Financial intermediaries as a growth catalyst: A time-series analysis of Nepal using the Cobb–Douglas function framework

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ABSTRACT

This study examines the impact of financial development (FDS) on economic growth (ECOG) in Nepal, utilizing the Cobb-Douglas production function (CDPF). This study examines the key factors, including domestic credit (DCR), capital formation (CFR), exports, and population growth (POP), to assess their long- and short-term impacts on ECOG. This study utilizes secondary data for the period from 1992 to 2023. It employs the Autoregressive Distributed Lag (ARDL) bounds testing approach to investigate long-term relationships and short-term dynamics among the aforementioned study variables. The results show that DCR—a proxy of FDS—has a favorable effect on GDP in the long run, suggesting that DCR impacts ECOG. However, DCR does not impact ECOG in the short run. The results showed that CFR and exports have an influence on ECOG in both the short and long term. In contrast, the results showed that POP does not affect ECOG in either the short or long term. Annually, approximately 41 percent of deviations from long-term equilibrium are corrected. Results indicate that FDS, CFR, and exports are crucial for Nepalese ECOG. Policymakers should develop policies that increase capital investment, encourage export growth, and alleviate barriers to FDS, thereby fostering sustainable ECOG in Nepal.

Keywords: Cobb-Douglas Production Function, Economic Growth, Financial Development, Nepal
JEL: O_{16}, O_{47}, C_{67}, E_{44}

I. INTRODUCTION

Economic growth (ECOG) is an indicator of a country's economic prosperity, encompassing both its economic and social development (Dahmani et al., 2022). The high level of ECOG can enhance the standard of living for people by increasing incomes and reducing poverty, which in turn leads to improved healthcare, education, and overall quality of life. Additionally, ECOG stimulates government tax revenue, which can be utilized to build new infrastructure, innovation, and technology. It also brings political and social stability to any nation. Previous theoretical and empirical studies have examined the various factors that influence the ECOG of any economy. However, there are no such common factors that affect ECOG. However, financial development (FDS) can play a significant role in fostering ECOG in developing countries like Nepal.

Financial development (FDS)—encompassing financial markets and institutions—plays a crucial role in channeling needed funds from surplus units to deficit units, offering easy access to credit that can increase output and foster economic growth (Puscasu, 2022; Tripathy & Mishra, 2023). Additionally, it brings competition and reduces information, transaction, and overall funding costs, which creates an investment environment for infrastructure, innovation, and new technology, which can help boost output, thus leading to an increase in ECOG.

The ability of credit markets to allocate financial resources to profitable investments reflects their importance. Individuals, businesses, and governments utilize credit for consumption and investment, thereby facilitating production, consumption, and capital development (Asteriou & Spanos, 2019). Credit markets enable a steady flow of financial resources, therefore supporting economic activity and fostering growth. Nepal, as a developing country, exemplifies the

critical connection between FDS and ECOG (Gajurel, 2023). Furthermore, FDS reduce growth volatility (Mushtaq et al., 2025).

The Nepalese financial system, historically regulated by banking institutions, has undergone significant transformations since the mid-20th century. The foundation of the Nepalese banking sector was established after the operation of Nepal Bank Limited in 1937 and Nepal Rastra Bank in 1956. Notably, the growth of Nepalese banking and non-banking institutions began after the government implemented a deregulation policy in the 1990s (Pandey, 2022). Despite these developments, the Nepalese financial sector remains primarily bank-dominated, with limited contributions from its capital market. The Merger and Acquisition Acts of 2011 and 2016 were adopted to enhance efficiency and resilience in the banking sector by improving capital adequacy and operational sustainability.

The influence of FDS on ECOG is still unclear. For example, Sehrawat and Giri (2016) and Coulibaly (2018) found that FDS favorably impact ECOG. Similarly, Ahmed et al. (2022) and Aziz et al. (2023) found that FDS favorably affect green growth in the long run. However, a more recent study of Gizaw et al. (2024) found that FDS have a favorable but insignificant influence on the growth of emerging Asian and African nations. Hussain et al. (2024), on the other hand, found that financial inclusion has a favorable impact on growth in Asian countries. It is noteworthy that the impact of financial inclusion on growth is more pronounced in developing countries than in developed countries. Similarly, Rasoulinezhad and Mostaghimi (2024) examined the impact of FDS and growth using a sample of Asian countries for the period 1993-2021. Using ARDL and PMG estimators, the outcome demonstrated that FDS positively affect growth.

The conflicting result could be the proxies used to measure of FDS. The previous study of Murari (2017) used two alternative measures of FDS—(1) DCR provided by the banks and, (2) DCR to the private sectors—to examine the influence on growth and results showed that first proxy has shown bidirectional nexus between FDS and growth, which supported supply-leading and demand-following hypotheses and second measure of proxy has shown a unidirectional effect running from FDS to growth, which supported supply-leading hypothesis. In addition, the study of Tripathy and Misra (2023) also supported the supply-leading hypothesis and confirmed that FDS favorably affect growth in India. Furthermore, using the VECM estimator, Mustafa (2023) found that growth affects FDS in India and Pakistan. However, in Bangladesh and Sri Lanka, growth did not affect FDS. It indicates that the impact of FDS on growth and the growth of FDS depend upon the economic conditions and other relevant factors. Similarly, the impact of FDS on growth depends upon the economic condition of the nation. For instance, Wang et al. (2024) concluded that FDS have a negligible impact on growth in underdeveloped nations, while it turned into positive in moderately and highly developed economies. This suggests that countries with better economic status and FDS tend to foster prosperity by bringing economic stability and protecting against economic shocks. Hence, this inconclusive empirical finding forces us to conduct another study, and the CDPF can be a robust model for examining the relationship between FDS and ECOG in Nepal. This study explores the complex driving forces of ECOG, such as FDS, DCR, CFR, population, and exports, which can fill the research void in the Nepalese context.

The remaining parts of the study outline are as follows. Section two reviews the earlier studies. Section three mentions the methodology applied in this study. Section four presents the results, and Section five explains the discussion. Finally, section six presents the conclusion.

1.1 Research Objectives

This study's main objective is to evaluate the effects that financial development (FD) has on economic growth (EG) in Nepal. The reference framework will be based on a Cobb-Douglas Production Function (CDPF). Therefore, the purpose of this research will be to investigate the relationship between domestically generated credit (DCR), capital formation (CFR), export growth (EXP), and population growth (POP), and their effect on EG, including both short-term and long-term effects on the Nepali economy.

II. LITERATURE REVIEW

2.1 Theoretical Review

The Cobb–Douglas production function (CDPF) was developed by Charles Cobb and Paul Douglas in 1928. It provides a functional link between factors of production (capital and labor) and the production of output, which has made it one of the most popular models used for empirical analyses of economic growth (Cobb & Douglas, 1928). Underlining the assumption that total production results from the combined input of factor resources makes this theoretical model suitable for identifying the factors that contribute to overall economic growth. Therefore, this paper will be utilizing the CDPF as the theoretical basis by which to model economic growth (ECOG) in Nepal using gross capital formation (CFR) as the measure of physical capital and population (POP) as the measure for the input of labor resources.

There is also empirical support for the ability of the CDPF framework to provide robust and adaptable results. The CDPF was examined again by Smirnov and Wang using a bi-Hiltonian method, who also verified that when using

the same data set, the results from the CDPF were identical and globally replicable (Smirnov & Wang, 2021). This provides further evidence of the reliability of the production function method used in this research. Similarly, Roubalová and Viskotová looked at whether the linear or nonlinear specification would best explain economic growth for six European countries between 1995 and 2015. Their analysis suggested that nonlinear regression models produced better results than linear ones (Roubalová & Viskotová, 2019).

Colther and Doussoulin also note that the extended CDPF has seen increased use in both sustainability and environmental economics around the world, particularly in countries like China and the US (Colther & Doussoulin, 2025). The studies conducted show how the CDPF can easily accommodate other macroeconomic and structural factors in addition to traditional input variables. As a part of this continued evolution, this study extends the original CDPF with the addition of domestic credit (DCR) and exports as other growth-enhancing factors to measure their effects on Nepal's economy. This extension will allow for an improved assessment of both the short- and long-term effects of financial deepening and trade dynamics on economic growth in the country.

2.2 Empirical Review

2.2.1 Financial Development (FDS) and Economic Growth

Guru and Yadav (2019) examined the finance-growth nexus using a sample of BRICS countries covering the period from 1993 to 2014. Deploying the GMM estimator, the findings showed that financial development has a favorable impact on ECOG in BRICS nations. Similarly, the development of the stock market also fosters ECOG in BRICS nations. However, Odhiambo and Nyasha (2020) investigated the FDS-growth nexus in Uganda for the period 1980-2015. Using the ARDL estimator, the findings showed that the link between FDS and ECOG is unclear, and they stated that it depends on the proxies used to measure FDS. For instance, liquid liabilities and bank deposits scaled by GDP serve as measures of FDS support, which supports the supply-leading hypothesis. Additionally, the ratio of "deposit money bank assets to bank assets" is another proxy for FDS, but it shows a bidirectional relationship.

In contrast, other proxies of FDS, "money supply to GDP and private credit by deposit money banks to GDP," did not impact ECOG and supported the neutrality hypothesis. Rustamov and Adaoglu (2018) investigated the FDS-ECOG nexus in Russia using a sample period 1992-2016. Deploying the Toda Yamamoto and FMOLS estimators, the empirical results demonstrated that FDS affects ECOG and support the supply-leading hypothesis. Furthermore, FMOLS results also confirmed that FDS has a favorable effect on ECOG in Russia. Rahmije and Xhelili Krasniqi (2025) investigated the remittance, FD, and growth nexus using the sample of Western Balkan countries for the period 2002-2022. Utilizing OLS, fixed-effects, and 2SLS, this study's findings indicate an unclear influence of FDS, as measured by money supply and NIM, on growth in Balkan nations. They further added that remittance can reduce the role of FDS on growth in Balkan countries.

Contrary to this finding, Aziz et al. (2022) employed ARDL and PMG estimators and found that FDS has a favorable impact on growth in Asian countries for the period 2001-2017. Similarly, recently, Gizaw et al. (2024) examined the FDS-growth nexus using a sample of 22 Asian and African countries for the period 1981-2021. Utilizing the Dynamic Common Correlation Effect (DCCE) estimator, the results demonstrated that FDS has a positive but insignificant impact on growth.

H1: *Financial development (FDS) has a positively and significantly impacts on real GDP in Nepal.*

2.2.2 Trade and Economic Growth

Trade, primarily through exports, increases market share by selling goods and services in international markets. Additionally, exports give foreign currency, which is required to purchase basic resources from global markets. Furthermore, exports reduce production costs and capitalize on the benefits of economies of scale (Arvin et al., 2021). Navarro et al. (2024) investigated fuel-trade-growth in Peru for the period 1965-2022. Utilizing the ARDL estimator, the findings revealed a bidirectional causal relationship between trade and ECOG. This finding indicates that international trade extends markets for goods and services, which increases efficiency through specialization, thus stimulating ECOG. Sutbayeva et al. (2024) analyzed the trade-growth nexus in Kazakhstan for the period 2990-2022. Utilizing ARDL and VECM estimators, trade favors affect ECOG in the short- and long-run. This study also revealed that ECOG has an impact on trade in Kazakhstan. Abendin and Duan (2021) analyzed the trade-growth nexus using POLS, fixed-effects, and random-effects, as well as GMM estimators, for the period 2000-2018. The study's outcome revealed that trade has a favorable effect on ECOG in Africa. Roquez-Díaz and Escot (2018) explored the trade-growth nexus in Latin America, covering the period 1990-2013. This study employed Granger causality tests and found that trade has a unidirectional effect on ECOG in certain economies, including Chile, Peru, Nicaragua, and Uruguay. However, in some economies, such as Mexico and Honduras, trade and economic growth have a bidirectional relationship.

Furthermore, the results showed that ECOG has an impact on trade in Colombia and support the growth-led trade hypothesis. Dahmani et al. (2022) explored the trade-growth nexus using the sample period 1995-2018 and utilized the CS-ARDL estimator, finding that trade has a favorable impact on ECOG. Hence, this study put forward the second hypothesis as:

H2: *Trade has a favorable contribution to real GDP growth, with a positive relationship observed in both the short and long run.*

2.2.3 Capital formation and economic growth

Ghosh (2019) examined the impact of FDI, education, and capital formation on economic growth in Japan and South Korea, utilizing a sample period of 1971-2014. Deploying the ARDL bounds test estimator, this study concluded that capital formation stimulates economic prosperity in both the short term and the long term. It is suggested that a higher level of investment in physical and human capital increases output in the real economy. Similarly, deploying the ARDL bound test estimator, Wani (2022) further examined the capital formation-growth nexus in India for the period 1993-2019. The outcomes showed that capital formation, especially physical capital, boosts economic prosperity in India. Dahal et al. (2024) further checked the impact of capital formation on economic growth in Nepal for the period 1988/89-2021/22. Deploying a robust OLS estimator, the analysis confirmed that capital formation has a favorable impact on economic growth in Nepal. Dahmani et al. (2022) explored the trade-growth nexus using the sample period 1995-2018 and utilized the CS-ARDL estimator, finding that capital formation has a favorable impact on ECOG. Hence, this study put forward the third hypothesis as:

H3: *CFRR has a significant positive impact on real GDP in Nepal in both the short run and long run.*

2.2.4 Population growth and economic growth

Huang and Xie (2013) examined the population-growth nexus using the sample of 90 countries for the period 1980-2007. Deploying the SEM estimator, the results indicated that population growth hurts economic growth in middle-income countries. However, it was not significant in high-income and lower-middle-income countries. This finding rejected the conventional idea that a larger labor force boosts economic growth and supported the arguments that economic growth can be achieved through the use of more advanced technologies and an educated, skilled workforce (Strulik, 2024). Similarly, Yao et al. (2013) examined the population-growth nexus using time-series data in China. The study results indicated that the population's impact on GDP per capita was negative. However, other factors, such as the saving rate, advancements in technology, and industrialization, favorably affect economic prosperity in China.

Ayanaw Alemu and Belay Zegeye (2024) examined the bidirectional relationship between population growth and economic growth in Ethiopia for the period 1991-2022. Deploying the VCEM estimator, the findings showed that population growth has a favorable effect on GDP per capita in the short run, but becomes negative in the long run. Thanh Trong et al. (2024) further explored the nexus between population aging and growth in seven Asian countries for the period 2001-2021. By deploying the fixed-effects estimator, the results indicate that an aging population hurts economic growth in Asian countries. It suggests that the savings of young employees are allocated to the unproductive sector, reducing investment and ultimately leading to decreased economic prosperity. Rehman (2019) also examined the relationship between electricity access, population growth, and economic growth in Pakistan from 1990 to 2016. Deploying the ARDL bound test estimator, the results showed that urban population growth has a favorable impact on economic growth in Pakistan. However, the growth of the rural population has hindered economic growth in Pakistan. Mamun et al. (2020) examined the relationship between aging population growth and a sample of South Asian nations for the period 1972-2015. Deploying the ADRL estimator, an aging population has a significant, favorable effect on GDP per capita in the long run in Bangladesh. Hence, this study put forward the final hypothesis as:

H4: *Population growth has a significant positive/or negative long-run impact on real GDP.*

III. METHODOLOGY

This research uses the CDPF, established by Cobb and Douglas in 1928, which associates total production with labour and capital inputs (Cobb & Douglas, 1928).

$$Q = AK^{\propto}L^{\beta} \quad \text{..... (1)}$$

In this context, Q denotes total production; A signifies a constant; K represents capital; L indicates labour input; α reflects the elasticity of output concerning capital; and β illustrates the elasticity of output concerning labour, with α + β representing the returns to scale. The entire production function is represented as follows:

$$Y_t = A_t CFR_t^{\propto} POP_t^{\beta} \quad \text{..... (2)}$$

Yt signifies real GDP, while At indicates total factor productivity, which includes technological progress resulting from liberalization and financial development. CFR denotes capital formation, while $POPt$ represents labor during time period t. Furthermore, α and β denote the coefficients of the factor inputs—capital and labor.

By incorporating both domestic credit (DCR) and exports (EXP) into total factor productivity, the study create the following enhanced model:

$$A_t = f(DCR_t^{\mu}, EXP_t^{\partial}) \quad \ldots\ldots (3)$$

Combining the two equations yields the final model:

$$Y_t = f(DCR_t^{\mu}, EXP_t^{\partial}, CFRR_t^{\alpha}, POP_t^{\beta}) \quad \ldots\ldots (4)$$

Taking the natural logarithm of the variables to linearize the model:

$$ln\, Y_t = c + \mu\, ln\, DCR_t + \partial ln\, EXP_t + \alpha ln\, CFR_t + \beta ln\, POP_t + \epsilon_t \quad \ldots\ldots (5)$$

In this case, c represents a constant, and ϵ signifies the error term.

The research employs a descriptive and analytical methodology to examine the relationship between FDS and ECOG in Nepal. Y (real GDP) is the dependent variable, whereas capital formation (CFRR), population (POP), domestic credit (DCR), and exports (EXP) operate as explanatory variables. This study sourced secondary data from official websites such as Nepal Rastra Bank, Central Bureau of Statistics, and the World Bank covering the period from 1992 to 2023.

The study employs the Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests to assess the stationarity of variables. The study utilizes the ARDL bounds testing methodology (Pesaran et al., 2001) to examine long-term relationships, accommodating mixed-order integrations I (0) and I (1).

The ARDL model determines short- and long-term coefficients using the Schwarz Bayesian Criterion (SBC). The study employs the ECM to capture short-term dynamics and the adjustment rate toward equilibrium after establishing cointegration.

$$ln\, Y_t = c + \alpha ln\, CFR_t + \beta ln\, POP_t + \mu ln\, DCR_t + \partial ln\, EXP_t + \epsilon_t \quad \ldots\ldots (6)$$

The ARDL model captures relationships as follows:

$$\Delta \ln Y_t = \alpha_0 + \sum_{i=1}^{p} \lambda_i \Delta \ln Y_{t-i} + \sum_{i=0}^{q1} \alpha_i \Delta \ln CFR_{t-i} + \sum_{i=0}^{q2} \beta_i \Delta \ln POP_{t-i} + \sum_{i=0}^{q3} \mu_i \Delta DCR_{t-i} + \sum_{i=0}^{q4} \partial_i \Delta EXP_{t-i} + \gamma_1 \ln Y_{t-1} + \gamma_2 \ln CFR_{t-1} + \gamma_3 \ln POP_{t-1} + \gamma_4 DCR_{t-1} + \gamma_5 EXP_{t-1} + \nu_t \quad \ldots\ldots (7)$$

To determine short-term dynamics:

$$\Delta \ln Y_t = \alpha_0 + \sum_{i=1}^{p} \lambda_i \Delta \ln Y_{t-i} + \sum_{i=0}^{q1} \alpha_i \Delta \ln CFR_{t-i} + \sum_{i=0}^{q2} \beta_i \Delta \ln POP_{t-i} + \sum_{i=0}^{q3} \mu_i \Delta DCR_{t-i} + \sum_{i=0}^{q4} \partial_i \Delta EXP_{t-i} + \delta ECT_{t-1} + \nu_t \quad \ldots\ldots (8)$$

Where ECT_{t-1} indicates the speed of adjustment to long-run equilibrium.

Stability Check

This describes the tests that were done as part of the study. These include unit root tests for ARDL model estimation, lag selection using VAR criteria, limit tests for co-integration to look at long-term relationships, and tests of model stability and robustness. The study employs unit root tests to assess the stationarity of time series data. The ADF test evaluates unit roots, with the null hypothesis indicating non-stationarity, while the PP test, similar to ADF, accounts for autocorrelation and heteroskedasticity. The KPSS test asserts stationarity under the null hypothesis, making it the opposite of the ADF and PP tests. The study utilizes lag length criteria, including AIC, SC, and HQ, to determine the optimal lag, with lower values indicating better models. The bounds test for cointegration assesses long-term relationships by comparing the F-statistic to critical bounds (Engle & Granger, 1987; Granger, 1981). The following tests were performed to validate our empirical results.

A. Unit Root Tests

Augmented Dickey-Fuller (ADF) Test

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \sum_{i=1}^{p} \delta_i \Delta y_{t-i} + \epsilon_t$$

Where, y_t: Any variable among Y, CFR, POP, DCR, and EXP; Null Hypothesis (H0): γ=0 (Non-stationary); Alternative Hypothesis (H1): γ <0 (Stationary).

Phillips-Perron (PP Test: Similar to the ADF test but accounts for autocorrelation and heteroskedasticity in the error term.

$$\Delta Z_t = \mu + \lambda_t + \theta Z_{t-1} + \nu_t$$

Similar to the ADF test but accounts for autocorrelation and heteroskedasticity. Null Hypothesis (H0): θ=0 (non-stationary) and Alternative Hypothesis (H1): $\theta \neq 0$ (Stationary).

KPSS (Kwiatkowski-Phillips-Schmidt-Shin) Test:
$y_t = \mu_t + \epsilon_t,\ \mu_t = \mu_{t-1} + \eta_t$
Null Hypothesis (H0): The series is stationary and Alternative Hypothesis (H1): The series is non-stationary.

B. Lag Length Criteria for VAR Model

Using Yt, CFRt, POPt, DCRt, and EXPt in a VAR framework. AIC, SC, HQ: These criteria are used to select the optimal lag length for the VAR model. The equations for these criteria are:
Akaike Information Criterion (AIC)

$$AIC = \ln(L^2) + \frac{2k}{n}$$

Schwarz Criterion (SC)

$$SC = \ln(L^2) + \frac{k\ln(n)}{n}$$

Hannan-Quinn Criterion (HQ)

$$HQ = \ln(L^2) + \frac{2k\ln(\ln(n))}{n}$$

Where: L: Log-likelihood of the VAR model; k: Number of parameters estimated; n: Sample size and the optimal lag length p minimizes AIC, SC, or HQ.

C. Diagnostic Tests

Serial Correlation: $\epsilon_t = \rho\epsilon_{t-1} + u_t$
Normality: One common test for normality is the Jarque-Bera test. The equation for the Jarque-Bera statistic is:

$$JB = \frac{n}{6}(S^2 + \frac{(K-3)^2}{4})$$

Where, (n) is the sample size, (S) is the skewness of the sample, (K) is the kurtosis of the sample.
Heteroskedasticity Test: A common test for heteroskedasticity is the Breusch-Pagan test. The equation for the Breusch-Pagan test is:

$$BP = \frac{nR^2}{2}$$

Where, (R^2) is the coefficient of determination from the auxiliary regression, and (n) is the sample size.

IV. FINDINGS & DISCUSSION

4.1 Findings

Table 1 presents the descriptive data for five macroeconomic variables: GDP, CFR, POP, DCR, and EXP. Each statistic provides insights into the central tendency, variability, and distribution of these variables. The GDP averages Rs. 88,310.2 million, indicating substantial variability, with a standard deviation of 51,500.22, indicating significant fluctuations. The distribution exhibits a slight positive skew (0.51) and a kurtosis that is lower than usual (1.99). Similarly, CFR exhibits significant variation (standard deviation of 273,724.5), with a heavy right tail (kurtosis of 5.87) and a pronounced right skew (skewness of 2.24), indicating the presence of substantial outliers. In contrast, POP exhibits enhanced stability, with a mean of 21.03 and negligible skewness (0.00), signifying a symmetric distribution. DCR and EXP demonstrate less variability, characterized by nearly normal distributions with low skewness and kurtosis values. Their Jarque-Bera statistics indicate minimal deviation from normality, but GDP and CFR demonstrate increased volatility and non-normal distributions.

There is significant variation and deviation from normality in the variables GDP and CFR. It is evident from the strong positive skewness and high kurtosis, indicating the presence of outliers. Instead, POP, DCR, and EXP are more stable and have distributions that are very close to normal, as indicated by their lower skewness, kurtosis, and Jarque-Bera test statistics. The results highlight discrepancies in the statistical behavior of economic indicators, with GDP and CFR exhibiting considerable volatility and sensitivity to outliers. At the same time, the other variables show greater stability and symmetry.

Table 1

Descriptive Statistics

Stat	Mean	Median	Max	Min	Std. Dev.	Skewness	Kurtosis	J-B	Probability	Sample
GDP	Rs. 88310.2	796118.2	209991.2	33455.5	51500.22	0.51	1.99	3.62	0.147	32
CFR	Rs. 155701.9	61232.5	1010773.0	2211.01	273724.5	2.24	5.87	59.11	0.000	32
POP	21.03	21.02	28.88	11.19	4.99	0.00	1.61	2.07	0.110	32
DCR	Rs. 38.33	34.99	80.04	10.01	19.03	0.27	2.33	2.03	0.342	32
EXP	Rs. 6.56	5.98	12.88	2.24	2.52	0.49	2.29	2.33	0.290	32

Table 2 presents the outcomes of the lag length selection criteria. The results support for Lag 2, which enhances prediction accuracy and model fit, Lag 3, which emphasizes improved fit, and Lag 1, which favors simpler models. Lag 2 is the most commonly supported optimal lag, since it combines prediction accuracy and goodness of fit (low FPE, substantial LR test). However, the AIC recommends Lag 3 for optimal fitting, while SC and HQ prioritize Lag 1 due to its simplicity.

Table 2

Lag Length Selection

Lag	0	1	2	3
LogL	-77.96	214.43	239.69	259.15
LR	NA	519.01	40.01*	43.31
FPE	6.03E-06	8.88E-11	8.46e-12*	8.66E-11
AIC	4.49	-9.01	-9.09	-9.32*
SC	3.99	-7.07*	-5.97	-5.51
HQ	4.82	-8.51*	-8.11	-7.59

*Note: * Lag order selected criterion*

The stationary test evaluates whether the time series variables exhibit a stable mean and variation across time, which is crucial for reliable econometric modeling, as demonstrated in Table 3.

Table 3

Stationary Test

ADF Unit Root Test						
Variable		lnGDP	lnCFR	lnPOP	lnEXP	lnDCR
Level	Constant	0.66	0.56	-2	-1.51	0.76
	Constant and Trend	-3.21*	-1.69	-0.8	-1.3	-1.89
First Difference	Constant	-5.88***	-3.56***	-1.23	-4.71***	-5.36***
	Constant and Trend	-5.39***	-3.61**	-1.86	-4.92***	-6.61***
Phillips-Perron Test						
Level	Constant	1.06	0.61	-5.99***	-1.12	0.91
	Constant and Trend	-3.33	-1.76	-0.25	-0.78	-1.99
First Difference	Constant	-6.59***	-6.39***	-1.31	-5.69***	-5.38***
	Constant and Trend	- 6.69***	- 6.69***	-2.24	- 5.59***	- 5.49***
KPSS Test						
Level	Constant	0.73***	0.73***	0.64***	0.18	0.79***
	Constant and Trend	0.2	0.08	0.23**	0.16**	0.16**
First Difference	Constant	0.17	0.13	0.81*	0.31	0.19
	Constant and Trend	0.12	0.12	0.13	0.1	0.06
Structural Break						
	t-stat	year			Test	
lnGDP	-2.88***	2003			Stationary	
LnPOP	-2.23***	2002			Stationary	
lnCFR	-3.31***	1999			Stationary	
lnDCR	-3.36**	1990			Stationary	
lnEXP	-2.32***	1991			Stationary	

*Note: * (10%), ** (5%), *** (1%) significant*

The study employed the Augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1979), the Phillips-Perron (PP) test, the KPSS test, and the Structural Break Unit Root Test to assess the stationery of the variables (lnGDP, lnCFR, lnPOP, lnEXP, and lnDCR). Table 3 displays the results. The study conducted the tests under two conditions: (1) with a constant and (2) with a constant plus a trend.

The 5% significance level of the ADF test shows that only lnGDP with a constant and trend (-3.21*) rejects the null hypothesis of non-stationarity. It means that most variables are not stationary in their original form. After post-differencing, most variables (lnGDP, lnCFR, lnEXP, and lnDCR) exhibit stationarity, as indicated by ADF test statistics that are significant at the 1%, 5%, or 10% levels of significance. The initial deviation of lnGDP from a constant yields a value of -5.88**, indicating stationarity at the 1% significance level. However, lnPOP continues to exhibit non-stationarity at the first difference, necessitating further differencing or alternative transformations.

The study conducted the PP test, similar to the ADF test, under two conditions: at both the level and initial difference. At the specified level, most variables do not reject the null hypothesis of non-stationarity, except lnPOP, which exhibits stable behavior at the 1% significance level (-5.99***). After differencing, most variables achieve stationarity. For instance, lnGDP and lnCFR demonstrate substantial stationarity, with test statistics of -6.59*** and -6.02***, respectively. Nevertheless, lnPOP persists in demonstrating non-stationarity, signifying the need for more differencing or alternative techniques.

The KPSS test evaluates stationarity, with the null hypothesis asserting that the series is stationary. At the constant level, most variables demonstrate non-stationarity, as their test statistics exceed the critical thresholds for stationarity. For example, lnGDP, lnCFR, and lnDCR exhibit significant values (0.73*** for lnGDP), allowing for the rejection of the null hypothesis at the 1% significance level. Nevertheless, lnEXP remains constant at a fixed value. Following the initial differencing, most variables exhibit stationarity, accompanied by minimal test statistics. In both constant and trend analyses, all variables exhibit stationarity, except for lnPOP and lnEXP, which show marginal significance at the 0.05 level.

The structural break unit root test accounts for any structural changes in the data. The study identifies all variables as stationary, rejecting the null hypothesis of a unit root at significant levels, even when accounting for structural breaks. For example, lnGDP demonstrates stationarity at the 1% significance level, with a t-statistic of -2.88*** and a structural break occurring in 2003. Some variables, such as lnPOP, lnCFR, lnDCR, and lnEXP, also exhibit stationarity. It is demonstrated by significant t-statistics and set break years, such as 2002 for lnPOP and 1999 for lnCFR. The findings demonstrate that structural modifications, such as economic reforms (or policy adjustments) influenced the series during the designated break years. After evaluating these interruptions, all variables exhibit stationarity, thereby enabling effective modeling in time series analyses.

The results of the unit root test (ADF, PP, KPSS, and Structural Break Unit Root Test) show that most of the analyzed variables (lnGDP, lnCFR, lnEXP, and lnDCR) are non-stationary at their levels but achieve stationarity after first differencing, indicating their integration of order one, I (1).

Furthermore, this study examined the presence of cointegration among the variables under study. Table 4 presents the outcomes of cointegration bound tests, which confirm that a long-term co-integrating relationship exists between the variables mentioned above.

Table 4

Bound Test of Cointegration

t- stat	Value	K
F-stat	28.79	4
Significance	I (0)	I (1)
10%	1.8	3.18
5%	2.65	4.44
2.50%	1.87	4.79
1%	2.91	3.77

The study employed the lag length criteria of VAR to determine the optimal number of lags. The study, utilizing the SBC, determined that a lag time of 1 was optimal, coinciding with the highest selection according to the SC criterion.

Table 5

Long run coefficients

Variable	Coeff.	Std. Err.	t-Stat.	Probab.
lnCFR	0.19	0.03	6.33***	0.00
lnPOP	0.12	0.44	0.27	0.61
lnEXP	0.01	0.01	1.00**	0.02
lnDCR	0.01	0.01	1.00***	0.00
C	7.87	0.76	9.85	0.00

*Note: ***, ** and * significant at 1%, 5% and 10% respectively*

Table 5 presents the long-term coefficients derived from a regression analysis, demonstrating the relationship between the dependent variable and the independent variables within the model. The coefficient for lnCFR is 0.19, significant at the 1% level (t-statistic = 6.33, p-value < 0.01), demonstrating a strong positive correlation between the dependent variable and lnCFR. For lnPOP, the coefficient is 0.12; nevertheless, it is statistically insignificant (t-statistic = 0.27, p-value = 0.61), signifying a lack of a significant long-term relationship. The coefficients for lnEXP and lnDCR are both 0.01 and are statistically significant at the 5% and 1% levels, respectively, indicating a modest but significant long-term beneficial effect. The constant term (C) is 7.87, statistically significant (t-statistic = 9.85, p-value < 0.01), representing the baseline level of the dependent variable when all independent variables are at their mean values. These results underscore the relative importance and significance of the variables inside the model.

The results of the long-term regression analysis clarify the relationships between the dependent variable and the independent variables. The variable lnCFR demonstrates a strong and positive long-term correlation with the dependent variable, as indicated by a significant coefficient of 0.19 at the 1% significance level. In contrast, lnPOP does not exhibit a significant long-term correlation, as its coefficient is not statistically significant. Both lnEXP and lnDCR have positive, albeit minimal, long-term effects, with coefficients of 0.01, and are statistically significant at the 5% and 1% levels, respectively. The constant term C is essential, signifying the baseline value of the dependent variable. These findings underscore the varying significance of the independent variables in clarifying the dependent variable over an extended period. Table 6 presents the short-run coefficients obtained from an ARDL (1,0,0,0,1) model, which clarifies the immediate effects of independent variables on the dependent variable, together with the error correction term.

Table 6

Short Run Coefficients

	Coeff.	**Std. Err.**	**t- Stat**	**Probab.**
D(lnCFR)	0.06	0.03	2.00**	0.05
D(lnPOP)	0.06	0.33	0.18	0.64
D(lnEXP)	0.01	0.02	0.50***	0.00
D(lnDCR)	0.01	0.01	1.00	0.21
CointEQ(-1)	-0.41	0.06	-6.83***	0

1% (***), 5% (**) and 10% (*) significant

The coefficient for D(lnCFR) is 0.06, statistically significant at the 5% level (t-statistic = 2.00, p-value = 0.05), indicating a marginal positive short-term impact of lnCFR. Conversely, D(lnPOP) has a coefficient of 0.06, which is statistically insignificant (t-statistic = 0.18, p-value = 0.64), suggesting a lack of a short-term relationship. The coefficient for D(lnEXP) is 0.01, significantly relevant at the 1% level (t-statistic = 0.50, p-value < 0.01), indicating a weak but statistically significant short-run effect. For D(lnDCR), the coefficient is 0.01; nevertheless, it lacks statistical significance (t-statistic = 1.00, p-value = 0.21). The error correction term CointEq(-1) has a coefficient of -0.41, which is statistically significant at the 1% level (t-statistic = -6.83, p-value < 0.01). This indicates that each session corrects approximately 41% of divergences from the long-term equilibrium. This underscores the calibration process of the model, which aims to achieve long-term equilibrium. This indicates that within one year, the model corrects 41% of the discrepancy between the actual value and the equilibrium level. The remaining 59% of the variation will carry over to subsequent years, gradually diminishing as further adjustments take place. This signifies a somewhat modest adjustment rate toward equilibrium, requiring approximately 2–3 years to fully return to long-run equilibrium, depending on the persistence of the deviations.

Table 7

Correlation Matrix of Long run and short run coefficient

Coefficient	Long Run	Short Run
Long Run	1.0	0.93
Short Run	0.93	1.0

The long-run and short-run coefficients exhibit a strong positive correlation of approximately 0.93, as shown in Table 7. It implies that there is a constant relationship between these two sets of coefficients, as the short-run coefficients increase in tandem with the long-run coefficients. The diagnostic tests of the ARDL model indicate its adequacy and robustness.

Table 8

Diagnostic Tests

Tests	Prob.
Normality Test	0.41
Heteroscedasticity Test	0.39
Serial Correlation Test	0.19
Ramsey RESET Test	0.06

Table 8 shows that the normality test reveals a probability of 0.41, indicating a normal distribution of the residuals. These findings jointly confirm the reliability and validity of the ARDL model for inference and prediction. The heteroscedasticity test yields a probability of 0.39, indicating the absence of heteroscedasticity and a consistent variance in the residuals. The probability value for the serial correlation test is 0.19, which exceeds the standard significance threshold of 0.05, indicating insufficient evidence for serial correlation in the residuals. The Ramsey RESET test gave a probability of 0.06, which is just above the 5% significance level. It means that the model does not have severe functional form misspecification, but it may be close to it.

Table 9

The Results and Hypothesis Validation

Hypotheses	Results	Validation
H1: *DCR positively influences real GDP, and a bidirectional causal relationship exists between DCR and GDP.*	DCR positively impacts GDP in the long run (coefficient = 0.01). Bidirectional causality between DCR and GDP is confirmed by the Toda-Yamamoto Granger test.	Supported
H2: *EXP has a favorable contribution to real GDP growth, with a positive relationship observed in both the short and long run.*	EXP positively affect GDP with a statistically significant coefficient of 0.01 in both the short run and long run.	Supported
H3: *CFR has a significant positive impact on real GDP in Nepal in both the short run and long run.*	CFR has a strong positive impact on GDP in both the short run (coefficient = 0.06) and long run (coefficient = 0.19), both significant at the 1% level.	Supported
H4: *POP has a significant positive/or negative long-run impact on real GDP.*	POP is insignificant in both the short run (coefficient = 0.06, p = 0.64) and the long run (coefficient = 0.12, p = 0.61).	Supported

The hypothesis of Table 9 confirms the significant positive impact of CFR, exports, and DCR on Nepalese ECOG, with both short-term and long-term advantages supported by statistically significant coefficients. Although POP does not have a significant long-term impact on GDP, it corrects deviations from long-term equilibrium at a moderate annual rate of 41%, which supports this notion.

4.2 Discussion

This study explored the determinants of ECOG in Nepal based on the grounds of CDPF frameworks. The primary focus of this study is to examine the FDS-growth nexus in Nepal. Findings showed that FDS has a favorable long-term impact on ECOG in Nepal. However, this effect is insignificant in the short run in Nepal. This outcome is similar to that of earlier studies by Rustamov and Adaoglu (2018), Guru and Yadav (2019), Aziz et al. (2022), and Gizaw et al. (2024).

Economic theory logically describes how the lagged effect of financial development on real GDP can be explained through the extended Cobb-Douglas production function model. Even if larger amounts of domestic credit

provide more opportunity for people to access the financial resources necessary for starting new projects, that does not mean those projects will yield an immediate increase in the output of goods and/or services produced by a given economy because all investment projects take time to come to fruition (Dahal et al, 2024). First, when credit is expanded, the initial effect is increasing capital formation through capital accumulation resulting in increased production capacity over time. Because of factors such as the length of time required for investment to generate new revenues, the cost of adjustments to new technology, and the dynamic nature of the accumulation of capital, the growth effects from financial development become fully realized after multiple periods rather than within the same period (Rahmije & Xhelili Krasniqi, 2025).

In contrast, this outcome differs from the earlier studies by Odhiambo and Nyasha (2020) and Rahmije and Xhelili Krasniqi (2025). This finding can be supported as FDS boosts credit availability, encouraging more investment in innovation, infrastructure, and new technology that enhances production efficiency, which in turn stimulates ECOG. The outcome from the ARDL model demonstrated that CFR affects ECOG in both the short and long term. This result aligns with earlier studies by Ghosh (2019), Wani (2022), Dahal et al. (2024), and Dahmani et al. (2024). This finding supported the arguments of investment efficiency and savings mobilization stimulate growth. Similarly, EXP has a favorable effect on ECOG in both the short and long term. This finding aligns with the previous results of Arvin et al. (2021), Navarro et al. (2024), and Sutbayeva et al. (2024). It is because trade can increase market share, earn foreign currency to purchase basic resources, and reap the benefits of economies of scale. Finally, POP does not affect ECOG in both the short- and long-run. This result is similar to the earlier outcomes of Huang and Xie (2013) and contrasts with the earlier findings of Yao et al. (2013), Rehman (2019), and Ayanaw Alemu and Belay Zegeye (2024). This outcome supports the argument that economic growth can be achieved through the use of more advanced technologies and an educated, skilled workforce, rather than relying on a large unskilled labor force.

The insignificance of domestic credit (DCR) in the short run indicates that in Nepal, developing the financial system does not lead to an increase in output immediately; however, it will do so eventually. The expanded Cobb-Douglas production function suggests that credit growth has an indirect effect on growth by increasing productivity and capital accumulation over time; this is slow-moving as well. Investments created with borrowed money will require time to mature before they can increase production due to latency, time spent in processing by the different financial institutions, and will experience costs associated with making the adjustment Wani (2022). In addition, other factors/characteristics within the economy of Nepal may reduce the impact of financial development in the short run; these include that the credit will be used primarily for trade-related activities or for purchasing real estate rather than other productive activities that would be considered more immediate and therefore have a greater impact on growth rates. For this reason, we conclude that financial development is a long-term driver of economic growth instead of acting as an immediate stimulus for current economic activity.

V. CONCLUSION & RECOMMENDATION

5.1 Conclusion

The primary objective of this study is to investigate the impact of financial development (FDS) on economic growth (ECOG) in Nepal, using the ARDL bound test estimator for the period 1992-2023. The main finding depicted that FDS stimulates ECOG in the long run in Nepal. However, the FDS does not impact ECOG in the short run in Nepal. This indicates that FDS boosts the economy through mobilizing scarce resources to the productive sector. It reduces information, transaction, and funding costs and offers loans for innovation that increase investment and foster ECOG. Similarly, capital formation (CFR) has a favorable impact on ECOG in both the short term and the long term. This indicates that easy access to capital stimulates economic growth via two alternative channels: (1) individual investors save more for future consumption, and financial institutions mobilize this saving to productive sectors; and (2) corporate houses can easily get loans at reasonable rates, which reduces funding costs and increases investment opportunities. Similarly, trade, as measured by exports, has a favorable impact on ECOG in Nepal. This suggests that an increase in exports also leads to an increase in foreign currency reserves and market shares. Additionally, it can benefit from economies of scale, which can increase production efficiency, thus increasing ECOG in Nepal. Finally, the result showed that population growth (POP) does not affect ECOG in Nepal. This suggests that the increase in CFR, exports, and FDS contributes to an increase in ECOG in Nepal.

5.2 Policy Recommendations

FDS is positively correlated with growth but only in the long-term, policymakers should focus on making long-term financial sector reforms changes to promote development. Examples include increasing the depth of financial markets, creating appropriate regulations, improving supervision of banks, and increasing stability in the financial system. It is essential that financial institutions give high priority to providing loans to productive sectors of the economy, such as agriculture, industry or hydropower as well as small and medium scale enterprises (SMEs). Increasing the

amount of loan funding available to these productive sectors will help translate financial resources into real growth of the economy by encouraging domestic saving and promoting investment friendly policies in these sectors. Expanding banking and other forms of finance into rural areas and into areas that are not served by banks and other financial institutions will help mobilize savings and encourage investment through savings. The government can promote domestic savings through capital formation.

The government should also create an environment that is attractive to all forms of investment through stable macroeconomic policies and encourage the attraction of foreign direct investment by providing for an investment-friendly environment through stable macroeconomic policies. Reducing the cost of lending is essential to increasing investment by allowing for funding at a lower rate of interest through improved Financial Intermediaries. Increasing exports is positively related to increasing GDP in Nepal. The Government of Nepal should adopt a strong export-promotion and diversification strategy which increase the number of goods and services that are exported to the rest of the world, improve the quality of goods and services that are exported, increase the volume and quality of trade infrastructure (both physical and electronic), and increase the amount of time that goods and services spend in international markets. The Government of Nepal needs to adopt a coordinated strategy to develop more sustainable economic growth and development through increased financial development, increased capital accumulation and increased export development.

Declaration of Interest

The authors declare that they do not have any known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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