}y_{3,t-1} + \epsilon_{1t}$$

$$y_{2,t} = \alpha_2 + A_{21}y_{1,t-1} + A_{22}y_{2,t-1} + A_{23}y_{3,t-1} + \epsilon_{2t}$$

$$y_{3,t} = \alpha_3 + A_{31}y_{1,t-1} + A_{32}y_{2,t-1} + A_{33}y_{3,t-1} + \epsilon_{3t}$$

3.3.2 Variance Decomposition

There is a general variance decomposition formula for $c \geq 2$ components. For two conditioning random variables the variance decomposition formula is given as :

$$\text{Var}[Y] = \text{E}(\text{Var}[Y | X_1, X_2]) + \text{E}(\text{Var}[\text{E}[Y | X_1, X_2] | X_1]) + \text{Var}(\text{E}[Y | X_1]),$$

This follows from the law of total conditional variance.

$$\text{Var}[Y | X_1] = \text{E}(\text{Var}[Y | X_1, X_2] | X_1) + \text{Var}(\text{E}[Y | X_1, X_2] | X_1).$$

In our case Y represents the Gross Domestic Product and X_1 and X_2 represent either domestic credit or exports to other countries. Note that the conditional expected value $\text{E}(Y | X)$ is a random variable in its own right, whose value depends on the value of X . Notice that the conditional expected value of Y given the *event* $X = x$ is a function of x (this is where adherence to the conventional and rigidly case-sensitive notation of probability theory becomes important!). If we write $\text{E}(Y | X = x) = g(x)$ then the random variable $\text{E}(Y | X)$ is just $g(X)$.

IV. EMPIRICAL RESULTS

4.1 Trade Situation

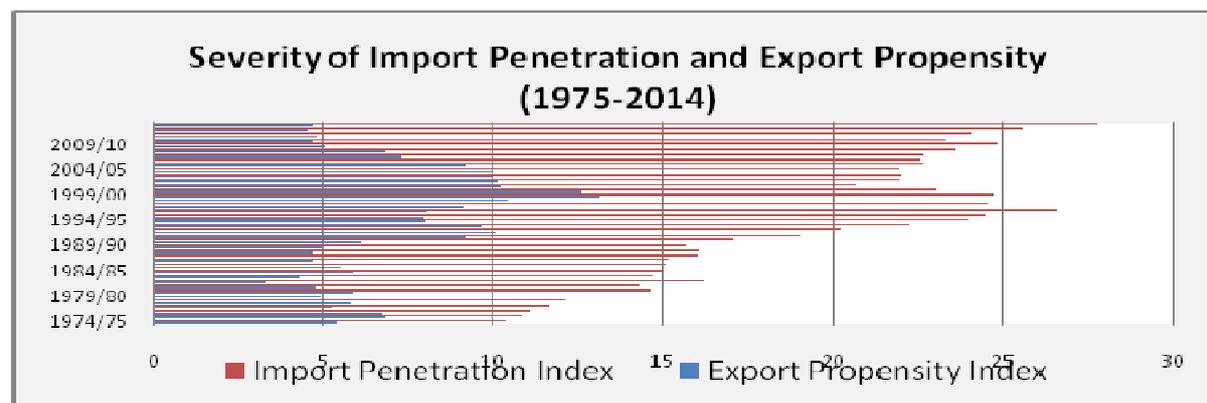
The overall trade situation normally can be viewed through the three indices named as import penetration index, export propensity index and the trade dependence index. The import penetration index is the ratio of total imports to the difference between total outputs to total trade. The export propensity index is the ratio between total exports to the total output. Similarly the total trade dependence index is the ratio between total trades to the output.

Table 1 : Situation of EPI, IPI & TDI

Indicators	1974/75	1990/91	2000/01	2013/14
Export Propensity Index	5.37	6.14	12.61	4.68
Import Penetration Index	10.37	17.05	23.07	27.83
Trade Dependence Index	16.32	25.43	38.81	41.43
Normalized Trade Index	-0.34	-0.52	-0.35	-0.77

Source : Author's Calculation

The trend of export propensity index, import penetration index and trade dependence index shows that the seriousness is creating by the import penetration index. The value of import penetration was low during the 1974/75 and it is being gradually increased in the recent years. It reached to 27.83 in 2013/14 whereas the export propensity is almost same in 1974/75 and 2013/14. The trade dependence index is being dragged by the import penetration index.



4.2 Stationary Test Results

The variables are tested whether they are stationary or not. For this purpose Augmented Dickey Fuller Test and Phillip Parron Tests are performed. The ADF test and PP test of the variables shows the data on level and log level are not stationary as they have unit root. The variables are not suffering from the unit root when they are log differenced (Table No.1). The

variables with no unit root and are of stationary nature can be utilized for the modeling purposes.

Table 2 : Unit Root Test

Variables	Data Form	Intercept		Trend & Intercept	
		t-statistic	Prob.**	t-statistic	Prob.**
GDP	I(0)	4.245898	1.0000	3.800793	1.0000
	LNI	-0.237297	0.9248	-1.658804	0.7498
	LND(GDP)	-4.377963	0.0013	-4.296732	0.0082
DC	I(0)	4.950116	1.0000	4.764399	1.0000
	LNDC	-1.793558	0.3781	-1.472241	0.8222
	LND(DC)	-6.099057	0.0000	-6.818459	0.0000
OE	I(0)	-0.488084	0.8828	-2.394125	0.3767
	LNOE	-2.347724	0.1629	-1.333736	0.8643
	LND(OE)	-4.925777	0.0003	-4.974255	0.0014

ADF Test of the variables

4.3 Co integration Test Results

The Johansen Test of co integration is the test which reveals whether the data are co-integrated or not. This also indicates the presence or the absence of long run relationships of the variables. The variables GDP, DC and OE are processed from the Johansen Test of Co-integration and it is found that the variables are not co integrated in the long run as the null hypothesis of none; at most one and at most two co integrating equations are not significant (Table No.2).

Table 3 : Johansen's Co-integration Test

Hypothesized No. of CE(s)	Eigen Value	Trace Statistic	0.05 Critical Value	Prob.**
None	0.396639	24.8127	29.79707	0.1682
At most 1	0.136943	5.61382	15.49471	0.7406
At most 2	0.000458	0.0174	3.841466	0.8949

Trace Test indicates no co integration at the 0.05 level.

4.4 Variance Decomposition Results

The variance decomposition of the variables under the VAR model shows the impulse or innovation or the shock of one variable to influence another variables. In the short run the impulse or the innovation or the shock to GDP account for 91.53 percentage variation of the fluctuation in GDP i.e. own shock. Shock to domestic credit can cause 2.06 percent fluctuation in GDP. Similarly the shock to other countries exports can cause 6.41 percent fluctuation in GDP. In the long run the impulse or innovation or shock to GDP account for 88.97 percent variation of the fluctuation of GDP i.e. own shock. The shock to domestic credit account is 4.65 percent fluctuation in GDP which is almost doubled from the short run innovation. The shock to other countries exports account for 6.38 percent in the long run. The story or the effects remained unchanged in the short run and in the long run.

The shock to GDP account is 24.62 percent and 24.74 percent fluctuation in domestic credit in the short run and long run respectively. The shock or the innovation of domestic credit account for 71.20 percent and 69.27 percent fluctuation in the domestic credit in the short run and in the long run respectively i.e. own shock. The shock or the innovation to other country exports account for 4.18 percent and 5.99 percent fluctuation in the domestic credit in the short run and long run respectively.

In the short run the shock or the innovation or the impulse to GDP account for 24.62 percent, 3.83 percent and 71.55 percent fluctuation in itself, domestic credit and the other country exports respectively. In the long run the innovation or the shock to GDP account is 27.08 percent, 5.20 percent and 67.72 percent fluctuation in itself, domestic credit and the other country exports respectively. (Table No.3)

Table 4 : Variance Decomposition

Independent Variables (Impulse Givers)	Dependent Variables (Impulse Receivers)					
	GDP		DC		OE	
	Short Run	Long Run	Short Run	Long Run	Short Run	Long Run
GDP	91.53040	88.96581	24.62065	24.73571	24.61979	27.07539
DC	2.060257	4.65017	71.20035	69.2769	3.833265	5.200815
OE	6.409345	6.384016	4.178997	5.987924	71.54695	67.7238

Source : Author's Calculation

V. CONCLUSIONS AND RECOMMENDATIONS

The shocks of same variable to influence itself remained high in the short run as well as in the long run which is consistent with the theoretical framework. However, the shocks of associate variables differ in the short run and in the long run to influence the fluctuation of the dependent variable or impulse receiver.

In short run the shock or innovation of GDP accounts for 91.53 percent, 2.06 percent and 6.41 percent to itself, domestic credit and other country exports respectively. Similarly, the shock or the innovation of GDP account for 88.97 percent, 4.65 percent and 6.38 percent to itself, domestic credit and other country exports respectively. In short run the shock or the innovation of domestic credit account for 24.62 percent, 71.20 percent and 4.18 percent to GDP, itself and other country exports respectively. In long run the shock or innovation of domestic credit account for 24.74 percent, 69.28 percent and 5.99 percent to GDP, itself and other country exports respectively. In short run the shock or the innovation of other country exports account for 24.62 percent, 3.83 percent and 71.55 percent to GDP, domestic credit and itself. In long run the shock or innovation of other country exports account for 27.08 percent, 5.20 percent and 67.72 percent to GDP, domestic credit and itself respectively.

The export promotion and the increase of gross domestic product may be achieved through the variation of domestic credit of the economy. So, giving proper focus on the strategies through which the domestic credit will be accelerated will be beneficial to increase GDP and this influences exports but the influence of exports to GDP can hardly be achieved. Further researches and in-depth studies in different dynamics of these variables will be more fruitful for policy execution proposes.

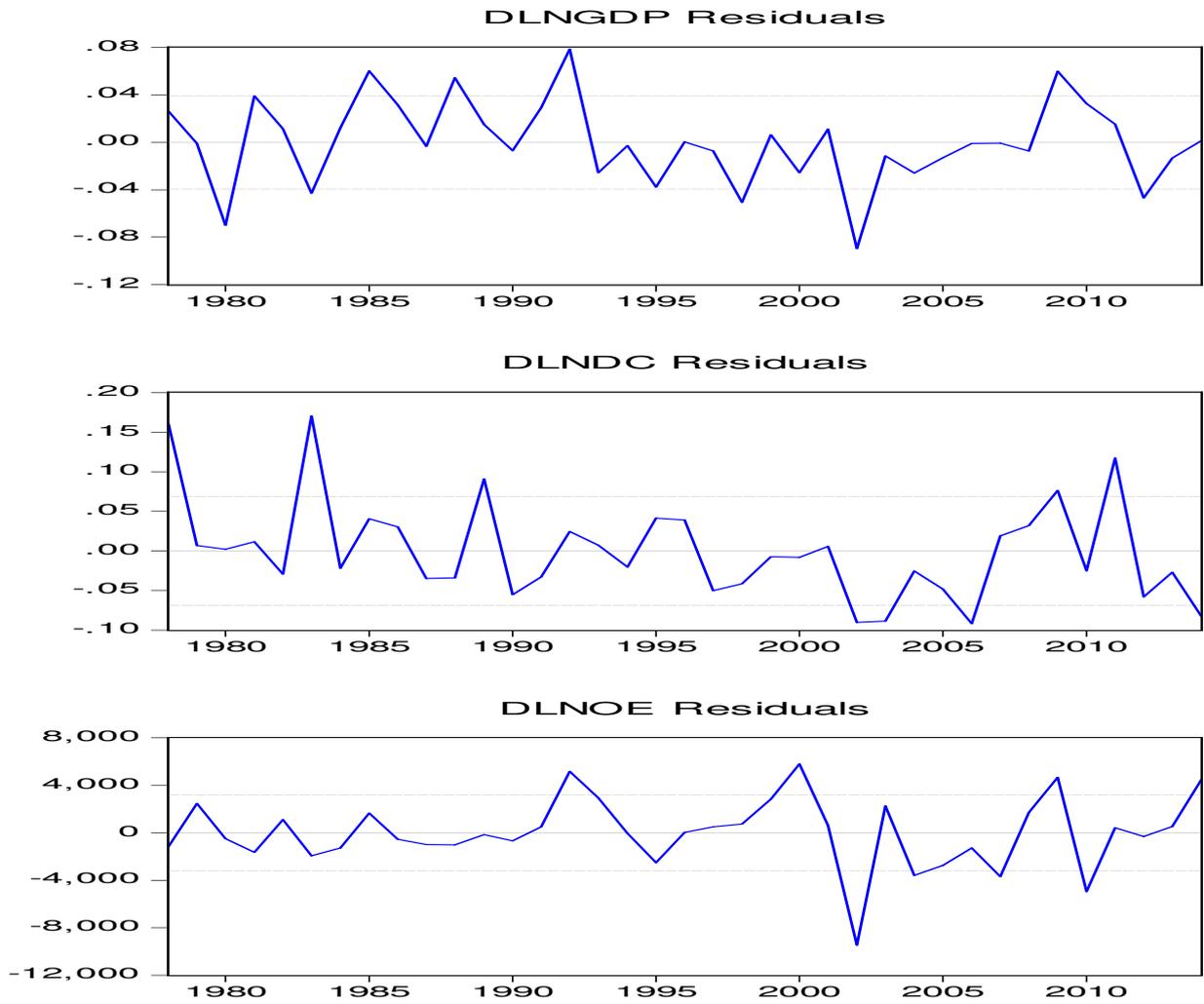
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Appendix I



Appendix II

