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FINANCIAL ECONOMICS | RESEARCH ARTICLE

Financial institutions depth and growth in Nepal: Sensitivity to the choice of depth proxy

Keshab Khatri Chettri^{1*}

Abstract: This paper examines the long-run and short-run growth effects of financial institutions depth in Nepal along with the sensitivity to the choice of proxy representing financial depth. Using annual time-series data for the period from 1980 till 2019, obtained from Quarterly Economic Bulletins published by Nepal Rastra Bank, the study employed autoregressive distribute lag (ARDL) model with bounds testing procedures to examine cointegration. Domestic credit to private sector, broad money supply, total deposits and financial institution's assets are used as proxies for financial institutions depth as indicated by World Bank. Real GDP is used to measure economic growth and the influence of macroeconomic environment is accounted by inflation and trade openness. The bounds tests found cointegration in economic growth functions and the regression results revealed that domestic credit to private sector performed better than other indicators in terms of its significant contribution to economic growth both in the long-run and the short-run. Money supply and financial deposits show significant positive contribution to growth in the long-run. The positive relationship of financial depth indicators with economic growth also supports the supply-leading (finance-led-growth) hypothesis in the long-run. Policies must be aimed at efficient allocation of affordable credit to profitable projects for short-run and long-run growth. Expansionary fiscal and monetary policy and long-term deposits are highly desirable for the long-run growth in Nepal.

Subjects: Asian Economics; South Asian Economics; Monetary Economics; Finance

Keywords: ARDL; economic growth; financial depth; financial development; Nepal

1. Introduction

The growth of an economy includes the development of its financial sector and the development of financial sector takes place with the process of developing and increasing institutions, instruments and markets that can support large investments for economic development. Levine (2004) has put financial development as improvements in generation of investments information, monitoring of investments, embracing corporate governance, risk management and diversification, pooling and mobilizing savings to productive sectors, and speeding up trade. These financial functions then would influence saving and investment decisions and eventually lead to economic growth. However, financial sector development and its role in economic growth has been debated for long on their causality relationship. The indispensable role of financial development for economic growth is advocated by Goldsmith (1969) and Levine (1997) among others. Lucas (1988), a neoclassical theorist, on the other hand, argued that the role of financial development is overstressed in regard to determining economic growth. Moreover Robinson (1952) and Patrick's demand-following hypothesis (Patrick, 1966) advocated for the growth in the economy to create

the demand for financial instruments and institutions. However, the debate to a great extent has been addressed by the researchers from different parts of the world confirming the finance-led-growth hypothesis (Adu et al., 2013; Bayraktar, 2014; Christopoulos & Tsionas, 2004; Demirguc-Kunt & Levine, 1996; Naik et al., 2015).

Financial researchers, mostly based on cross-country analyses, have advocated that it is the advancement of the financial sector that has played a crucial role in fostering the growth of the economy at remarkable levels (Levine, 1997, 1998). These cross country studies, however, fail to consider the differences of economic and political structure and other factors that may vary across countries. As such, some empirical studies (Al-Yousif, 2002) suggest that the relationship between financial development and economic growth cannot be generalized across nations, as economic policies vary from country to country, and thus it is necessary to carry out the research for one country at a time. Aghion and Howitt (2009) opined that in a country with efficient and trustworthy banks and financial institutions people are more willing to save and free-up the resources for investors. Whereas people are not encouraged to saving in a country with malfunctioning banking institutions. Understanding the causal dispute of finance-growth relationship, this study attempts to examine the relationship in single country and also focuses to examine the strength of long-run and short-run relationship of different indicators of financial depth with economic growth.

The assessment of financial sector development and its impact on economic growth depends on different measures such as depth, efficiency, stability and access. Majority of the existing literature is focused on financial depth which is concurrently also used to indicate financial development. Depending on different indicators of measuring financial depth, the empirical findings have presented different conclusions in regard to impact of such indicators on growth. Moreover, the relevance of indicators used are also found to be country specific because of legal, political and institutional differences across the countries (Biplov & Halder, 2018; Le et al., 2019; Puatwoe & Piabuo, 2017; Tursoy & Faisal, 2018). In the realm of globalization and liberalization, it is also worth noting how the individual emerging financial markets are functioning and how do they interact with the economic growth through different financial indicators. Few studies with mixed results (see Bist & Bista, 2018; Dhungana, 2019; Kharel & Pokhrel, 2012; Paudel & Acharya, 2020; Rimal, 2014; Timsina, 2014) have examined the finance and growth relationship in Nepal and in most of these studies, financial intermediation has been indicated by one or few of the variables, such as broad money, domestic credit to private sector, total credit from banking sector, private sector credit and ratio of financial system asset to total asset. Most of these studies examine causal relationship between financial development and economic growth and there still remains lack of consensus on observed relationships and appropriateness of financial depth measure. Hence, the current study is motivated by observed gap in knowledge in finance-growth area. As such, this study seeks to contribute to the existing debate on the issue of appropriate measure to proxy financial institutions depth as well as to uncover the short-run and long-run impact of different measures of financial institutions' depth on Nepal's economy.

Following the introduction, the rest of the paper is organized as follows: Section 2 briefly presents financial system and economic performance in Nepal. Section 3 outlines brief literature review. Section 4 introduces empirical methodology and findings are discussed in Section 5. Section 6 concludes the paper with summary, recommendations and suggestions.

2. The financial sector and economic performance in Nepal

Nepal pursued state-led planned development strategies since 1956 through which government established public enterprises, kept under control the trade and industry, provided subsidy to agricultural inputs, encouraged lending of commercial banks, protected the domestic industries against high tariffs and more. But the output was well below the expectation (population growth was high to 3 percent per annum in five years from 2.7 percent in 1970–1980, exports was stagnant at around 5 percent of GDP in 1985/86, imports rose to 17 percent in 1985 from 11 percent in 1975, macroeconomic and foreign exchange crisis was severe (Sharma, 2006). In

Table 1. Financial institutions		Mid July							
Types of financial institutions	1980	1985	1990	1995	2000	2005	2010	2015	2020
CBs	2	3	5	10	13	17	27	30	27
DBs	2	2	2	3	7	26	79	76	20
FCs				30	47	60	79	78	22
MFDBs				4	7	11	18	38	85
Insurance	4	4	5	9	12	19	25	26	40
Total	8	9	12	56	86	133	228	248	194
CB branches	241	381	441	444	439	375	990	1672	4436
CB assets	4543.9	10678.5	26687.9	83795.5	210894.8	341022.5	771139.4	1753726	4446865

Source: Banking and Financial Statistics of various issues, NRB; CBs: Commercial Banks; DBs: Development Banks; FCs: Finance Companies; MFDBs: Micro-finance Development Banks (in numbers); CB Branch: Commercial Banks' branches in units; CB Assets: Commercial Banks' total assets in million, Nepali rupees.

order to bring the macroeconomic engine back on rail, the government underwent economic reforms by adopting economic stabilization, liberalization and more importantly structural adjustment programmes (SAPs) of the IMF and the World Bank, respectively, in the mid-1980s.

It was only after the establishment of the first bank, Nepal Bank Limited in 1937, formal financial activities got into play and general public got access to banking transaction. The financial system gained momentum after the establishment of Nepal Rastra Bank as a central bank of Nepal in 1956 under Nepal Rastra Bank Act 1955. The first development bank, Nepal Industrial Bank was established in 1957 and second commercial bank, Rastriya Banijya Bank established in 1966. Nepal Rastra Bank Act 2002 and Banks and Financial Institutions Act 2006 empowered the central bank with more necessary legal authority for the regulation and supervision of banks and financial institutions.

Deposit taking and contractual saving institutions form the composition of the Nepalese financial system where commercial banks, development banks, micro-credit development banks, finance companies, cooperatives and non-government organizations with limited banking activities constitute deposit taking financial institutions. On the other hand, contractual saving institutions comprise of insurance, employee's provident fund, citizen investment trust, postal saving offices and Nepal Stock Exchange.

After the adoption of liberalization policy in 1980s, new financial institutions entered the market and the trend kept growing till 2015 as observed in [Table 1](#). However, through the monetary policy of Fiscal Year 2014/15, NRB announced to raise the minimum paid up capital of commercial banks to then four times high to Nepalese rupees 8 billion and twenty-four times increment to Rs. 2.5 billion for the development banks within mid-July 2017. This led to the increase in commercial banks' assets from Rs. 1,753,726 million in 2015 to Rs. 4,446,865 million in 2020. As such, the Bank and Financial Institutions Merger By-laws 2011 that came as encouragement for consolidation became an indirect compulsion for many small institutions to foster merger and acquisition thereby increasing capital base. As a consequence, 96 BFIs had taken part in the merger process till June 2016 to become 35 institutions (NRB, 2016). This led to a huge drop in the number of development banks and financial companies bringing down the total to 194 in 2020 from 248 in 2015. The Nepalese economy is bank based economy because banks are the dominant section in the financial system and commercial banks alone occupies around 70 percent of the total assets of the Nepalese financial system (e.g., 71.9% in 2005, 76.5% in 2010, 80.3% in 2015). Since liberalization, commercial banks have been extending their services through increase in the number of their branches. After the adoption of federation system in 2015, the central bank encouraged the commercial banks to open their branches in every local unit. The monetary policy of fiscal year 2017/18 assured interest free loan of Rs. 10 million for each branch of A, B and C class BFIs opened outside the headquarters of remote districts. The central bank along with incentives also threatened to penalize on any defiance of such directives. As such, the branches of commercial banks rose from 1672 in 2015 to 4436 in 2020.

Financial indicators in [Table 2](#) show significant deepening of the financial sector that could be attributed to the structural reforms. Broad money as a percentage of GDP rose from 24.73% (1980–1984) to 86.02% (2015–2019). Credit to private sector has outpaced over the study period from 8.38% (1980–1984) to 55.52% (2015–2019) relative to GDP and from 50.46% (1980–1984) to 89.32% (2015–2019) relative to total financial deposits. The total deposits have also increased impressively during the study period. Financial innovation measured by the ratio of narrow money and broad money has decreased over the years which indicate the need to improve financial services and credit facilities along with development of the financial instruments. The financial assets that comprised of assets of central bank and commercial banks in this study is observed to rise sharply since 1980–84 from 28.89 percent to 100% of GDP during 2015–2019. However, following the financial structural changes and overall financial deepening thereafter, the economic growth has not been impressive as it just hovered around 4 percent for the last four decades with

Table 2. Economic growth and financial intermediary indicators (in percent)

Indicators	1980–84	1985–89	1990–94	1995–99	2000–04	2005–09	2010–14	2015–19
Real GDP growth	4.43	4.73	5.44	4.3	4.09	4.19	4.44	5.53
Inflation	10.79	10.47	11.68	8.72	3.49	7.54	9.27	6.07
Trade openness	21.11	22.57	29.43	38.23	36.99	35.22	33.01	36.01
Domestic credit to private sector/GDP	8.38	9.89	12.43	23.32	29.87	37.96	47.21	66.52
Broad money/GDP	24.73	27.73	32.28	39.57	49.59	56.59	64.24	86.02
Narrow money/broad money	49.43	45.27	42.52	37.26	33.61	32.13	24.67	21.78
Total deposits/GDP	16.82	19.15	22.77	29.46	38.09	44.58	54.05	74.33
Domestic credit to private sector/total deposit	50.46	51.55	54.54	79.18	78.38	85.01	87.46	89.32
Total domestic credit/GDP	21.39	27.74	28.60	36.54	44.49	51.29	57.67	73.85
Bank assets/GDP	21.25	23.97	31.58	44.05	58.33	56.15	53.61	70.32

Source: Various issues of Quarterly Economic Bulletin of Nepal Rastra Bank and author's summarization.

around 1 percent increase during 1990–1994 and 2015–2019. The inflation remained high for the first decade after the implementation of structural adjustment programmes which lowered around by 3% and fluctuated between 3 and 9% thereafter. Although the inflation rate shows huge fluctuations the same is not reflected on the financial indicators. This is due to cost-push theory of inflation which largely attribute inflation to non-monetary, supply-side effects changing the costs of production (Humphrey, 1998) as Nepal heavily relies on imports of petroleum, fertilizers, construction materials and other raw materials. Other theoretical studies (Boyd et al., 2001; Choi et al., 1996) have also demonstrated non-linear relationship between inflation rate and financial market development.

3. Literature review

3.1. Theoretical and empirical review

Finance-growth nexus have been envisaged differently across economic studies that tend to differ substantially and possibly due to differing structure, features and size of markets (Hondroyannis et al., 2005) and thus two basic theoretical arguments are proposed in the literature which are demand-following and supply-leading hypotheses. The demand-following hypothesis argues that as the economy grows, it creates demand for financial services and instruments that in turn lead to financial development and is supported both theoretically and empirically by many (Ang & McKibbin, 2007; Apergis et al., 2007; Robinson, 1952). The supply-leading hypothesis however argues that it is the growth in the financial sector that leads to the economic development and is supported theoretically and empirically by several studies (Bayar et al., 2014; Cojocaru et al., 2016; Demircuc-Kunt & Levine, 1996; McKinnon, 1973; Naik et al., 2015; Shaw, 1973). Infact, the liberalization of the financial sector in many low-income economies including Nepal through IMF/World Bank's Structural Adjustment Programme (SAP) had the foundations in the seminal works of McKinnon (1973) and Shaw (1973) who underlined the significance of financial liberalization in stimulating domestic savings and eventually investment.

The extant literature although stands for financial development to cause economic growth, there still remain disagreement on the appropriate indicator of financial development because of different conclusions. Moreover, the relevance of each indicator depends of a particular country's legal, political, socio-economical and other institutional variances (Adu et al., 2013).

In a recent study, Khan et al. (2020) studied the role of financial development on the economic well-being of Pakistan using data from 1981 to 2018. Employing autoregressive distributive lag (ARDL) model, the results indicated that both domestic credit and money supply have statistically positive significant impact on GDP per capita. The results also showed that real effective exchange rate and inflation had significant inverse relationship with economic well-being measured by GDP per capita in Pakistan. Alsamara et al. (2019) examined the influence of financial development proxied by broad money supply (M2), trade openness and energy imports relative to GDP in Turkey over the period 1960–2014. The findings showed that broad money supply and trade openness had positive impact on real GDP per capita whereas negative impact of energy imports. Using data for the period 1977–2016, Biplop and Halder (2018) empirically investigated the relationship between financial development and economic growth in Bangladesh. The study regressed GDP growth on domestic credit to private sector, broad money, savings, investments and inflation rate using vector error correction model (VECM) framework. The findings revealed significant long-run causality running from financial development to economic growth. While examining the impact of foreign direct investment on economic growth in Sri Lanka, Samantha and Haiyun (2017) observed that FDI positively impact economic growth in the short-run and long-run but the relationship was not significant. Domestic investment however was significant in determining economic growth. Trade openness and labour force showed positive but insignificant coefficients. Puatwoe and Piabuo (2017) employed ARDL approach to examine the impact on economic growth of Cameroon by three indicators of financial development: broad money, domestic credit to private sector and deposit as a percentage of GDP. The results revealed that in the long-run all the

indicators showed positive significant influence on economic growth. In the short-run, however, only money supply showed significant positive influence, but domestic credit to private sector and deposits showed negative non-significant influence. In Cyprus, Tursoy and Faisal (2018) used total bank deposits as the financial depth along with inflation revealing the result that financial depth has significant positive and inflation has significant negative impact on the economic growth in the long-run. Adu et al. (2013) investigated the long-run growth effects of financial development in Ghana and observed that credit to private sector have significant positive impact on economic growth whereas broad money supply is observed not conducive to economic growth with negative significant coefficient. Trade openness and inflation are also observed to cause negative impact on the economic growth in the long-run. Audu and Okumoko (2013) used annual time series for the period 1970–2012 in Nigeria to examine the co-integration between financial development and economic growth. The results revealed that lending rate.

The association of the banking indicators are also different in many cross country studies. Sethi et al. (2022) investigated relationship between financial development, FDI, trade openness, domestic investment and labour force with GDP per capita in India, Sri Lanka and Pakistan for the period 1990–2018. The findings showed that FDI and financial development measured by domestic credit to private sector had positive impacts on the economic growth variable. Le et al. (2019) examined the relationship between financial depth and economic growth among ASEAN+3 countries for the period 2000–2014. The results showed immediate impacts of domestic credit and broad money (M3) to be significantly negative whereas significantly positive in lag 1. Market capitalization another measure of financial depth was observed to have significant positive impact immediately and negative in lag 1. Labour force did not show significant impact on economic growth whereas net interest margin and capital formation showed significant negative and positive impacts, respectively. Bist and Read (2018) investigated finance-growth nexus in 16 selected low-income African and non-African countries over the period 1995–2014. The study used credit to private sector to represent financial development and also incorporated control variables, such as gross fixed capital formation, trade openness, inflation and labour force. The long-run estimates indicated positive and significant impact of financial development on economic growth represented by real GDP. Trade openness, inflation and labour force also revealed to cause significant positive impact on economic growth. Guru and Yadav (2019) in BRICS countries revealed that credit to deposit ratio, domestic credit to private sector and money supply showed positive and significant relationship with economic growth but in the presence of stock market indicators. Chaitip et al. (2015) studied the impact of money supply on economic growth in ASEAN countries. The short-run findings brought out significant negative impact of money supply (M1) on economic growth in Indonesia, Philippines and Laos. Masoud and Hardaker (2012) investigated the affect of financial market and banking sector development on economic growth of 42 emerging markets over 12 years. They regressed GDP per capita on stock market size, liquidity and efficiency as well as banking assets and credit to private sector with control variables inflation, trade openness and economic freedom ratio. Among 8 different models used, the findings of majority of them reveal positive and significant relationship of banking and financial market variables with economic growth. Anwar and Cooray (2012) using panel data over the period 1970–2009 examined the impact of interaction of financial development and quality of governance on economic growth in seven South Asian countries. The results of system GMM showed that money supply, bank assets and domestic credit have significant positive influence in the South Asian countries excluding Maldives and Bhutan.

In the Nepalese context, Kharel and Pokhrel (2012) found that banking sector play a key role in economic development. Similarly, Timsina (2014) found positive effect of bank credit to the private sector on the economic growth in the long run. In another study, Bist and Bista (2018) found that long-run causality is unidirectional from financial development to the economic growth in case of Nepal and credit to private sector proxy for financial development has a significant positive impact on economic growth both in short-run and long-run, whereas inflation has significant positive impact in the long-run but non-significant negative relationship in the short-run. Paudel et al.

(2018) observed that broad money supply negatively but insignificantly impacts economic growth where as domestic credit to private sector impacts positively with significant coefficient. Dhungana (2019), shows that there is a long-run significant positive impact of financial system deposit and negative significant impact of domestic credit to private sector on economic growth. In a more recent study, Paudel and Acharya (2020) found that broad money supply, domestic credit by banking sector and domestic credit to private sector have long-run significant positive impact on economic growth. In short-run, however, the coefficients are not significant with positive coefficients for all except for broad money.

The existing literature reveal the use of different measures of financial depth (domestic credit to private sector, money supply, bank assets, financial system deposit), control variables (inflation, labour force, trade openness, investment) in the study of finance-growth nexus with mixed results. This inconsistency in the findings necessitates to examine the association of financial institutions depth indicators and economic growth in Nepal as well as examine the influence of different financial depth indicators on the economic performance.

3.2. Objective and hypothesis

There is no consensus in the literature regarding the finance-growth relationship as well as choosing of appropriate proxy to represent financial depth which in many studies has been portrayed as financial development, financial institutions development or financial intermediation. The studies in low income economies on the finance-growth nexus is meagre and the studies undertaken in Nepalese perspective is very less and inconclusive. The objective of this paper is to contribute to the empirical evidence on finance-growth nexus, by identifying the significance of different measures of financial institutions depth on economic growth.

In addition to identifying appropriate depth measure, this study will test the following hypotheses within financial development and economic growth framework.

- Demand leading hypothesis: economic growth cause financial sector development in Nepal.
- Supply leading hypothesis: financial sector development cause economic growth in Nepal.

4. Data, variables, model specification and econometric methodology

4.1. Data collection

The current study uses annual time-series data and the period of analysis is from 1980 to 2019 (40 years) which covers adoption, execution and post liberalization period. The sample period around 40 is fairly used in annual time series analysis of cointegration (Ho, 2019; Olokoyo et al., 2020; Puatwoe & Piabuo, 2017). Depending on the availability of data, the study employs private sector credit to GDP, financial institution's assets to GDP, broad money supply to GDP and total deposits to GDP as different proxies of financial depth as outlined by The World Bank. The economic performance is measured by real GDP and the influence of macroeconomic environment is assumed by incorporating inflation and trade openness as control variables. The data for all the variables are calculated and obtained from various issues of Quarterly Economic Bulletin published by the central bank Nepal Rastra Bank (NRB). The real GDP and consumer price index are measured at base year 2010/11.

4.2. Variables description

Financial depth variables are taken based on the World Bank financial development indicators and based on their usage in different empirical studies. Table 3 provides description of dependent, explanatory and control variables with references.

4.3. Model specification

The empirical relationship between financial depth and economic growth is adapted following the studies of Christopoulos and Tsionas (2004) and Tursoy and Faisal (2018). In this simple model,

Table 3. Computation of variables and references

Variables	Abbrev.	Description	Reference
Growth	RGDP	Real GDP Base year 2011	Alsamara et al. (2019); Le et al. (2019); Bist and Read (2018); Manu et al. (2011)
Credit to private sector	CPS	Domestic credit to private sector (% of GDP)	Sethi et al. (2022); Le et al. (2019); Bist and Read (2018); Biplop and Halder (2018); Adu et al. (2013)
Financial Institutions' assets	FIA	Bank assets (% of GDP)	Masoud and Hardaker (2012); Anwar and Cooray (2012)
Broad Money Supply	M2	M2 (% of GDP)	Alsamara et al. (2019); Puatwoe and Piabuo (2017); Adu et al. (2013)
Total financial deposits	TFD	Total financial deposits (% of GDP)	Tursoy and Faisal (2018); Adu et al. (2013)
Trade openness	OPEN	Total exports and imports (% of GDP)	Sethi et al. (2022); Alsamara et al. (2019); Bist and Read (2018)
Inflation rate	INF	$[(CPI_t - CPI_{t-1})/CPI_{t-1}]$ Base year 2011	Bist and Read (2018); Biplop and Halder (2018); Tursoy and Faisal (2018); Manu et al. (2011)

Source: Author's compilation.

financial depth variable is included in an endogenous growth model which shows how indicators of financial depth through economic relations reveal to have impact on the economic growth

$$Y_t = \delta_0 + \delta_1 FID_t + \delta_2 Z_t + \mu_t \quad (1)$$

where μ_t denotes the white noise; Z denotes a vector of control variables of growth including inflation (*INF*) and trade openness (*OPEN*) to proxy total exports and imports; Y is real output proxied by real GDP (*RGDP*); FID denotes a vector of proxies for financial depth comprising private sector credit to GDP (*CPS*); financial institution's assets to GDP (*FIA*); broad money to GDP (*M2*) and total financial deposits to GDP (*TFD*). All variables are in natural logarithm except for descriptives and correlations. The control variable inflation is used to capture the influence of macroeconomic environment. Theoretically inflation (macroeconomic instability) may have inverse relationship with growth through reducing the investment (Fischer, 1993) and thus the capital stock accumulation. Trade openness indicates the level of trade liberalization there by access beyond the national trade boundaries. Technology is an endogenous variable in growth models and with the increase of trade openness, developing countries get access to global technologies thereby enhancing productivity and efficiency (Samantha & Haiyun, 2017).

4.4. Empirical methodology

The study models long-run and short-run relationship between financial depth and the economic growth time series data for which ARDL cointegration analysis is conducted after confirming that the variables are stationary below the second difference.

4.4.1. Unit root tests

The unit root properties of macroeconomic data were evidenced in the seminal work of Nelson and Plosser (1982) revealing unit root in 13 out of 14 long-term annual macroeconomic time series in the United States by employing Dickey and Fuller (1979) unit roots test. However, Perron (1989)

Table 4. Descriptives and correlations for selected series

	RGDP	CPS	M2	TFD	FIA	OPEN	INF
Descriptive statistics							
Mean	1083956.00	29.45	47.60	37.41	44.91	31.57	8.51
Maximum	2339741.00	75.41	92.83	81.86	79.53	41.72	21.05
Minimum	378963.30	7.98	22.63	14.93	19.45	19.83	2.43
Std. Dev.	541059.10	19.60	20.07	18.98	17.21	6.74	3.82
Skewness	0.60	0.70	0.68	0.77	-0.01	-0.48	0.86
Kurtosis	2.35	2.48	2.47	2.59	1.81	1.79	4.39
Jarque Bera	3.07	3.68	3.52	4.27	2.32	3.99	8.12
p-value	0.22	0.16	0.17	0.12	0.31	0.14	0.02
Observations	40	40	40	40	40	40	40
40							
Correlation matrix							
RGDP	1						
CPS	0.993	1					
M2	0.992	0.995	1				
TFD	0.992	0.996	0.999	1			
FIA	0.909	0.906	0.916	0.899	1		
OPEN	0.629	0.610	0.617	0.593	0.811	1	
INF	-0.384	-0.386	-0.396	-0.381	-0.534	-0.454	1

Source: Author's calculations.

RGDP in million Nepalese currency; CPS, M2; TFD; FIA; OPEN and INF in percentages.

contended this result stating the failure to account for structural changes in the data and thus incorporated an exogenous structural break for 1929 crash and reversed Nelson and Plosser (1982) conclusions for 10 of the 13 series. Again, Zivot and Andrews (1992) argued in favour of an over rejection of unit root hypothesis with exogenous priory based structural break and thus by incorporating a single endogenous break, they were unable to reject unit root hypothesis for GNP deflator, money stock, real GNP per capita and real wages of Nelson and Plosser (1982) series whose unit root hypotheses were rejected by Perron (1989). Lumsdaine and Papell (1997) allowed for two endogenous breaks in trend and were unable to reject unit roots in more series than Zivot and Andrews (1992) but less than Perron (1989). In this backdrop, the relevance of unit root tests with structural breaks overpowers the conventional tests such as Dickey-Fuller. However, in Zivot-Andrews test and Lumsdaine-Papell test, the critical values are derived assuming no break(s) under null hypothesis. This assumption leads to size distortions and the conclusion could be made in favour of trend stationary when actually it is non-stationary with breaks (Lee & Strazicich, 2003b). To address this issue, one break Lagrange Multiplier (LM) unit root test as substitute to Zivot-Andrews test was suggested by Lee and Strazicich (2004) and two breaks LM unit root test as alternative to Lumsdaine-Papell test was suggested by Lee and Strazicich (2003b). This study uses conventional Augmented Dickey-Fuller (ADF) unit root test (Dickey & Fuller, 1979) along with LM unit roots test with two structural breaks to confirm if the series follow integration requirement for cointegration analysis.

4.4.2. Autoregressive distributed lag model (ARDL)

The current analysis uses the autoregressive distributed lag model (ARDL) suggested by Pesaran et al. (2001) to investigate the long-run relationship between economic growth and financial development indicators. ARDL approach has many advantages over other cointegration estimation methods. ARDL bounds test approach can be used regardless of whether the chosen regressors are

integrated at level or first difference [I(0) or I(1)] but not I(2) because in this case it would normally invalidate the results (Adu et al., 2013). Second, the ARDL technique unlike other cointegration methods are not sensitive to the size of sample as it can provide more consistent coefficients in a small sample size as well (Panopoulou & Pittis, 2004). In analyzing long-run relationship between the economic growth as represented by real GDP per capita and financial institutions depth indicators, the study uses bounds testing procedures for cointegration test within the ARDL framework. The ARDL model of equation (1) can be mathematically written as

$$Y_t = \alpha_0 + \sum_{i=1}^p \beta_i Y_{t-i} + \sum_{j=0}^q \gamma_j' FID_{t-j} + \sum_{k=0}^r \delta_k' Z_{t-k} + \varepsilon_t \quad (2)$$

The analysis incorporates four models/equations undertaking each indicator of financial institutions depth as predictor variable along with inflation and trade openness as controlled variables. In order to examine the cointegration, the ARDL bounds testing involves the estimation of unrestricted error correction model presented in equation (3)

$$\begin{aligned} \Delta Y_t = & \alpha_0 + \lambda_1 Y_{t-1} + \lambda_2 FID_{t-1} + \lambda_3 Z_{t-1} + \sum_{i=1}^p \gamma_{1i} \Delta Y_{t-i} \\ & + \sum_{j=0}^q \gamma_{3j} \Delta FID_{t-j} + \sum_{k=0}^r \gamma_{3k} \Delta Z_{t-k} + \varepsilon_t \end{aligned} \quad (3)$$

where α_0 is a drift component, Δ is the first difference operator and other variables as defined in section 4.2. The coefficients $\lambda_1 - \lambda_3$ represent the long run coefficients and $\gamma_1 - \gamma_3$ represent short term dynamics of the model. The values (p,q,r) are the selected number of optimum lags for cointegrating equations based on Schwarz Criteria (SC).

4.4.3. ARDL cointegration test and error correction model (ECM)

The bounds test for cointegration is based on the Wald-test (F-statistic). We verify the existence of cointegration by testing the null hypothesis of no cointegration $H_0: \lambda_1 = \lambda_2 = \lambda_3 = 0$ against the alternative hypothesis of presence of cointegration $H_1: \lambda_1 \neq \lambda_2 \neq \lambda_3 \neq 0$ in equation (3). The variables are cointegrated if we reject the null hypothesis. Two sets of critical F values at I(0) and I(1) have been provided by Pesaran and Shin (1999) and Pesaran et al. (2001) for large samples and for small sample size ranging from 30 to 80 by Narayan (2005). It is essential to note that the critical values based on large sample size deviates significantly from that of small sample size (Narayan, 2004a, 2004b, 2005). Thus, critical values constructed by Narayan (2005) are used in this study to compare the calculated F-statistic and confirm the existence of long-run relationship if any. If the F-statistic falls below the lower bound values, we do not reject the null hypothesis of no co-integration. In contrast, if the F-statistic is greater than the upper bound values we reject the null hypothesis. However, the test is inconclusive if the F-statistic falls between the lower and the upper bound critical values.

If the cointegration is established, the next step involves formulation and estimation of long-run ARDL model using the OLS procedure in equation (2). Finally, it involves the formulation and estimation of short-run dynamics based on the restricted error correction model using the following reduced form:

$$\Delta Y_t = \alpha_0 + \sum_{i=1}^p \gamma_{1i} \Delta Y_{t-i} + \sum_{j=0}^q \gamma_{2j} \Delta FID_{t-j} + \sum_{k=0}^r \gamma_{3k} \Delta Z_{t-k} + \mu ECT_{t-1} + \varepsilon_t \quad (4)$$

where ECT_{t-1} is the lagged value of error correction term. ECT indicates both long-run causality and the speed of adjustment. The coefficient of the error correction term μ is expected to be negative

which implies that when variables drift apart from the equilibrium in the short-run, they can quickly correct back to their equilibrium levels.

The study also applies residual diagnostics such as normality of residuals, test for serial correlation and heteroscedasticity and functional form to check the model misspecification if any along with model stability using CUSUM and CUSUMSQ.

5. Empirical results and discussion

5.1. Descriptives and correlation

Table 4 contains basic statistics and correlation coefficients of the variables under study. The average real output during the study period is Rs. 1083.956 billion with minimum of Rs. 378.963 billion to maximum of Rs. 2337.741 billion. All the financial indicators also show great variations. The control variable trade openness however is observed to have been doubled during the study period. The result of Jarque Bera shows that all the series are normally distributed except for inflation. The correlation matrix shows high and positive correlations among the financial depth indicators as well as with real GDP except for inflation which is negatively correlated with all the variables. The correlation coefficients indicate that increase in credit to private sector, broad money, financial deposits and financial institutions assets could contribute to the economic growth. Likewise more open the international trade higher the economic growth as indicated by correlation. Correlation also shows that increase in price lowers the aggregate demand.

5.2. Unit root tests without and with breaks

ARDL model requires that all the series to be analyzed be either integrated of order zero, $I(0)$ i.e., at level or at order one, $I(1)$, i.e., at first difference. In order to ascertain that the variables under study are not integrated of order two, $I(2)$ or higher, the study employed Augmented Dickey-Fuller (ADF) unit root test without structural breaks and Lee and Strazicich LM unit root test with two structural breaks. ADF results in Table 5 show that all the variables are integrated at the first difference except for inflation which is integrated at level. Examining the stationarity of the series in the presence of structural breaks, the results of LM unit root test also show all variables to be non-stationary at level with two structural breaks except for financial institutions asset.

The first break in the financial series are observed to occur during 1990s and are associated with the implementation of Liberalization policies in late 1980s. The break in the series can be attributed to restoration of democracy with multi-parties government in 1991; Privatization Act, 1994 enacted to increase productivity by enhancing efficiency of state owned enterprises and also encouraging participation of private sector in such enterprises for overall economic development. Other possible reasons for the first break in financial indicators could be attributed to sector reform programs such as allowing commercial banks to accept current and fixed deposits in foreign currencies in 1985; introduction of World Bank Structural Adjustment Program I in the year 1986 and Program II in the year 1989. The first break in inflation is associated with the Asian Financial Crisis of 1997–98 and the second break is associated with the Global Financial Crisis of 2008–09. The second breaks in most of the financial series occur in 2000s and these breaks can be attributed to Asian Development Bank Rural Finance Sector Development Cluster Program I and II in the year 2006 and 2010, respectively, in Nepal. The GDP grew by an estimated 5.2% in fiscal year 2014 up from 3.5% in the fiscal year 2013 and the growth is associated with increased agricultural harvest, recovery in construction and high remittance income (ADB, 2014).

5.3. ARDL cointegration test, long-run and short-run estimates

The results of bounds tests are presented in Table 6 and critical values of bounds tests are presented in Table 7. The optimal lags for model selection were taken using Schwarz Criterion which requires that lag length be chosen on the basis of smallest critical value. Control variable trade openness is excluded in the fourth model to avoid the chances of multicollinearity as there

Table 5. Unit root tests

Variable	ADF (level)		ADF (first difference)		LM (with 2-breaks)			
	Intercept	Intercept & trend	Intercept	Intercept & trend	α [k]	t-statistic	T _{B1}	T _{B2}
lnRGDP	-0.531	-3.107	-7.642***	-7.479***	-1.539 [1]	-6.158	2002	2014
lnCPS	0.260	-2.156	-4.901***	-4.918***	-1.048 [4]	-5.389	1993	2004
lnM2	0.245	-2.893	-6.485***	-6.443***	-1.048 [1]	-5.175	1997	2012
lnTFD	0.289	-2.745	-6.520***	-6.497***	-0.899 [1]	-4.741	1991	2003
lnFIA	0.261	-1.3836	-5.388***	-5.424***	-1.698 [8]	-8.890**	1998	2009
lnOPEN	-1.711	-1.722	-6.245***	-5.114***	-0.803 [1]	-4.516	1990	1999
lnINF	-3.263	-3.573**	-7.836***	-7.721***	-1.276 [1]	-5.485	1999	2009

Source: Author's calculations; α : unit root coefficient; k: lags selected; T_{B1}: Break date 1; T_{B2}: Break date 2.

*** and ** indicate statistical significance at 1% and 5% levels, respectively. Critical values for LM test at 1 & 5%: -6.932 & -6.175, respectively.

Table 6. Bounds tests

Function	Model	F-statistic	Outcome
$F_{\ln \text{RGDP} \ln \text{CPS}, \ln \text{INF}, \ln \text{OPEN}}$	(1,0,0,1)	44.20	Cointegrated
$F_{\ln \text{RGDP} \ln \text{M2}, \ln \text{INF}, \ln \text{OPEN}}$	(1,1,0,1)	36.32	Cointegrated
$F_{\ln \text{RGDP} \ln \text{TFD}, \ln \text{INF}, \ln \text{OPEN}}$	(1,1,0,1)	34.33	Cointegrated
$F_{\ln \text{RGDP} \ln \text{FIA}, \ln \text{INF}}$	(1,0,0)	46.75	Cointegrated

Source: Author's calculation.

Table 7. Critical values of ARDL bounds test

Level of significance (%)	k = 3		k = 2	
	Lower bound	Upper bound	Lower bound	Upper bound
10	2.618	3.532	2.845	3.623
5	3.164	4.194	3.478	4.335
1	4.428	5.816	4.948	6.028

Source: Case II, Narayan (2005, p. 1987), finite sample n = 35.

exist high correlation between financial institutions' asset and trade openness. The upper bounds and lower bound values are obtained from Table Case II: Restricted intercept and no trend (Narayan, 2005). Wald F-statistics calculated for all the models are above the upper bound critical value at 1% level of significance. Thus, we fail to accept the null hypothesis of no cointegration and conclude that there is cointegration or long-run relationship between real RGDP and other regressors based on ARDL cointegration. The existence of cointegration will be further confirmed by the coefficient of error correction term in restricted error correction model estimation.

Table 8 presents the results of our estimation of long-run impacts of financial depth indicators on economic growth in Nepal, derived by employing long-run OLS estimation of ARDL equation (2). Each of the four variables of interest is treated as the independent variable in each of the models estimated whose dependent variable is real GDP. In all the models, the proxy measures for financial depth have positive and statistically significant coefficients providing the evidence for long-run and statistically significant positive relationship of CPS, M2 and TFD with RGDP. The elasticity 0.77 of CPS suggests that one percentage point rise in the domestic credit to private sector as a ratio of GDP causes the real GDP to increase by 0.77%. The positive contribution of CPS on economic growth in the long-run is consistent with different empirical findings (Adu et al., 2013; Biplop & Halder, 2018; Khan et al., 2020; Puatwoe & Piabuo, 2017; Tursoy & Faisal, 2018). In the Nepalese context, the results follow the findings of Timsina (2014), Bist and Bista (2018), and Paudel and Acharya (2020) but contradicts with the findings of Dhungana (2019). The second model shows that one percentage point increase in broad money supply as a ratio of GDP causes the real GDP to rise by 1.22%. Money supply causing economic growth in the long-run is supported by the findings in the empirical studies (Alsamara et al., 2019; Guru & Yadav, 2019; Khan et al., 2020; Puatwoe & Piabuo, 2017) and in contrast to the findings of Adu et al. (2013). The result supports the outcome of Paudel and Acharya (2020) in Nepal. Similarly, one percentage point rise in total financial deposits cause the GDP to increase by almost 1%. The long-run positive influence of financial deposits is consistent with the findings of Puatwoe and Piabuo (2017) and Tursoy and Faisal (2018) and in Nepal to the findings of Dhungana (2019). Although the coefficient is positive banks' asset did not show significant influence on economic growth in Nepal which is found to be significant in cross countries studies (Masoud & Hardaker, 2012; Sajid & Cooray, 2012). In regard to the control variables considered to accommodate the macroeconomic influence, inflation is observed to relate negatively with economic growth in all the models except in model with financial institutions

Table 8. ARDL long-run results of the selected models									
Variables	Models								
	lnRGDP			lnRGDP			lnRGDP		
	Coeff.	t-stat.		Coeff.	t-stat.		Coeff.	t-stat.	
lnCPS	0.770***	8.617							
lnM2			1.215***		11.651				
lnTFD						0.995***		13.682	
lnFIA							1.968		1.591
lnINF	-0.134	-1.122	-0.028		-0.349	-0.014		-0.217	0.739
lnOPEN	-0.424	-1.259	0.060		0.282	0.113		0.642	
C	13.587***	10.224	9.474***		11.620	10.301***		15.348	0.158

Source: Author's calculation.

*, ** and *** indicate significance at 10%, 5% and 1% levels, respectively.

Table 9. Short-run results and error correction form

Variables	Models									
	$\Delta \ln \text{RGDP}$			$\Delta \ln \text{RGDP}$			$\Delta \ln \text{RGDP}$			$\Delta \ln \text{RGDP}$
	Coeff.	t-stat.		Coeff.	t-stat.		Coeff.	t-stat.	Coeff.	t-stat.
$\Delta \ln \text{CPS}$	0.061*	1.959								
$\Delta \ln \text{M2}$			-1.229							
$\Delta \ln \text{TFD}$				-0.070			-0.048	-0.962		
$\Delta \ln \text{FIA}$										
$\Delta \ln \text{INF}$	-0.010	-1.507		-0.003	-0.387		-0.001	-0.229	-0.030	-1.020
$\Delta \ln \text{OPEN}$	0.121***	3.041		0.125***	3.612		0.132***	3.812	-0.012	-1.393
$\text{ECT}(-1)$	-0.080***	-15.742		-0.105***	-14.294		-0.123***	-13.898	0.015***	14.245

Source: Author's calculation.

*, ** and *** indicate significance at 10%, 5% and 1% levels, respectively.

Table 10. Robustness tests

Functions	Estimates	Diagnostic tests			
		χ^2_{NOR}	χ^2_{SC}	χ^2_{HET}	F_{RESET}
$F_{\text{InRGDP} \text{InRGDP} \text{InCPS} \text{InINF} \text{InOPEN}}$	Test statistic	0.867	4.401	3.815	1.633
	p-value	0.648	0.111	0.576	0.21
$F_{\text{InRGDP} \text{InRGDP} \text{InM2} \text{InINF} \text{InOPEN}}$	Test statistic	1.788	1.563	9.185	1.914
	p-value	0.408	0.211	0.163	0.176
$F_{\text{InRGDP} \text{InRGDP} \text{InTFD} \text{InINF} \text{InOPEN}}$	Test statistic	1.791	1.443	9.543	1.249
	p-value	0.408	0.229	0.145	0.272
$F_{\text{InRGDP} \text{InRGDP} \text{InFIA} \text{InINF}}$	Test statistic	0.297	1.265	1.165	2.841
	p-value	0.861	0.261	0.648	0.101

Source: Author's calculation.

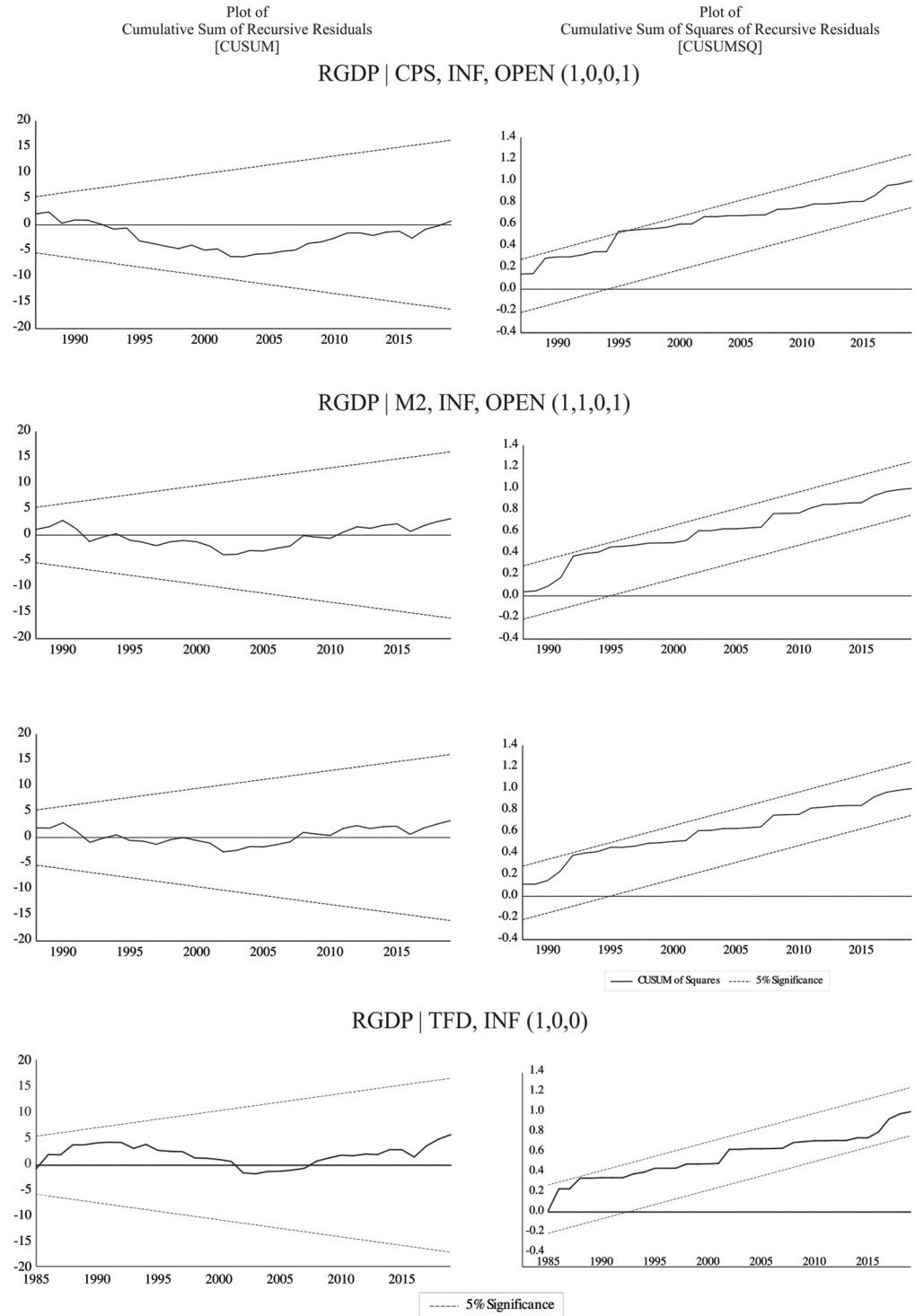
Note. NOR, Jarque Bera test of normality; SC, Lagrange Multiplier test for serial correlation; HET, Breush-Pagan-Godfrey test for heteroscedasticity; RESET, Ramsey RESET test for model specification.

assets where the relationship is positive but insignificant. Thus, inflation may not be able to predict long-run economic growth in Nepal. The negative relationship of inflation is consistent with the findings of Tursoy and Faisal (2018) and Adu et al. (2013). Likewise, trade openness is observed being positively related in two models with M2 and TFD as predictors. However, with CPS as independent variable, trade openness reveal negative relationship although not significant. The positive (negative) relationship of trade openness with economic growth in the long-run contrasts (supports) to the findings of Adu et al. (2013).

The short-run elasticities presented in Table 9 however reveal contrasting results as compared to long-run outcomes except for credit to domestic sector. The credit to private sector is observed to significantly contribute to the economic growth in Nepal in the short-run at 10% level and the outcome is consistent to the findings of Bist and Bista (2018) for Nepal but in contrast to the findings of Puatwoe and Piabuo (2017). The money supply is not observed to significantly cause the economic growth rather the relationship is negative as evidenced by Paudel et al., (2018) and Paudel and Acharya (2020) but in contrast to the findings of Puatwoe and Piabuo (2017) but in consistent to the findings of Chaitip et al. (2015) for few Asian countries. The total financial deposits is also observed to negatively impact the growth in the short-run as opposed to the findings of Puatwoe and Piabuo (2017). Financial institutions assets proxied by bank assets to GDP shows insignificant non-linear negative elasticity in the short-run. The inflation in the short-run too portrays insignificant negative relationship with growth in three models whereas negative but significant in the model with financial institutions assets. However, trade openness is observed to significantly and positively contribute to the growth in the short-run in all the models. The results in Tables 8 and 9 confirm the supply-leading hypothesis or finance-led growth in the long-run if broad money supply and financial deposits are taken as proxies for financial depth. The credit to private sector in the other hand confirms the finance-led growth in both the short-run and the long-run.

Table 9 also presents the coefficient of lagged ECT terms of all the models. In the model with CPS, the coefficient of $\text{ECT}(-1)$ is -0.08 and is statistically significant even at 1% level. This outcome reveals that the real GDP converges to equilibrium in the long-run with 8% speed of adjustment via the channel of domestic credit to private sector. Alternatively, in case of disequilibrium in the short-run, 8% of the departure in the previous period is corrected within the current year. The negative and significant coefficient also confirms the cointegration and shows that CPS Granger causes RGDP in the long-run. The system converge to equilibrium in the long-run for all the models except for model with financial institutions assets. The positive coefficient of $\text{ECT}(-1)$ in model with financial institutions assets confirms the nonexistence of cointegration between RGDP and FIA and thus only the short-run coefficients can be considered for further implication in regard to FIA as financial depth indicator.

Figure 1. Stability test of ARDL models.



5.4. Diagnostic and stability tests

The results of model fits and stability checks to confirm the validity of the research findings are summarized in Table 10 and Figure 1. Diagnostics of all four models show that residuals are normally distributed as evidenced by Jarque-Bera test. The Lagrange Multiplier serial correlation

test confirms that there is no serial correlation and Breusch-Pagan-Godfrey heteroscedasticity test confirms homoscedastic residuals in all the models. The results of Ramsey RESET test shows that all the models are correctly specified as evidenced by F-statistics.

Cumulative sum of recursive residuals (CUSUM) and cumulative sum of square of recursive residuals (CUSUMSQ) tests are used to test the parameter stability in the models. CUSUM test recognizes systematic changes in the regression coefficients, while the CUSUMSQ test identifies sudden constancy changes in the regression coefficients. Figure 1 show that all the plots of both CUSUM and CUSUMSQ for each model lie within the critical bound of 5% confidence interval. The results indicate absence of instability of the regression coefficients and confirm that all the four models are stable. The overall results show that the models under study are fit and stable.

6. Conclusion and recommendation

This study examined long-run and short-run growth effects of financial institutions depth using different indicators and the sensitivity to the choice of proxy representing financial depth. The cointegration is tested using ARDL bounds testing approach on the series examined for unit roots in the presence of two structural breaks. Financial institutions depth is measured by four different indicators such as credit to private sector, broad money supply, financial deposits and financial institutions assets all relative to GDP. Moreover, the macroeconomic environment is assumed by including inflation and trade openness in regression models.

The ARDL long-run estimates and error correction model for short-run dynamics reveal significant long-run and short-run influence of credit to private sector on economic growth. This indicate that the efficient allocation of domestic credit to profitable projects via private sector has a prospect of bettering economic activities and consequently the economic growth in both long-run and short-run. The positive significant long-run and negative insignificant short-run coefficient of money supply indicate that using financial institutions to increase money supply will lower the price of borrowing and increase consumption leading to economic growth in the long-run in Nepal but may adversely contribute to growth in the short-run possibly because of high inflation. The increase in financial system deposits indicate the rising possibility of extending long-term loan amounts which will be utilized in the productive sectors and may contribute toward the economic development in the long-run. However in the short-run, the bank deposits are observed to have inverse relationship with growth possibly because bank deposits are dominated with short-term deposits that may indicate over liquidity in the financial system and deposits cannot be used efficiently in productive sectors. The financial institutions assets however show no significant impact on the economic growth both in the short-run and the long-run. This justifies with overall estimations of the three indicators that financial depth as a whole contributes to economic growth in the long-run than in the short-run. However, considering the individual indicator of financial depth, credit to private sector is observed to contribute to the economic growth in both short and long-run. Financial institutions asset is not a significant influencer of economic growth in Nepal. In regard to macroeconomic environment, trade openness seems to contribute more to the economic development in the short-run. Inflation, on the other hand, shows opposite relationship with the economic growth. The overall result also supports finance-led growth or supply-leading hypothesis in the long-run in case of Nepal.

Following the key findings of the study, it is recommended that policy makers choose appropriate financial depth indicator as policy instrument. As evidenced by the results, domestic credit to private sector seems to be more appropriate considering short-run and long-run application. Thus, in context of low income economy like Nepal, policies giving access to credit to private sector including small and medium enterprises, would enhance productivity of agriculture, manufacturing and industry to generate employment, increase household income, increase consumption and thus economic growth as a whole. The result also indicate that expansionary monetary and fiscal policy causing excess money supply contribute to the growth in the long-run but could be inimical to economic growth in the short-run although the coefficient is not significant. The policy makers

and regulators should bring policies to increase long-term deposits in financial institutions as they can be used for long term investments causing enhanced output and growth. Policies to resize the assets of financial institutions should be made appropriately as the result suggests no significant impact of assets on growth although the direction of relationships alter in short-run and the long-run. Finally, macroeconomic environment should be controlled by taming inflation and formulating policies to expand international trade by specifically increasing exports and reducing imports.

The current study used four out of five indicators of financial depth outlined by the World Bank to examine their impact as well as their competency as depth proxy. Future researchers can do for other dimensions of financial development such as access, efficiency and stability. Future studies can also incorporate other control variables such as interest rate, savings and investments to account for the macroeconomic environment. Remittance being one of the major contributors in the financial system of Nepal, it can also be included in the finance-growth relationship to examine how it affects the model. The causal relationships of finance-growth nexus can also be examined in the future research.

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