An ARDL Bounds Testing Approach to the Relationship between Financial Development and Output Growth in Nepal

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Abstract: *This paper examines the relationship between financial development and output growth in Nepal over 42 years of period from mid-July 1975 to 2017 using ARDL bounds testing approach to co-integration. The study uses natural logarithm of per capita real GDP as a proxy of output growth and means removal average of broad money (M2) to GDP ratio and domestic private credit to GDP ratio as a proxy of financial development indicator. The results of ARDL bounds test show that financial development and output growth in Nepal is co-integrated over the study period. The study results demonstrate that financial development in Nepal leads to output growth in the long-run. However, the study fails to detect any impact of financial development on output growth in Nepal over the short-run. Based on long-run results of this study, it can be concluded that development of financial sector in Nepal can stimulate long-run output growth. Thus, considerable efforts should be paid on promoting the development of the financial sector that contributes significantly to achieve long-run output growth.*

Key Words: Financial Development, Output Growth, Co-integration, ARDL.

I. INTRODUCTION

The relationship between financial development and output growth has received considerable theoretical and empirical attentions since the longer period. Schumpeter (1911) built up the theoretical foundations of this relationship, which asserts that well-functioning financial sector promotes technological innovation by identifying and funding innovative projects and production process that fosters the economic growth. In the later period, Gurley and Shaw (1967), Goldsmith (1969), McKinnon (1973), and Shaw (1973), initiated extensive debate on this relationship. Similarly, during 1990s, particularly after the evolution of endogenous growth literatures, a set of theoretical papers renewed this

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debate, which include Greenwood and Jovanovic (1990), Saint-Paul (1992), Bencivenga and Smith (1993), and Obstfeld (1995), among others. The theoretical debates demonstrate that countries with better developed financial sector experience faster rate of output growth. It is generally argued that financial sector plays important role in promoting output growth in an economy by making possible the mobilization of capital for investment. For example, Cherif and Gazdar (2010) argue that a well-developed financial system reduces information, transaction, and monitoring cost and also enhances the efficiency of financial intermediation thereby fostering output growth. Thus, financial development is closely related with output growth in a sense that financial system consists of a system of capital accumulation and supply of funds thereby encouraging output growth.

There are several other views on the relationship between financial development and output growth. Robinson (1952) presents a contrary opinion on the relationship between financial development and output growth, asserts that higher rate of output growth is capable of creating demand for particular type of financial services in the economy. As a result, financial sector automatically emerges and grows to respond these demands for financial services in the economy. There are some other literatures which fully ignores the role of financial development in output growth process. The proponents of this view include Lucas (1988) and Stern (1989), among others, who assert that it is meaningless to overemphasize the role of financial development in output growth because it plays no significant role. Despite of diversified views on the relationship between financial development and output growth, majority of the views argue that an efficient financial system helps in pooling small savings by providing savers with convenience access to several financial instruments, providing efficient allocation of capital, and creating more wealth by redirecting savings from individuals and slow-growing sectors of the economy to faster-growing sectors.

A large number of studies provide evidence that financial development matters for output growth. In an attempt to determine empirically whether financial development has a transitory level effect or permanent growth effect, Atje and Jovanovic (1993) documented a significant correlation between growth over the period 1980-88 and financial development indicators. Building on the methodology used by Atje and Jovanovic (1993), Harris (1997) re-examined the empirical relationship between financial development and economic growth over a period 1980-91 for a sample of 49 countries and concluded in the same line of Atje and Jovanovic. Additionally, this study showed strong financial development effect on growth for less developed countries as compared against developed countries.

Levine and Zerovs (1996), using a sample of 47 countries over the period 1976-93, documented that stock market liquidity and banking development indicators both are good predictors of economic growth, capital accumulation and productivity growth. Similarly, Khan and Senhadji (2000) examined the evidence on the relationship between financial sector development and economic growth for a large cross-section sample of countries. The results confirmed the strong positive and statistically significant relationship between financial depth and growth in the cross-section analysis. This study also established the important role of financial depth in determining the cross country differences in growth.

In recent period, Uzunkaya (2012) demonstrated the existence of financial development effect in promoting economic growth in both financially developed and underdeveloped economies. Similarly, Oima and Ojwang (2013) showed that improvement in the provision of stock market and banks boosts long-run economic growth. Solo (2013) also concluded that the overall level and quality of financial services matter for economic growth. In the similar line, Rajabi and Muhammad (2014) and Nyasha and Odhiambo (2015) indicated that, in the long run, financial development plays a pivotal role in propelling real sector growth. However, in a more recent period, Iheanacho (2016) examined the relationship between financial intermediary development and economic growth in Nigeria over the period 1981–2011 using the auto-regressive distributed lag (ARDL) approach to co-integration analysis. The results showed that the relationship between financial intermediary development and economic growth in Nigeria is insignificantly negative in the long-run and significantly negative in the short-run.

The empirical documentations of many studies (for example, Levine and Renelt (1992), King and Levine (1993b), Levine and Zerovs (1998), among others) are based on cross-country regression to examine the finance-growth relationship. However, cross-country regressions do not address the causality issues satisfactorily because institutional structures of countries associated are different (Arestis & Demetriades, 1997). It is reasonable to believe that financial development predicts economic growth simply because it anticipates future growth (Rajan and Zingales, 1998). Consequently, the development of financial sector can be a leading indicator of economic growth rather than a causal factor. Particularly, cross-country regressions involve averaging out variables over long period of time to explain the cross-country variations in growth rates. This technique does not permit different countries to exhibit different patterns of relationship, yet it is likely that in some countries the financial sector is a leading sector while in others it is not. Hence, the results from cross-country studies are only valid on average and they do not completely resolve the issue in the country specific case (Levine, Loyaza & Beck, 2000).As Maghyereh (2001) argues, cross-country growth regressions also suffer from different problems. For example, there is no defensible view for including different countries in the same regression. Also, various factors such as government's policies, preferences, and business cycle change during the time period of study. So it is not possible to capture all these changes by certain explanatory variables averaged over time. This approach is also not able to distinguish whether or not the financial development affects the long-term growth rate of the economy, or it just influences the short-term level of development. For instance, in cross-country regression, a country experiencing short period of rapid growth and no growth after is treated the same empirically as the one experiencing moderate growth over longer period of time. Thus, cross country studies do not address the peculiar country-specific characteristics.

Above mentioned facts primarily encourage the study at individual country level. Even at individual country level, the previous studies have used data from the United States, European and advanced Asian countries. Thus, further attempts are necessary using data from a developing economy. Nepalese economy is still passing through

the developing stage. The unstable political situation has prevented the country from achieving satisfactory rate of economic growth. Besides, Nepal is facing problems in meeting global standards of economic behavior as demanded by economic policy of globalization and liberalization. Furthermore, inadequate capital formation and ineffective use of capital are some of the problems of economic development in Nepal (Regmi, 2012). Among these problems, the Nepalese financial system is witnessing a developing stage in terms of growth in number of banks and financial institutions, credit flow to private sectors, and participation in stock market investments. On the overall, equity and banking culture is increasing among Nepalese people. In these backdrops of Nepalese economy and state of financial development, it is necessary to examine whether the financial development has contributed to economic growth in case of Nepal. Therefore, this study particularly attempts to examine the role of financial development on economic growth process of a small and developing economy of Nepal. More particularly, this study takes Nepal as a country-specific case study using more recent data sets to examine the long-run and short-run dynamics of the relationship between financial development and output growth using ARDL bounds testing approach.

The rest of this paper is organized as follows: section II deals with data and methodology adopted in the study; section III discusses the study results; and finally section IV presents study conclusion and implications.

II. DATA AND METHODOLOGY

a. Data Source

The empirical results, in this study, are based on the analysis of time series data extracted from various sources. Nepal has yet not adopted the practice of announcing quarterly GDP. Therefore, the study results are based on the annual time series of this variable indicating economic growth and thus this does not permit the analysis of real sector on quarterly basis. However, Campbell and Perron (1991) argue that as far as the power of recent time series test is concerned the span of data is much more important than the number of observations. Demetriades and Hussein (1996) also suggest that it is much more preferable to use fewer annual observations data covering longer period of time than using larger observations covering short span of time. Thus, the annual time series data used in this study covers 43 years of period from mid-July 1975 to mid-July 2017.

The GDP series from mid-July 1975 to 2017 were extracted from Economic Survey (2010/11), Statistical Tables Volume II and various issues of Economic Survey published by Government of Nepal, Ministry of Finance. The data on financial development series such as M2 and domestic credit to private sectors by commercial banks, and the data on imports, exports and National consumer price index (CPI) were extracted from various issues of Quarterly Economic Bulletin published by Nepal Rastra Bank. Similarly, other macroeconomic data such as gross fixed capital formation and gross domestic savings

were retrieved from World Bank National Account Data and OECD National Account Data Files. Finally, data on population were derived from UN data source. The population data until mid-July 2010 were actual data. For mid-July 2015 and later, the population forecast used medium variant to project the population development. The medium variant is the most likely development of population.

b. Definition of variables and their measurement

Economic Growth Variable

There are several measures of economic growth. For example, Levine and Zerovs (1996) used real per capita GDP growth as proxy of economic growth, whereas Levine and Zerovs (1998) used three measures- real per capita GDP growth, capital stock growth, and productivity growth- as the proxy for economic growth. The data on capital stock and productivity growth of Nepal are not available. Thus, following with the growth literature (for example, Levine & Zerovs, 1996, among others), this study employs the natural logarithm of per capita real GDP as a measure of economic growth.

Financial Development Variables

There are several indicators of financial development. Traditionally, several studies such as Goldsmith, 1969; McKinnon, 1973 used proxy for financial depth defined as broad money (M2) divided by GDP as one important indicator of financial development. However, King and Levine (1993a) argue that this measure does not indicate whether the liabilities are those of central banks, commercial banks or other financial intermediaries. They also assert that this measure of financial depth cannot measure where the financial system allocates the capital. Levine and Zerovs (1998), therefore, argue that the ratio of the value of domestic private credit to GDP measure improves upon traditional financial depth measures by isolating credit issued by banks, as opposed to credit issued by the central bank or other intermediaries. Similarly, this measure absolutely represents the credit to private sector as opposed to credit issued to governments. As suggested by King and Levine (1993b), private credit is the most comprehensive indicator of activity of commercial banks as it measures the activity of the banking sector in channeling savings to investors. However, several studies also used broad money to GDP ratio to reflect the size of financial development, depth of financial sector and motivation toward investment. World Bank and International Monetary Fund also standardize this ratio across a country. For the purpose of this study, financial development index (FD) has been used as a proxy for the level of financial development. This index was constructed from two financial development variables, namely, the ratio of broad money (M2) to GDP and ratio of domestic private credit to GDP. To construct an overall index of financial development, the means-removed values of these two indicators of financial development were averaged in a two-step procedure following Demirguc-Kunt and Levine (1996). First, the means-removed values of M2 to GDP, and domestic private credit to GDP were computed. The means-removed value of a variable is defined as the value of variable minus the

mean value of variable divided by absolute mean value of the variable, where, the mean value of variable is measured as the simple average over the mid-July 1975-2017 period. Second, a simple average of the means-removed M2 to GDP and domestic private credit to GDP was computed to obtain an overall index of financial development (FD).

Control Variables

In order to control for other possible determinants of economic growth not captured by the financial development variables, this study includes four control variables used in most previous studies. Several empirical literatures on growth (such as Levine & Zerovs, 1996; Levine, Loyaza & Beck, 2000, among others) have identified a large number of control variables that are partially correlated with economic growth. They include investment, saving, initial per capita GDP, initial level of education attainment, government recurrent expenditure to GDP ratio, inflation rate, sum of exports plus imports to GDP ratio, and the black market exchange rate premium. However, inclusion of larger number of these variables as explanatory variables in the regressions results into loosing degree of freedom in empirical analysis especially for a study covering fewer observations. Therefore, due to this technical constraint, the study has limited the use of the macroeconomic conditional variables to the ones most generally used in the literatures (for example, Barro, 1991; Mankiw, Romer & Weil, 1992; Levine & Renelt, 1992, among others). Thus, this study considers only four macroeconomic control variables, namely, investment, saving, trade openness, and macroeconomic stability. The ratio of gross fixed capital formation to GDP has been used as a proxy for investment (INV); the ratio of gross domestic savings to GDP has been used as a proxy for saving (SAV); the sum of exports and imports as a share of GDP, also termed as OPEN, has been used to capture the degree of trade openness and natural logarithm of consumer price index, termed as INF, has been used as an indicator of macroeconomic stability. The purpose of using these control variables is to reduce the chance that growth regression either omits an important variable or includes a selected group of regressors that yields favorable results. Table 1 provides a summary of the definition of variables used in the study.

Table1: Definition of Variables

Variables	Definition
GROWTH	Growth rate in per capital real GDP measured as natural logarithm of per capita real GDP
INV	Proxy of Investment measured as gross fixed capital formation as a percentage of GDP
SAV	Proxy of Savings measured as gross domestic savings as a percentage of GDP
FD	Proxy of financial development index measured as means removal average of M2, and Domestic credit by commercial banks to private sector
OPEN	Proxy of trade openness measured as imports plus exports as a percentage of GDP
INF	Proxy of macroeconomic stability measured by natural logarithm of National Consumer Price Index

c. The ARDL Model

The standard Johansen and Juselius (1990) and VAR error correction form of testing long-run and short-run relationship among variables suffer from serious limitation of checking the order of integration (Pesaran, Shin & Smith, 2001). Therefore, to avoid such limitation, this study has applied autoregressive distributed lag (ARDL) bound testing approach popularized by Pesaran and Shin (1995). This model offers several advantages. First, the ARDL bound testing approach does not involve pretesting variables, which means that the test for the existence of relationships between variables are applicable irrespective of whether the underlying regressors are purely I(0), purely I(1) or mixture of both. However, none of the variables should be I(2). Second, while conventional cointegration methods estimate the long-run relationship within the context of a system of equations, the ARDL method employs only a single reduced form equation (Pesaran & Shin, 1995). Third, the ARDL technique generally provides unbiased estimates of the long-run model and valid t-statistics, even when some of the regressors are endogenous (Odhiambo, 2011). Fourth, while other cointegration techniques are sensitive to the size of the sample, the ARDL test is suitable even when the sample size is small. Thus, the ARDL test has superior small sample properties compared to the Johansen and Juselius (1990) cointegration test (Pesaran & Shin, 1995). Consequently, the approach is considered very suitable for analyzing the underlying relationship and it has been increasingly used in empirical research in recent years. This approach consists of estimating ARDL model of Equation (1).

$$\Delta GROWTH_t = \alpha_0 + \sum_{i=1}^{n} \beta_{1i} \Delta GROWTH_{t-i} + \sum_{i=1}^{n} \beta_{2i} \Delta FD_{t-i} + \sum_{i=1}^{n} \beta_{3i} \Delta INV_{t-i} + \sum_{i=1}^{n} \beta_{4i} \Delta SAV_{t-i} + \sum_{i=1}^{n} \beta_{5i} \Delta OPEN_{t-i} + \sum_{i=1}^{n} \beta_{6i} \Delta INF_{t-i} + \varphi_1 GROWTH_{t-1} + \varphi_2 FD_{t-1} + \varphi_3 INV_{t-1} + \varphi_4 SAV_{t-1} + \varphi_5 OPEN_{t-1} + \varphi_6 INF_{t-1} + \varepsilon_t \quad \ldots (1)$$

In Equation (1), β_{1i},β_{2i}, β_{3i}, β_{4i}, β_{5i} and β_{6i} represent the short-term dynamics of the model whereas parameters φ_1, φ_2, φ_3, φ_4, φ_5 and φ_6 represent the long-run relationship. The null hypothesis of no long-term relationship is H_0: $\varphi_1 = \varphi_2 = \varphi_3 = \varphi_4 = \varphi_5 = \varphi_6 = 0$. The process starts with conducting bounds test for the null hypothesis of no co-integration. The calculated F-statistic is compared with critical value tabulated by Pesaran, Shin and Smith (2001). If the test statistic exceeds the upper critical value, the null hypothesis of no long-run relationship is rejected regardless of whether the underlying order of integration of the variable is *I*(0) or *I*(1). Similarly if the test statistic falls below a lower critical value, the null hypothesis is not rejected. However, if the test statistic falls between these two bounds, the result is inconclusive. When the order of integration of the variables is known and all the variables are *I*(1), the decision is made based on the upper bound. Similarly, if all the variables are *I*(0), then decision is based on the lower bound.

The ARDL method estimates $(p+1)^k$ number of regressions in order to obtain the optimal lag length for each variable, where *p* is the maximum number of lags to be used

and *k* is the number of variables in the equation. The orders of lags in the ARDL model are selected by either Akaike Information Criterion or Schwartz Information Criterion, before the selected model is estimated by ordinary least square. In the second step, if

$$GROWTH_t = \alpha_0 + \sum_{i=1}^{n} \beta_{1i} \Delta GROWTH_{t-i} + \sum_{i=1}^{n} \beta_{2i} \Delta FD_{t-i} + \sum_{i=1}^{n} \beta_{3i} \Delta INV_{t-i} + \sum_{i=1}^{n} \beta_{4i} \Delta SAV_{t-i} + \sum_{i=1}^{n} \beta_{5i} \Delta OPEN_{t-i} + \sum_{i=1}^{n} \beta_{6i} \Delta INF_{t-i} + \varepsilon_t \quad \text{... (2)}$$

there is evidence of long-run relationship among the variables, the long-run model of Equation (2) is estimated.

After ascertaining the evidence of a long-run relationship, the next step involves estimating error correction model (ECM), which indicates the speed of adjustment back

$$\Delta GROWTH_t = \alpha_0 + \alpha_1 EC_{t-1} + \sum_{i=1}^{n} \beta_{1i} \Delta GROWTH_{t-i} + \sum_{i=1}^{n} \beta_{2i} \Delta FD_{t-i} + \sum_{i=1}^{n} \beta_{3i} \Delta INV_{t-i} + \sum_{i=1}^{n} \beta_{4i} \Delta SAV_{t-i} + \sum_{i=1}^{n} \beta_{5i} \Delta OPEN_{t-i} + \sum_{i=1}^{n} \beta_{6i} \Delta INF_{t-i} + \varphi_1 GROWTH_{t-1} + \varphi_2 FD_{t-1} + \varphi_3 INV_{t-1} + \varphi_4 SAV_{t-1} + \varphi_5 OPEN_{t-1} + \varphi_6 INF_{t-1} + \varepsilon_t \quad \text{... (3)}$$

to long-run equilibrium after a short-term disturbance. The standard ECM involves estimating the Equation (3).

To ascertain the goodness of fit of the ARDL model, diagnostic and stability tests are conducted. The diagnostic test examines the serial correlation, functional form, normality, and heteroscedasticity associated with the model. The structural stability test is conducted by employing the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ).

III. STUDY RESULTS AND DISCUSSION

Results of Unit Root Test

The application of ARDL bound testing approach requires that none of the variables are integrated of order 2, that is, they should not be I(2). Therefore, first it is necessary to confirm the order of integration for each variable. For this purpose, this study uses Augmented Dickey-Fuller (ADF) test proposed by Dickey and Fuller (1979) and Phillips-Perron (PP) test proposed by Phillips and Perron (1988). The study has chosen to estimate on both tests that include intercept and both trend and intercept in the test regression. For ADF test, the study employed automatic lag length selection using Akaike Information Criterion (AIC) that includes maximum lag length of 6. The automatic lag length selection was set up limited to maximum 6 lags because, for a small number of observations, allowing for higher lag order results into loosing the power of test. For PP test, the spectral estimation method is Bartlett- Kernel, which uses a Kernel sum of covariance estimator with Bartlett weights. The lag length or bandwidth used for spectral

estimator was controlled using Newey-West automatic bandwidth selection method. The unit root test results are reported in Table 2.

Table 2 : Results of Unit Root Test

Variables	ADF Test (Intercept)		PP Test (Intercept)	
	Level	First Difference	Level	First Difference
GROWTH	0.9021	-6.9941*	1.1627	-7.0111*
FD	3.2831	-5.2650*	3.9871	-5.3158*
INV	0.0014	-3.3059**	0.0889	-7.3530*
SAV	-4.1836*	-6.7942*	-4.1836*	-8.5128*
OPEN	-2.3495	-9.8141*	-2.0282	-15.7830*
INF	-0.5502	-5.1910*	-0.4950	-5.1877*
Variables	**ADF Test (Trend and Intercept)**		**PP Test (Trend and Intercept)**	
	Level	First Difference	Level	First Difference
GROWTH	-3.0258	-7.1377*	-2.9929	-7.1785*
FD	1.0705	-6.3008*	1.7891	-6.3000*
INV	-1.7136	-4.4199**	-1.5062	-7.4129*
SAV	-4.2411*	-6.6334*	-4.2807*	-8.1539*
OPEN	-4.6221*	-6.9044*	-4.6781*	-16.3119*
INF	-1.4202	-3.7371**	-1.3325	-5.2843*

Note: The reported values are test statistics. '*" indicates that result is significant at 1 percent level, and '**' indicates that result is significant at 5 percent.

Table 2 reports the ADF and PP unit root test results by including intercept only and by including both trend and intercept. As can be seen, by including intercept only in test equation, ADF and PP tests both fail to reject the null hypothesis of unit root for all series at level except for SAV. However, the unit root seems to improve in first difference series for all variables, and hence all series, except SAV, are *I*(1) according to both ADF test and PP test. Similarly, when the test equation includes both trend and intercept, these tests fail to reject the null of unit root for all series, except for SAV and OPEN, in level. Both unit root test statistics again reject the null of unit root for all series at 1 percent or 5 percent level when trend and intercepts are included in test equation. Thus, all unit root test results detect that the variables are integrated of either order 0 or order 1, that is, they are either I(0) or I(1) but none of them are I(2). Hence, ARDL model is applicable to these variables.

Co-integration and ARDL model Results

This section examines the long-run relationship between the variables in the general ARDL model using the ARDL bounds testing procedure. In this process, the first step is to obtain the appropriate lag order on the first differenced variables in Equations (1) by using the Akaike Information Criterion (AIC) and the Schwartz Information Criterion (SIC). The results for appropriate lag order selection are reported in Table 3. The lag selection using

both information criteria produce the same results for the ARDL model. The optimal lag length selected for the ARDL model with no serial correlation is 1.

Table 3 : Lag Order Selection

Lags	AIC	SIC	LM
1	8.55*	10.32*	35.15 (0.5089)
2	8.99	12.29	61.13 (0.0056)
3	8.82	13.64	34.62 (0.5340)

Note: * Sign indicates the optimal lag length according to given information criteria. LM is serial correlation LM test statistic.P-values are reported in the parentheses.

Before estimating the coefficients for long-run and short-run relationship, it is necessary to confirm the existence of long-run relationship among the variables under consideration. Therefore, in the second step, this study uses ARDL bounds test to Equation (1) to confirm the existence of co-integration relationship among variables under study. The results of the ARDL bounds F-test are reported in Table 4.

Table 4 : ARDL Bounds Test for the Existence of Co-integration

Test Statistic	Value	k
F-statistic	4.33	5
Critical Value Bounds		
Significance	**Lower Bound**	**Upper Bound**
10%	2.26	3.35
5%	2.62	3.79
1%	3.41	4.68

Following the estimation of the ARDL model and the use of AIC or SIC for optimal lag-length selection, the SIC-based ARDL (1, 0, 0, 0, 1, 0) model was selected because it is more parsimonious than the AIC-based model. As reported in Table 4, the F-statistic for ARDL bounds test is 4.33, which is greater than upper bound critical value at 5 percent level (2.62, 3.79). It implies that there is sufficient evidence to reject the null of no co-integration. Thus, the results of the ARDL bounds F-test suggest that there exists a long-run relationship between output growth, financial development, level of investment, level of saving, trade openness and inflation in Nepal over the period mid-July 1975-2017. In other words, these variables tend to have long-run equilibrium and they tend to move together in the long-run. However, this result should be considered preliminary, and simply indicates that that there is long-run relationship among variables under investigation. Hence, ARDL model can be applied to estimate the long-run and short-run coefficients.

After confirming the existence of long-run relationship, the next is to estimate the long-run and short-run coefficients of the selected ARDL model. The long-run results of the ARDL(1,0,0,0,1,0) model are reported in Panel A of Table 5 and the short-run results are reported in Panel B.

Table 5 : Results of ARDL (1, 0, 0, 0, 1, 0) Model

Panel A: Long-run Coefficients (Dependent Variable – GROWTH)			
Regressor	**Coefficient**	**Std. Error**	**t-Statistic**
C	8.770*	0.064	136.64
FD	0.003**	0.001	2.25
INV	-0.001	0.004	-0.17
SAV	0.007**	0.003	2.17
OPEN	-0.004***	0.002	-1.84
INF	0.280*	0.031	8.98
Panel B: Short-run Coefficients (Dependent Variable – ΔGROWTH)			
Regressor	**Coefficient**	**Std. Error**	**t-Statistic**
ΔFD	0.001	0.001	1.64
ΔINV	-0.000	0.002	-0.16
ΔSAV	0.003**	0.001	2.26
ΔOPEN	-0.000	0.001	-0.10
ΔINF	0.126*	0.029	4.30
ECM(-1)	-0.449*	0.125	-3.60
R-squared	0.997	Akaike info criterion	-5.143
Adjusted R-squared	0.996	Schwarz criterion	-4.812
S.E. of regression	0.017	Hannan-Quinn criter.	-5.021
Residual sum of square	0.010	Durbin-Watson stat	2.283
F-statistic	1657.527*		

Note: '*" indicates that result is significant at 1 percent level, '**' indicates that result is significant at 5 percent, and '***' indicates that result is significant at 10 percent.

The long-run results reported in Panel A of Table 5 show that the coefficient of financial development indicator is positive and statistically significant at 5 percent level. The results particularly show that financial development in Nepal leads to an increase in real output growth in the long run. This documentation is confirmed to various previous studies in recent periods (for example, Uzunkaya, 2012; Oima & Ojwang, 2013; Rajabi & Muhammad, 2014; Nyasha & Odhiambo, 2015, among others), which demonstrated the existence of financial development effect in promoting output growth in both financially developed and underdeveloped economies. The long-run results associated with the effects of other variables show the mixed results. The coefficient of investment is negative, contrary to the expectations of this study, though the level of investment (INV) has no significant impact on output growth. On the other hand, the level of saving (SAV) is positively and statistically significant at 5 percent level implying the existence of a positive long-run impact of savings on output growth in Nepal. In contrast, the long-run effect of the trade openness (OPEN) is negative and marginally significant at 10 percent level. The marginally significant negative effect of trade openness is attributed to the fact that increased negative trade balance in Nepal has negative impact on the output growth in the long-run.

The coefficient of macroeconomic stability (INF), however, is found to be positive and statistically significant. Earlier studies (for example, Bekaert, Harvey & Lundblad, 2005; and Huang, 2003) documented that countries with lower inflation rate, particularly below 10 percent annually, can accelerate the pace of economic growth, while countries

with high inflation about 10 to 20 percent annually can injure the long-run economic growth (Gylfason & Herbertsson, 2001; and Andres, Hernando, & Lo'pez-Salido, 2004). Thus, findings of this study with respect to the relationship between inflation and output growth implies that in order to promote the growth in the country, the government should attempt to maintain a lower rate of inflation.

Panel B of Table 5 shows the short-run dynamics of the ARDL(1, 0, 0, 0, 1, 0) model. As opposed to the case of the long-run results, these results show that although the coefficient of financial development indicator has positive effect on output growth, the effect is not significant in short-run. This implies that financial development in the short-run does not lead to output growth in Nepal. As with long-run results, the coefficients of investment (INV) is negative, though insignificant. Similarly, the coefficient of savings (SAV) is positive and statistically significant, implying that savings affect the output growth in Nepal over the short run. Importantly, the coefficient of ECM (-1) is statistically significant at 1 percent level with negative sign as per expectation. The coefficient of ECM (-1) shows the speed of adjustment toward long-run equilibrium if any disequilibrium exists in the short-run. The results show that the deviations in the short run towards the long run equilibrium are corrected by 44.9 percent each year. This low speed of adjustment in output growth might be due to the poor competitiveness of financial sector in Nepal. Based on long-run results, development of financial sector in Nepal was found to stimulate long-run output growth. Thus, the policy implication of these results for Nepal is that considerable efforts should be initiated to promote the development of the financial sector that stimulates the long-run output growth.

Table 6 : ARDL (1, 0, 0, 0, 1, 0) Model Diagnostic Tests

Diagnostic Test	LM-Version	F-Version
Serial Correlation	Chi-Square(2) = 2.86 (0.239)	F(2, 31) = 1.13 (0.335)
Heteroscedasticity	Chi-square (8) = 7.56 (0.477)	F(8, 33) = 0.90 (0.523)
Functional Form		F(1, 32) = 2.17 (0.150)
Normality		JB = 3.45 (0.178)

Note: Reported values are test statistics; and p-values are in parentheses.

Diagnostic tests were also applied to check the adequacy of the model specifications. The results of diagnostic tests of the ARDL (1, 0, 0, 0, 1, 0) model are reported in Table 6. The results of diagnostic tests suggest that long run and short-run estimates are free from serial correlation, heteroscedasticity, misspecification of the short run model, and non-normality of the error term.

As Hansen (1992) argued, the potential bias and misspecification of the model should be avoided when testing the stability of long run parameters. Therefore, the stability of the ARDL parameters was tested by applying the CUSUM and CUSUMSQ tests developed by Brown, Durbin and Evans (1975). Figure 1 and Figure 2 show plots of the cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMSQ), respectively. These results show that the ARDL parameters are stable because graphs of the CUSUM and CUSUMSQ are within the

Figure 1

Plot of Cumulative Sum of Recursive Residuals

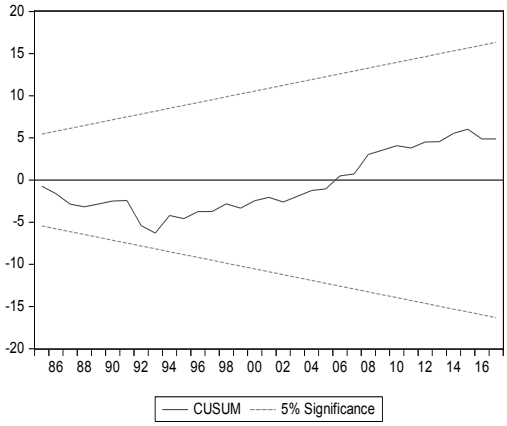
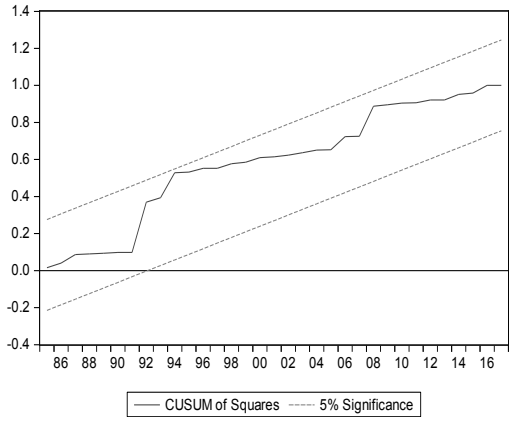


Figure 2

Plot of Cumulative Sum of Squares of Recursive Residuals



critical bounds at the 5 per cent level of significance. Thus, the model is stable and it confirms the stability of the long-run coefficients of the regressors.

IV. CONCLUSION AND IMPLICATIONS

This paper examined the long-run co-integrating relationship between financial development and output growth in Nepal using 43 annual observations on the time series of economic growth measured by natural logarithm of per capita real GDP and financial development indicators measured by means removal average of broad money (M2) to GDP ratio and domestic private credit to GDP ratio over the period mid-July 1975 to 2017.The study employed ARDL bounds testing approach to examine the co-integration between variables of interest. The results of ARDL bounds test revealed long-run relationship between financial development and output growth in Nepal. The positive and significant long-run coefficient of financial development indicator observed in this study implies that financial development in Nepal is a leading indicator of real output growth in the long-run. The main implication of this study finding is that the development of financial sector in Nepal can be viewed as an effective leading sector for channeling and transferring financial resources between surplus and deficits units to promote long-run output growth. The long-run positive finance-growth relationship documented in this study is compatible with many earlier studies such as Christopoulos and Tsionas (2004) for Thailand during the period 1970-2000, Habibullah and Eng (2006) for Malaysia during the period 1976-2000.

The long-run results associated with the effects of other variables showed the mixed results. The coefficient of investment is negative, though not significant impact on output growth. On the other hand, the level of saving is positively and statistically significant implying the existence of a positive long-run impact of savings on output growth in Nepal. In contrast, the long-run effect of the trade openness is negative and marginally

significant. The marginally significant negative effect of trade openness implies that the government should attempt to reduce the size of trade deficit to achieve the positive growth enhancing impact of trade openness in Nepal. The positive and statistically significant coefficient of inflation observed in this study can be viewed as similar to earlier studies (for example, Bekaert et al, 2005; and Huang, 2003), which documented that countries with lower inflation rate, particularly below 10 percent annually, can accelerate the pace of economic growth. Thus, there is a need to maintain a lower rate of inflation to promote growth in the country. With respect to short-run dynamics of the finance-growth relationship, results showed no significant effect of financial development on output growth in the short-run. As with long-run results, the study showed negative, though not significant, impact of investment. Similarly, the study observed positive and statistically significant effect of saving on output growth in Nepal over the short run.

Finally, based on long-run results of this study, it can be concluded that development of financial sector in Nepal can stimulate long-run output growth. Thus, considerable efforts should be paid on promoting the development of financial sector that stimulates the long-run output growth. Particularly, Nepal should adopt appropriate macroeconomic policies, encourage competition within the financial sector, and develop a strong and transparent institutional and legal framework for financial sector activities that promote long-run output growth.

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