The Effect of Financial Intermediation on Economic Development in Sierra Leone (1980-2023)

by

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ABSTRACT

Sierra Leone is confronted with a weak macroeconomic and financial sector growth couple with challenges such as the long civil war, lack of capital market and several external shocks which impede financial intermediaries to adequately facilitate the flow of funds between economic agents. Previous studies focus on linking financial intermediation and GDP growth, applied traditional unit root tests, focus on capital market and cross sectional data. However, this study is distinguished from earlier research by using GDP per capita as dependent variable, which gives better measure of economic wellbeing. Also, in addition to the traditional unit root tests, the Perron-Vogelsang structural break test is employed to account for stationarity during break points. Given that the country has no structured capital market, it is worthwhile to investigate financial intermediation under the circumstance of banks as the major players with a country specific study rather than cross sectional. Thus, the research examines the effect of financial intermediation on economic development in Sierra Leone and the causality between financial intermediation and economic development. The dynamic OLS, ARDL approach is used to estimate the model and the Granger Causality test was applied to affirm the causation between financial intermediation and economic development with time series data from 1980 to 2023 sourced from WDI database with Stata software package version 14.2 applied. The results revealed that DCPS has a negative impact but insignificant, whiles BM shows a positive effect on economic development in the short run but negative effect in the long run. The granger causality test shows a uni-directional result, which validates that DCPS granger causes economic development in Sierra Leone, but Economic development does not granger causes DCPS. There is no causality relationship between BM and economic development. The study recommends that GoSL to allocate resources to productive sectors and encourage private sector growth, to develop the capital market to facilitate bonds and equity transaction as supplement to long term financing, to improve the legal and regulatory framework for financial institutions, and reinforce contract agreements. GoSL to focus on capacity building programs for the youthful population, and roll out infrastructural projects. The BSL to implement prudent monetary stability policy in tandem with rationalize public spending. The study will encourage authority in Sierra Leone to deepen financial intermediation processes thereby foster economic development.

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List of Abbreviations

ADF: Augmented Dickey Fuller

ARDL: Autoregressive Distributed Lag

APEs: Asia Pacific Economies

BSL: Bank of Sierra Leone

BM: Broad Money Supply

DCPS: Domestic Credit to the Private Sector

DOLS: Dynamic Ordinary Least Squares Methods

EAC: East African Community

EOWAS: Economic Community of West African States

GCF: Gross Capital Formation

GDP: Gross Domestic Product

GMM: Generalized Method of Moment

GoSL: Government of Sierra Leone

IMF: International Monetary Fund

OLS: Ordinary Least Squares Methods

POPN: Population growth

PPPs: Public Private Partnership

RE: Random Effects

SSAs: Sub Saharan Africa

TOP: Trade Openness

UNCDF: United Nation Capital Development Fund

VAR: Vector Autoregressive

WB: World Bank

WDI: World Development Indicators

CHAPTER ONE

1.0 Introduction

Sierra Leone like many other developing countries, its financial intermediaries are largely dominated by the banking sector that covers over 70 percent of total financial assets, whilst the non-bank financial institutions represent a smaller portion (Barrie, 2024). These institutions play a pivotal role to serve as conduit for financial intermediation processes and expedite the flow of funds between economic agents. They serve as hub where financial resources are harvested through deposits and then channelled these surplus funds as loans and other financial instruments to investors who are in dear need of these resources to embark on productive ventures (Konstantakopoulou, 2023).

Cetorelli, *et. al* (2012) reported that many financial crises in history have been attributed to failure of financial intermediaries, with direct references to banks. This supports the argument that financial intermediaries are crucial to economic development. However, it is apparent that financial intermediation provided by banks creates the enabling environment to encourage deposits, which will eventually provide financing to support investment projects. This was emphasized by McKinnon (1973) and Shaw (1973) that higher level of savings would facilitate financial deepening and thereby guaranteeing higher volume of investments leading to economic development. Also, when financial Intermediation is done efficiently by transmitting resources to credible investors, it is obvious that this could trigger economic development. This was further underscored by Beck *et al..,* (2007) that financial intermediation has the tendency to curtail absolute and relative poverty.

In the recent past, the effect of financial intermediation on economic development has attracted heated debate among researchers across the globe with divergent views and mixed results. According to Umar *et.al* (2015), Dima and Opris (2013), Xu (2016), Tarawally *et*. al (2015) and Chen (2006) a positive relationship exists between financial intermediation and economic growth. Basher (2013) revealed a weak and insignificant relationship of financial sector development and economic growth in Nigeria. Similarly, Duramany-Lakkoh, *et. al* (2022) posited that banks, as financial intermediaries, do not create a significant impact on the economic growth of Sierra Leone based on indicators such as, the deposit on interest rate, bank liquidity reserve, interest rate spread, and gross domestic savings, except for domestic credit to the private sector, which is believed to have an impact on economic growth. In contrast, John and Nwekemezie (2019) identified that

financial intermediation had no impact on growth, whilst Yeboah (2020) disclosed that financial intermediation in fact reduces economic growth. These results revealed a lack of unanimity in studies concerning the interrelationships between these factors, a key reason being lack of standardisation of the various estimation techniques used by the different groups of researchers. Further, Sierra Leone is marked with a weak financial sector, and combine with macroeconomic instability over the years (Johnson, 2022). It is worth investigating the nexus of financial intermediation and economic development in the country, and thereby infer recommendations to policy makers.

1.1.Background

Benston and Smith Jr. (1976) revealed that before the advent of financial intermediation, financial transaction was tedious and faced high transaction costs, adverse selection and moral hazards problems. However, the emergence of financial intermediation help mediates to reduce costs and address the bottleneck of information asymmetry, where one party may have more information than the other, and thus used the information to their advantage. Similarly, Kithandi (2025), pointed to the role financial intermediation played in bridging the gap between surplus and deficits units in the economy with the motivation to address market imperfections. Also, Rochet and Tirole (2002) further emphasized the role financial intermediaries played to smoothen the payment and clearing systems to facilitate financial transactions.

Across the globe, financial intermediation has been widely acclaimed as a key segment that mobilize savings, which is useful to finance investments and subsequently fuel economic development. Demirguc-Kunt *et al.,* (2014) pointed the significant role banks played to mobilize household deposits. In Sierra Leone, banks are crucial to convert surplus savings, and direct such funds to deficits spending units in the form of loans and other instruments to economic agents.

The Gross Domestic product (GDP) is a comprehensive broad aggregates and gives an overall picture of the economy. It measures the total income of everyone in the economy, which gives the value of the overall economic activities of the economy. (Mankiw, 2010, p. 18). However, given that GDP per capita measures the income of the average person in the economy, but economic development goes beyond the mire figures of GDP, as it factors the process through which an economy creates material wealth and uses it to improve the wellbeing of its members through concerted efforts from various sectors, including the financial sector. Giugale (2017, p.1).

According to Wornom (2025), 60 percent of Sierra Leoneans live below the poverty line, while 43 percent live in extreme poverty (less than US$1.90 a day). This suggests that to sustain development, the wealth created should trickle down and transform the lives of its population. Otherwise, poverty may be persistence with its ravaging consequences. As a result, the study will focus on per capita income as a measure of development rather than GDP.

The Sierra Leone economy has been resilient with ups and downs marked with inconsistence growth. According to the WDI data set for GDP per capita, the graph shown below in figure 4.1 in panel A, depict significant fluctuations over the years. Between 1980s and 1990s was marked with frequent volatility, with a sharp decline noticed in early 1990s suggesting a severe contraction. Amid the 2000s, strong growth was recorded between 2000 to 2002, and 2013 to 2014 indicating recovery from the civil war and rebound in mining activities respectively in the country. However, in 2015 the country was hard hit to a recession due to the effects of the Ebola epidemic. Thereafter, the economy recovered gradually and then hit again by the Covid-19 in 2020. This underpinned that the growth trajectory of the economy is characterized by boom, moderate and burst over the years. (WDI, 2025). Also, before the Covid-19 pandemic, growth was projected to 4.5 percent between 2021 to 2023. Unexpectedly, the covid-19 reversed the growth to 2.2 percent in 2020, with the tourism, manufacturing, agriculture, and services sectors (including banks) suffered the most. (IMF, 2024, p. 38).

The Bank of Sierra Leone (BSL) as an autonomous body charged with the responsibility to preserve financial stability, provide regulatory and supervisory oversight of the banking system using the risk-based supervision (RBS) approach. Despite the efforts of GoSL and BSL, the country is confronted with a weak financial system that is mostly led by banks. According to Johnson (2022), the banking sector comprises fourteen (14) Commercial Banks; two (2) state owned banks, two (2) domestic private owned banks and ten (10) foreign owned subsidiaries mainly from Nigeria, all regulated under the Banking Act 2019. Given that the banking sector is the principal player in the financial intermediary business, it is imperative to holistically used banks as the major financial intermediaries to conduct this studies.

According to UNCDF (2021), 12.4 percent of adults in Sierra Leone have bank accounts, which implies that over 87% of the population do not operate through banks. In other words, there is a huge potential for the banking sector to leverage on this opportunity to increase financial intermediation and subsequently impact development.

Furthermore, the foreign commercial banks are limited to expand operations to remote areas in the country with a low probability to breakeven. However, the state-owned banks are compelled to facilitate financial deepening and spread more branches to remote areas, where economic activities are low. It is therefore expected that GoSL should support the state-owned banks for undertaking a quasi-fiscal activity to facilitate financial intermediation across the country.

1.2 Statement of the Problem

Sierra Leone ranks at the near bottom of the Human Development index and faced with persistence challenges ranging from the eleven (11) years civil war that ended in 2002, the Ebola epidemic virus in 2014, Covid-19 pandemic, and the ongoing Russia and Ukraine conflict, which led to shocking impacts and slowdown of economic activities. (Wornom, 2025). Moreover, Barrie (2024) highlighted several factors that contributed to the slow growth of Sierra Leone's financial system, ranging from political instability, a weak rule of law, a difficult business environment, low financial literacy, a high level of informal activities, and high inflation that threatens macroeconomic stability. These challenges may impede financial intermediaries' drive to accumulate enough savings needed to finance investment projects. Again, Mishkin (2019) underscored that factors leading to financial crises would suppress savings and by extension limit loans availability, which may have a trend in distressing borrowers' intention to finance productive investments, and thus causing economic activity to contrast.

Also, the non-functional stock market in the country, which limit the availability of additional funds to finance investments projects is problematic. Eze. *et.al.,* (2016) added that financial deepening evidence positive but weak impact on growth for the Gambia, Gabon and Sierra Leone. They stressed that the fragile financial deepening was largely attributed to inability of accessing credits, credit worthiness, lack of information and low level of bank deposits. Banks in Sierra Leone struggled to provide all the required resources to finance investment projects, and potential savers are also constraint to access financial intermediaries in hard to reach communities. Alternately, Bencivenga *et al*. (1996) emphasized that stock market liquidity expands growth through capital formation, risk mitigation and reduce investment costs through a more robust financial market. Considering the huge segment of the population that are underserved (UNCDF, 2021), it is appealing to assess the efficiency and financial depth, and the size of the financial intermediaries, particularly banks on their impact to boost economic development in Sierra Leone.

1.3 Research Aim and Objectives of the Study

The aim of the study is to investigate whether banks as primary financial intermediaries are sufficient to propel economic development in Sierra Leone. According to Adelman (2000) economic development is defined as a 'widespread improvement in the human condition'. Therefore, the research would explore how the size and financial depth of the banking sector transform the lives of the people of Sierra Leone.

The general objective is to explore the effect of Financial Intermediation on Economic development in Sierra Leone. The sub objectives are:

1. To investigate the short-run and long-run effect between financial intermediation and Economic Development
2. To determine the causality between financial intermediation and economic development
3. To provide policy recommendations on how financial intermediation could boost economic development.

1.4. Research Gap

Existing research focused more on establishing the relationship between financial intermediation and GDP. But GDP per capita growth rate is computed based on the gross domestic product divided by the midyear population. (WDI, 2025). Whilst development only occurs when the wealth created improve the lives of the people (Adelman, 2000). In addition, the World Economics, (2019), recorded a Gini coefficient of 53 percent measured in 2019 indicating a high level of income inequality rate in the country. As such, it is prudent to use the GDP per capita as proxy for development, which gives a better measure of individual economic wellbeing.

Moreover, studies rely on the traditional unit root tests to conclude on stationarity. However, the study expects to conduct a structural break test to account for stationarity during breakpoints. Again, researchers focus on the capital market, which are prevalent to developed and emerging economies with a well-structured financial market. This is not the case for Sierra Leone, where the financial market is based primarily on short term borrowing and dominated by banks. Hence, it is fascinating to examine the effect of financial intermediation on economic development under the circumstances of primary market to reflect the economic realities of Sierra Leone.

Furthermore, this study intends to explore a country specific study in Sierra Leone due to economic variability and to add to the body of literature concerning the subject.

1.5. Research Questions

The following research questions are based on the study objectives, which are expected to have been answered at the end of this research.

1. Does financial intermediation have effect on Economic Development in Sierra Leone?
2. Does economic development and domestic credit to the private sector have any causality relationship in Sierra Leone?
3. Does economic development and broad money supply have any causality relationship?

1.6. Research Hypothesis

Following the aforementioned objectives, the research intends to provide answers for a case in Sierra Leone to the hypotheses below:

Hypothesis 1

H0: There is effect between financial intermediation and economic development in Sierra Leone

H1: There is no effect between financial intermediation and economic development in Sierra Leone

Hypothesis 2

H0: There is a causal connection between financial intermediation and economic development in Sierra Leone

H1: There is no causal connection between financial intermediation and economic development in Sierra Leone

Hypothesis 3

H0: Investments has effect on economic development in Sierra Leone

H1: Investments has no effect on economic development in Sierra Leone

Hypothesis 4

H0: Trade Openness affects economic development in Sierra Leone

H1: Trade Openness does not affect economic development in Sierra Leone

Hypothesis 5

H0: Population growth rate affects economic development in Sierra Leone

H1: Population growth rate does not affect economic development

1.7. Limitation of the Study

The research is constraint with the availability of other relevant data within the study scope, and thus, the study utilized the available secondary data sourced from the WDI. The data used may not have given a comprehensive analysis or broad generalization of the effect of financial intermediation on economic development in Sierra Leone. Again, the study only focused on banks as key financial intermediaries, excluding non-bank financial institutions, such as, pension funds, microfinance, community banks, financial services associations and mobile money operators. Further research can be conducted given the proliferation of non-banks financial institutions in the country.

1.8. Significance of the study

Financial intermediation across the globe has been widely acclaimed for its contributions to economic development. More so, Sierra Leone is a developing country marked with persistence shocks, including the civil war, Ebola and the Covid-19 pandemic which stressed the financial sector, particularly banks, it require a deep dive empirical examination to adequately inform policy makers that despite these challenges, whether financial intermediaries in the country are sufficient to trigger economic development. Hence, the study will suggest to GoSL and BSL to make informed decisions regarding financial sector regulation and promoting financial inclusion across the country.

Also, substantial literature concerning this topic have already analyzed the broad spectrum of financial institutions as intermediaries. However, for the case of Sierra Leone, whose capital market is non-operational, the study intends to contribute to existing literature by providing empirical evidence on the impact of the financial depth, and the size of the banking system on economic development.

The study would suggest for banks to leverage on the underserved segment of the population as an opportunity to advance financial intermediation across the country.

1.9. Scope of the Study

This study scope analyzed the effect of financial intermediation on economic development in Sierra Leone with secondary data sourced from WDI from (1980-2023). Hence the scope of this study was confined in Sierra Leone for a period of 44 years.

1.10. Structure of the Study

This study will be divided into five chapters. Chapter 1 contains the general introduction which provides the background to the study, statement of problem, aims and objectives, research gap, research questions, research hypothesis, limitations, significance of the study and scope of the study. Chapter two examined the theoretical and empirical literature review. Chapter 3 provides the conceptual framework, theoretical framework of the study, research methodology employed: which explained model specification, research design and data collection, technique of estimation and regression diagnostic tests. Chapter four discussed the descriptive analysis and correlation matrix, stationarity tests, result estimation. Chapter five contains the summary, discussion of findings, conclusion and recommendations.

CHAPTER TWO
THEORETICAL AND EMPIRICAL LITERATURE REVIEW

2.0 Introduction

This section reviews both the theoretical and empirical literature, as well as the functions of financial intermediaries. It is germane to assess the theories from various economic context, including developed and developing economies, to ascertain whether financial development underpinned economic development.

2.1.0. Theoretical Literature Review

The argument that Financial Intermediation promote economic growth is reflected in both theoretical and empirical literature. Schumpeter, (2008), theory of economic development argued that financial development precedes economic growth. The theory supports that credit creation by banks is required to provide finance to entrepreneurs, which then drive economic development. Contrary, Robinson (1952) asserted that financial development responds to economic growth, as a result, when real growth set in, there is pressure that necessitate demand for financial assets, which eventually develop the financial sector and afterwards support economic growth.

2.1.1. Supply-leading finance-growth hypothesis

Croitoru, (2012) review Schumpeter's theory of economic development and cited that the economic role is reserved for entrepreneurs that are capable of transforming factors of productions to innovative actions that generate growth. Again the review mentioned that Schumpeter's idea of entrepreneurs are not actually the owners of capital but can access these capital through credit creation by capitalist or banks, which implies that entrepreneurs do not necessarily need to save before embarking on a productive venture, as entrepreneurs are typical debtors in the capitalist society. However, this idea may not be applicable to developing countries where there are inadequate funds and that entrepreneurs require at least startup funds to initiate a business.

Similarly, advancing on the work of Schumpeter, McKinnon (1973) and Shaw (1973) posit that financial liberalization allows a free hand to interest rate movement towards equilibrium, which encourages gains on savings and make more funds available to support investments and afterward impel economic growth. This suggest that any act of government to control interest rate, will hamper savings, increase costs of investments and slowdown economic growth.

Levine, R. (1997) further emphasized that financial development is a good predictor of economic growth, with justification that countries with improved banking system, and advance stock markets tends to grow faster compared to countries with shallow financial and stock markets development. This supplement the idea that countries indebted to high external financing with developed financial markets inclined to growth more than countries with high external financing but weak financial markets. King and Levine (1993) revealed that financial development are highly associated with capital formation, and economic growth.

2.1.2. Demand-Following Hypothesis

Robinson, J., (1952) offers a differing view to Schumpeter that financial development comes after economic development. He asserted that real sector growth that unfolds industrialization and production would prompt innovation in the financial system to improve on payment system, garner more savings and dished out more credit facilities as a result of a boom in the economy. This implies that growth fuels financial development, as opposed to the finance led growth hypothesis. Patrick, H.T., (1966) buttressed that 'enterprise leads finance follows', as a result of growth, new demand for financial services would bring about development in the financial sector. He further emphasized that the more the growth rate of the real sector, the greater will be the demand by enterprises for external funds. He stressed that financial intermediation would be significant as more firms would seek for more resources, since internal funds may be insufficient to meet the required expansion.

Again, Singh and Mishra (2014) examined the nexus between financial development and economic growth in India, and they suggested that enterprise leads and finance follows in a unidirectional causation. This exposed that Schumpeter's concept of finance and growth nexus does not apply in the context of Indian economy. Magaji, *et.al.,* (2021) added that economic growth leads financial development in Nigeria for the entire period of 1960-2019. This underscored that financial development mainly from the banking system does not drive economic growth in Nigeria.

2.1.3. Bank-Based and Market-Based Financial Systems

As in the case of Sierra Leone, banks dominate the financial climate in the intermediation business, as they play a leading role in the mobilization of deposits, converting illiquid assets to long term profitable loans, provide employment opportunities, manage risks, improve innovation and digital platform to facilitate money transfer and facilitate the treasury bills to aid government borrowings.

On the other hand, the market based financial system provide alternative funding mechanism through the issuance of stocks, bonds and Derivatives markets.

Sierra Leone struggle with a weak capital market that largely consist of government securities. There are no corporate bonds issuance, as authorities are putting efforts to establish a legal framework to structure and regulate the future domestic capital market. (ADB, 2009, p. 126). Again, Levine, R., (2002) expounded that the banks-based system outperformed the market-based financial system when economic development is at early stages and coated with weak institutional settings. Nonetheless, the market-based system also provides vital financial services that fuel innovation and long run growth.

2.2.0. Functions of Financial Intermediaries

Financial intermediaries across the globe performed similar functions with the aim of mobilizing deposits and facilitate the transfer of such funds to deficit units to promote economic development. Below are outlined of key functions performed by intermediaries.

2.2.1. Mobilization of deposits and Liquidity Provision

Financial Intermediaries offer financial instruments, including deposits accounts, savings bonds and other various investment products that are essential in mobilizing savings from governments, corporations and households. (Modi and Kulshreshtha, 2016). Financial intermediaries create assets for creditors and liabilities for debtors which is a gain for both sides compared to if the transaction would have been done directly between the two parties. (Kithandi., 2025). Diamond and Dybvig (1983) succinctly put it that depositors are uncertain of their liquidity needs in the future and that banks need to disburse less but profitable loans to meet the demand needs of depositors in order to avoid bank runs.

2.2.2. Reduction in transaction costs

In financial transactions, intermediaries benefit from economies of scale, as it manages the search, negotiation, and monitoring costs compared to individual savers lending directly to individual borrowers. This makes financial transactions more accessible and affordable by drastically lowering the expenses of lending and borrowing for both parties through the payment system. Centralizing this process at the level of financial intermediaries avoids wasteful duplication of verification costs. Kithandi., (2025). Also, Andrieş, (2009) added that loan commitment instrument

on the side of the borrower plays a significant role in transaction reduction costs. He cited that loan commitments have the potential to lower borrowing rates and remove the borrower's moral hazard issues. As a result, the loan obligations offer the chance to lower transaction costs.

2.2.3. Information Provision

Financial intermediaries are adept at gathering and screening information regarding the creditworthiness of borrowers and the feasibility of investment projects. They are able to evaluate risk more effectively and at lower cost than individual savers. They are also able to monitor borrowers and ensure that money is spent as agreed and the repayment commitments fulfilled. As a result, Intermediaries reduce the effects of information asymmetry, thereby addressing the problems of adverse selection and moral hazards. Further, Andrieş, (2009) submitted that as the bank gets bigger, the moral hazard issue gets less severe, and when the bank has a fully diversified portfolio of assets, it even goes away entirely. Thus, depositors have risk-free debt contracts and do not need to keep an eye on the bank (at least not constantly) provided the bank has a properly diversified portfolio of assets.

2.2.4. Payment Systems and Clearing

One of the main categories of financial intermediaries, banks offer effective and safe payment methods such as credit or debit cards, electronic transfers, and checking accounts that make real-world transactions easier. This has the tendency to increase the overall effectiveness of economic exchanges, simplifies business operations, and lessens the need for currency.

2.2.5. Risk Management and Diversification

By spreading investments over numerous borrowers and ventures, intermediaries minimize the risk savers might face. For instance, a bank minimizes the risk of default by lending to numerous companies and combining deposits from numerous individuals. For investors who are individuals, this lowers risk and incentivizes them to save. Because the risk is contained and dispersed over a large group, it also enables firms to engage in riskier but potentially more lucrative projects. Modi and Kulshreshtha, (2016) added that Intermediaries assist in distributing risks among a variety of assets and investments by using strategies such as risk pooling, hedging, and portfolio diversification.

2.3.0. Empirical Literature Review

On the empirical front, there have been contentions that financial intermediation does not only impact growth positively, but negatively as well, whilst others claimed insignificant and non-linear relationship. Based on these conflicting arguments, this section examines the literature on various themes as stated below:

2.3.1 The Role of Financial Intermediation to Economic Growth and Development

Forgha, *et.al.,* (2016) examined the relationship between financial intermediation, domestic investment and economic growth in Cameroon using the VAR estimation technique. Their findings show that financial intermediation indicators such as DCPS, central government claims and commercial bank credit to GDP ratio are insignificant to growth but indicators such as broad money supply have significant effects on economic growth. Monsura and Villaruz, (2021) used OLS multiple regression with time-series data from 1986 to 2015, investigated the effect of financial intermediation on economic growth and confirmed Cointegration relationship. The findings showed that bank credit to bank deposit ratio, private credit, stock market capitalization and time trend exert significant effect on GDP per capita. The Johansen cointegration result indicates presence of long-term equilibrium relationship between financial intermediation and time trend and economic growth in the Philippines.

However, John and Nwekemezie, (2019) further examined the effect of financial intermediation on the development of the economy of Nigeria using data spanning 1986 to 2017. The ARDL technique and error correction model were employed with credit to private sector, lending rate and money supply as independent variables, while real GDP growth rate and unemployment rate were used as dependent variables. The findings show that credit to private sector do not significantly impact economic development.

On the contrary, Mahran (2012) applied the ARDL bounds testing approach to Cointegration and examined the long and short run relationships between real GDP and financial development in Saudi Arabia. The results suggested that financial intermediation exerted a significant negative impact on real GDP. This was supported by Cevik and Rahmati (2020), after applying the Vector auto regression (VAR) and ARDL-based estimations and used the commercial bank credit to the private sector as proxy for financial Intermediation, they affirmed that financial development has a statistically significant negative effect on real nonhydrocarbon GDP per capita growth and

further ascertained that no long-run relationship between financial intermediation and output growth was found in Libya.

Yusifzada and Mammadova, A. (2015) employed Granger causality, VAR, OLS instrumental variables and generalized method-of-moments (GMM) to measure the relationship between financial development and economic growth. They concluded that the relationship between finance and growth has inverted S-shape and thus, non-linear. Also, Xu and Gui (2022) observed that a fast-expanding financial sector and a slowly growing economy coexisted, as China seems to have followed the 'too much finance' pattern in the most recent decade. The empirical part of this study supports a non-linear (S-shaped) relationship between financial development and GDP per capita. They stated that the two financial development indicators used (total loans and private credit) appear to have opposite effects on economic growth.

This theme outlays four fronts of unparalleled debate which argued that the role of financial intermediation has mixed results. It is observed that domestic credit to the private sector and broad money supply were widely used as indicators for financial intermediation, which is consistent to this research, whilst the dependent variable and estimation techniques varies.

2.3.2. Causation and Cross sectional studies of financial intermediation and economic growth

Esso (2010) applied the Pesaran et al. (2001) approach to Cointegration and the procedure for non-causality test of Toda and Yamammoto (1995) and established a positive long-run relationship between financial development and economic growth in five EOWAS countries. The author asserted that financial development 'leads' economic growth in Ghana, Liberia and Mali, but a growth-finance led nexus was found in Cote d'Ivoire, and a bidirectional causality in Cape Verde and Sierra Leone.

Umar *et al.* (2015) empirically investigated the relationship between financial intermediaries and economic growth in Nigeria with annual time series data covering 1970 to 2013. The bound testing technique for Cointegration and Error Correction model were applied and the result indicates a stable long-run relationship between financial intermediaries and economic growth. However, the causality test revealed a bi-directional relationship between bank credit and economic growth

while a unidirectional causality moves from economic growth to insurance premium and value of stock transactions.

An, *et al*., (2020) investigated the impact of financial development on economic growth in 30 Sub-Saharan Africa countries (SSA). The findings indicate that financial depth and financial intermediation reduce per capita income growth in low- and middle-income countries, but increases growth in upper-income countries. They stressed that overall, a positive relationship was found in SSA. Yakubu *et. al*. (2021) applied the random effects (RE) technique and found that broad money has a negative relationship with growth, but bank credit to the private sector and bank deposits are positively correlated with economic growth in sub-Saharan Africa. Equally, Asante, *et.al.,* (2023) employed the system-GMM estimation technique to examine the linkages between financial development and economic growth in the face of rule of law, regulatory quality, and political stability for the period spanning from 2000 to 2019 using twenty-nine (29) countries in SSA. The result found that financial development has a positive effect on economic growth.

Muhoza, (2019) examined the effect of financial intermediation on economic growth using panel ARDL model for the period of 1985 to 2017 of East African Community (EAC) countries such as Burundi, Kenya, Rwanda, Tanzania and Uganda. The author employed an index of financial intermediation which includes domestic credit to the private sector, broad money and domestic credit provided by the financial sector to form proxies for the development of the banking sector using the principle component analysis. The Kao and Johansen Cointegration tests were applied along with the Fully Modified OLS (FMOLS) and the Dynamic OLS (DOLS), and the result indicates that financial intermediation has a positive and significant effect on economic growth of the EAC countries. A long run relationships was also established.

Arestis and Demetriades, P. (1998) examined the causality between finance and growth, and ascertained that cross sectional studies may be misleading and as such offer no help in answering questions on causality between finance and development and then suggest that time series analyses and data are much more relevant than cross-section. They argued that country specific Institutional factors are likely to influence the causal nature of the relationship between financial development and economic growth, and suggested that a country specific study is by far more promising. In addendum, Andini (2009), pointed that outliers in a cross-sectional study may give unreliable results, as high growth countries may influence the outcome to positive causal effect between financial development and growth.

Following outliers effect on cross-sectional studies, and given Sierra Leone's fragile financial development, a cross sectional study would likely lead to a misleading conclusion. Hence, a country specific study would give a realistic view on the true impact of financial intermediation on economic development. Also, to check causality relationship between financial intermediation and economic development in Sierra Leone.

2.3.3. The Role of Banks to Financial Intermediation process

Luçi (2003) expounded that the banking sector of transition economies often faced constraint of inadequate funds and limitations on credit expansion. The author stressed that given the risk level, banks would not increase their lending to the private sector even if they have extra available funds. Relating to Sierra Leone, most banks divert their funds to invest in treasury bills, which crowd out capital from the private sector. Also, Fu. *et.al.,* (2018) investigated the impact of both the quantity and quality of bank intermediation on economic growth across 14 Asia-Pacific economies (APEs) from 2003 to 2015. Their findings revealed that the quality of bank intermediation enhanced by credit allocation support economic growth in APEs.

Yakubu *et. al*. (2021) pointed that banks serve as the main financial intermediaries mobilizing savings, techniques for risk-sharing and main channel to investors. They further investigated the effect of financial intermediation functions of banks on economic growth in sub-Sahara Africa (SSA). They applied the random effects (RE) technique and found that broad money has a negative relationship with growth, bank credit to the private sector and bank deposits are positively correlated with economic growth.

According to Kolawole, *et.al.,* (2024), Adewole, *et.al.,* (2019) financial intermediation is central to transforming deposits into loans and other financial instruments to support productive ventures. They posited a trickle-down effect to increase employment and income intermediation and thus contribute to overall economic growth. Acha, (2011) utilized bank deposits and bank credit to the private sector as variables for bank intermediation and real gross domestic product (RGDP) as proxy for economic growth. The regression result proved that banks through their intermediation function contribute about 93 percent to economic growth in Nigeria. But Toby and Dibiah (2022), employed the VAR approach and the result show that financial intermediation measures jointly

have no causal effect on real GDP growth, but only the effect of bank deposits ratio show a significant relationship with growth in Nigeria.

Based on the different perspectives outlined, it is established that banks are the leading financial institutions that facilitate the flow of funds from depositors to borrowers. In the case for Sierra Leone where the capital market is friable and banks are left with the central role to facilitating financial intermediation processes and hence, it is imperative to assess the impact of credit to the private sector by banks and broad money supply as key variables of financial intermediation on Economic development in Sierra Leone.

2.3.4. The link between Financial Intermediation and Economic Growth in Sierra Leone

The few studies conducted in Sierra Leone postulated that financial intermediation is essential for economic growth. Tarawally. *et.al.,* (2015) examined the link between financial development and economic growth from 1985-2010. The study applied the Granger Causality test and results show that the overall financial depth and credit to the private sector have positive impact on growth. Also, Ganawah and Koroma (2022) examined the nexus between financial sector development and economic growth between 1980-2018. The study employed the ARDL technique and the results showed that credit to the private sector and broad money influenced economic growth only in the short-run. Again, Duramany (2020) investigated fiscal policy impact on financial sector development from 1980 and 2015. The study used error correction model to estimate both long term and short term effects. The result shows that there is a long run relationship between private sector credit and its explanatory variables. He affirmed that the private sector is willing to borrow regardless of the interest rate in the economy. Kargbo, *et. al.* (2016) examined the link between financial development and human capital accumulation on economic growth in Sierra Leone from 1980-2012, using the OLS regression estimation technique. They submitted that financial development and human capital accumulation support a positive correlation with economic growth and furthered that both financial development and human capital accumulation have a significant positive impact on economic growth in Sierra Leone.

Given the few studies conducted in Sierra Leone, it is gathered that they narrowly focused on growth rather development, and applied the traditional unit root tests, such as Dickey Fully and Philips Perron tests to base their conclusions on stationarity. However, given that Sierra Leone had suffered civil war and external shocks, this research will incorporate a structural break test to

account for stationarity during breakpoints in order to avoid spurious regression. In addition, this research will capture recent data and reflect the current reality in the country.

2.3.5. Financial sector efficiency on economic growth

Kiani and Ali (2019), emphasized that efficiency in financial intermediation influences growth. The study employed ARDL approach, with GDP per capita as proxy for economic growth and credit to the private sector as a proxy for financial intermediation. The results showed that financial intermediation has a positive significant impact on the economic growth of Pakistan in both long run and short run while financial sector efficiency has a positive impact on economic growth only in the long run. The study further validate that the efficiency in the process of channeling funds from savers to borrowers contributes to economic growth. Grbic, (2016) further support that efficient financial intermediation helps distribute resources more effectively and thus, boast economic growth. The author concluded that a positive correlation between the efficiency of financial intermediation and economic growth was found in Serbia.

Yusifzada and Mammadova, (2015) found that the impact of financial depth, access, efficiency and stability varies and depends on the level of financial development. They concluded that growth of financial sector decreases per capita GDP when financial intermediaries are poorly or excessively developed and that efficiency is significantly positive but negative in a squared form.

This theme clarifies that financial intermediaries do not impact development by merely allocating funds from surplus units to deficit unit but rather when these funds are allocated to the most promising projects by thorough scrutiny of creditworthiness of borrowers and evaluation of investment proposals. This suggest that financial intermediaries should direct resources to projects with the greatest potential for growth.

2.3.6. Market Capitalization and Economic Development

Ezeibekwe, (2021) applied the vector error correction model and proposed that stock market development does not meaningfully contribute to long-run economic growth in Nigeria. This suggest that the stock market of the country is weak to impact development. Conversely, Ogunsanwo*., et.al*., (2023) employed the structural vector autoregressive (SVAR) and then suggested that financial market intermediation with market capitalization has a positive and significant effect on economic growth in Nigeria. These two studies were conducted within the same time period between 1981 to 2017 and ended with contradictory conclusions on the impact

of market capitalization on economic growth. Chatri, and Maaruf, (2023) also launched empirical investigation using stock exchange capital market as a barometer to measure economic performance. The study applied the Vector Error Correction model and Granger Causality to validate a stable long-term relationship between financial intermediation and economic growth in Morocco and that financial intermediation with capital market does granger cause economic growth.

Chakraborty, (2010) examined the impact of developments in the financial sector on economic growth in India in the post-reform period, using quarterly data for the period 1993 to 2005. The researcher applied the techniques of Cointegration and vector error correction method and the results show that capital–output ratio and rate of growth of human capital have positive effects on real rate of growth of GDP, irrespective of whether market capitalization or turnover indicator is used as stock market development. He stressed that an increase in the market capitalization dampens economic growth, whereas turnover has no significant effect, and an increase in the money market rate of interest has a positive effect on economic growth. The findings lend no support to the theoretical prediction that the stock market development would play an important role in enhancing economic growth in India.

The relationship between financial intermediation and economic development largely depend on the financial indicators used, and the papers reviewed indicate that the influence of capital market on economic growth is inconclusive. Thus, for the Sierra Leone context, it would be thought-provoking to investigate the effect of financial intermediation on economic development without the capital market.

2.4.0. Conclusion

Generally, the empirical literature established inconsistent view and mixed results. It was deduced that credit to the private sector by banks and broad money supply are key variables of financial intermediation. However, only traditional unit root tests were conducted without consideration for structural break. Finally, a review on the impact of market capitalization on economic growth was conducted and the reviewed indicate that the influence of capital market on economic growth is inconclusive. A case for Sierra Leone that largely depends on banks is worth investigating.

CHAPTER THREE

THEORETICAL FRAMEWORK AND RESEARCH METHODOLOGY

3.0 Introduction

This chapter will discuss the conceptual framework, theoretical framework and the research methodology. Also, in order to fully assess the impact of financial intermediation, a model with dependent and explanatory variables are specified, a priori expectations of these variables, source of the data, techniques of estimation and method of data analysis are all treated in this chapter.

3.1 Conceptual Framework

Financial intermediaries perform the function of intermediation through the allocation of surplus funds gathered from depositors and make these funds accessible to viable investors that otherwise would have been difficult to march idle resources to desirable investments projects. These intermediaries include banks and non-banks financial institutions that play a key role to the growth of any country. (Kithandi., 2025).

The existence of financial intermediaries is built on real life scenario that markets are imperfect. Allen and Santomero, (1997) succinctly added that 'when markets are perfect and complete, the allocation of resources is Pareto efficient and there is no scope for intermediaries to improve welfare.' However, it is obvious that in reality some market participants may have more information than others, and that without financial intermediation, marching individual savers and borrowers would incur the rigors of high search cost, other transactional costs. Diamond and Dybvig (1983) underscored that it is difficult to streamline savers short term deposit preference and borrowers long term productive preference of loan resources, and that the advancement of financial intermediaries across the globe makes diversification of investment portfolio seamless, foster robust assessment of credit and liquidity risks.

3.2 Theoretical Framework

When discussing financial intermediation, it is essential to cite the role it plays in facilitating the flow of funds in the economy. For instance, financial intermediaries, including banks, insurance companies, investment funds, pension funds, microfinance institutions and mutual funds are critical to smoothing transactions between savers and investors. These institutions are pivotal to the accessibility of funds**,** cost reduction, managing inadequate information, monitoring and risk

management**.** Thus, it is imperative to explore the different theories that laid the foundation to financial intermediation.

3.2.1 The Transaction Cost Theory

Benston and Smith Jr. (1976), support that financial intermediaries act as market makers by pooling surplus funds from savers and channeled these resources to investors. This was supported by Campbell and Kracaw (1980), that financial intermediaries benefit from improved technology, as a result enjoy economies of scale and reducing search, monitoring and auditing related transaction costs. Also, they argued that financial intermediaries create specialized financial commodities to meet consumers' demands, which may subsequently allow for more efficient inter-temporal and intra-temporal consumption decisions that has the tendency to reduce transaction costs for borrowers and lenders. Fama (1980) further elaborated on the contributions of banks that geared toward reduction of transaction costs through the provision of liquidity by mobilizing deposits and then convert to cash and other liquid assets. Pyle, (1971), Holmström and Tirole, (2001) added that financial intermediaries offer liquidity and diversification of risks through the technical guidance of matching surplus funds from savers and the requirement of borrowers, thereby reducing the associated transaction costs.

3.2.2 The Asymmetric Information Theory

Imbalance information between the borrower and the lender is a key problem that affect financial intermediation. Most often, it is known that borrowers have more information about their financial capability, whilst lenders may be limited with information about their borrowers. An imperfect market is generally exposed to information asymmetry, leading to adverse selection and moral hazard. According to Alao (2018), 'adverse selection arises where one of the parties to a transaction takes advantages of the other's ignorance to charge too high a price or to pay too low a price. Whilst Moral hazard arises where one of the parties to a transaction or relationship can take advantage of the other's ignorance either by engaging in activities that the other would not have agreed to or probably failing to perform the tasks as expected.'

Leland and Pyle (1977) emphasized that borrowers and entrepreneurs have hidden information about their financial situation, which speaks volume that borrowers are likely amplifying their credit rating and not being honest with their intentions. This makes it difficult for lenders to assess risk accurately. Alao (2018) contributed that imbalanced information threatened the lender in circumstances where it does not have absolute control over the borrower's financial records, also

when the borrower violates the contract by hiding critical information about the project, and where there is high risk of debt repayment. In sierra Leone, banks played a critical role to curb the anomalies of information asymmetry. Generally, banks conduct the Know Your Customer (KYC) due diligence to assess the credit rating of customers and monitor their financial activities to foil down consequences of adverse selection and moral hazards.

3.2.3 Risk Diversification Theory

DeFusco et al. (2004), underscored that Harry Markowitz's in 1952 revolutionized investment theory with his contribution to Modern Portfolio Theory (MPT), which revealed that risk of a portfolio goes beyond the average of the risk components of portfolio, but the correlation of returns of the constituents' asset determines the portfolio risks. This implies that returns of assets that are not highly correlated are less risky compared to combination of highly correlated assets. This formed the bedrock to risk diversification. Again, Allen and Santomero (1996) argued that risk management has become central to modern financial institutions, whiles the traditional financial intermediation theories, such as transaction cost and asymmetry information have considerable decline. This suggested that banks and other financial institutions have diverted focus from traditional lending to robust risk management as one of its core mandate to develop expertise in credit risk assessment, portfolio diversification, loan covenants, and hedging strategies, making financial markets more accessible. Mayowa (2020) relate risk management to reality facing financial intermediaries in the process of transforming risk exposure of savers and lenders with the aim to create economic growth. He stressed that if these risks are not well managed, and mitigated financial institutions' growth may be hindered.

3.3.0 RESEARCH METHODOLOGY

The methodology adopted in this study is the dynamic OLS ARDL model in level form, which estimate directly the correct dynamic interaction among the I (0) variables. The Granger Causality test is applied to confirm causality. The Augmented Dickey Fuller (ADF) and ADF-GLS unit root tests and as well the Structural break test of Perron-Vogelsang test using STATA Software are employed. The section discuss the Methodology applied in order to meet the objective of the study under the following sub-headings: Model Specification, a priori expectation and variable description, research design and data collection method**,** techniques of Estimation, regression diagnostic test.

3.3.1 Model Specification

The research aims to apply secondary annual time series data from 1980 to 2023. The data are obtained from the WDI. The explanatory variables include domestic credit to the private sector (which measure efficiency and financial depth of the banking system) and broad money (which represents the size of the banking sector) both were proxy for financial intermediation. Gross fixed capital formation proxy for investments, Trade openness and Population growth. Per capita GDP is the regressed variable. The study adopts a simple open macroeconomic growth model by Khan and Senhadji (2003), Beck *et al*. (2005), and Demirguc-Kunt, A and Levine (2008) to estimate the growth model for Sierra Leone. The functional form is as follows:

$$GDP\_pc = f(DCPS, BM, GCF, TOP, POPN) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where:

GDP_pc = Gross Domestic Product per capita income

DCPS = Domestic Credit to the Private Sector

GCF = Gross Capital Formation

BM = Broad Money Supply

TOP = Trade Openness

POPN = Population Growth

The linear form of the model with the regressan and regressors is specified of its stochastic form:

$$GDP\_pc = \beta_0 + \beta_1 DCPS + \beta_2 BM + \beta_3 GCF + \beta_4 TOP + \beta_5 POPN + \varepsilon_t \quad \ldots\ldots\ldots\ldots .. (2)$$

Where:

β_0 = Constant term

β_1, β_2, β_3, β_4 and β_5 = regression coefficients

ε_t = Error term

Even though the ARDL model is designed to model both short-run and long-run relationships between mix set of variables of I(0) and I(1), it is also an appropriate technique used to estimate short-run dynamics and lag structures when all the variables are stationary. In this case, there is no need to conduct co-integration test because there is no long-run equilibrium to estimate when all variables are stationary. Also, no error correction is estimated, since there is no disequilibrium

correction. This model directly estimates the lag of the dependent variable to measure persistency and lags of the independent variables

The ARDL model is written as follow:

$$GDP\_pc_t = \beta_0 + \sum_{i=0}^{y} \beta_1 DCPS_{t-i} + \sum_{i=0}^{z} \beta_2 BM_{t-i} + \sum_{i=0}^{M} \beta_3 GCF_{t-i} + \sum_{i=0}^{q} \beta_{4_2} TOP_{t-i} + \sum_{i=0}^{v} \beta_{5_3} POPN_{t-i} + e_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots. (3)$$

3.3.2 The A Priori expectation and Variable Description

3.3.2.1. GDP per capita growth rate

GDP per capita growth rate is computed based on the gross domestic product divided by the midyear population, which is measured with constant local currency. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. (WDI, 2025).

3.3.2.2. Domestic Credit to the Private Sector

Domestic credit to private sector refers to financial resources provided to the private sector by financial corporations, such as through loans, purchases of non-equity securities, and trade credits and other accounts receivable, that establish a claim for repayment. (WDI, 2025). The expected sign of domestic credit to the private sector is positive as private credit may have the propensity to drive production, increase employment and overall output.

3.3.2.3. Broad Money Supply

Broad money is the sum of currency outside banks; demand deposits other than those of the central government; the time, savings, and foreign currency deposits of resident sectors other than the central government; bank and traveler’s checks; and other securities such as certificates of deposit and commercial paper**.** (WDI , 2025). It is expected that broad money may positively impact growth due to its ripple effect on low interest rate, increase borrowing, facilitate high volume of transactions, boast production and overall growth.

3.3.3.4. Gross Capital Formation Ratio of GDP

Gross domestic investment is the additions to a country's capital stock that does not include deductions for depreciation. Data on gross capital formation is used to represent gross domestic investment. This measure represents investment in the Solow growth model. From the Solow model, an increase in investment is expected to increase capital stock and then leads to higher economic growth. Based on the Solow model, we expect a positive a priori relationship between the gross domestic investment and economic growth. (WDI, 2025)

3.3.2.5. Trade Openness

Trade Openness is the value of the exports of a country relative to the value of its imports. It is computed as the ratio of the country's export price index to the import price index taken as a percentage. (WDI, 2025). An increase in trade openness means that the value of the country's exports is increasing relative to the value of imports. Hence, we expect to see positive relationship between trade and economic growth.

3.3.2.6. Population Growth rate

Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship (WDI data base 2025). Given that population is key component to the computation of GDP per capita, it is expected that when the size of population increases, GDP per capita would be impacted negatively.

Table 3.1: Expected signs of model parameters.

Independent variable	Symbol	Sign
Domestic Credit to the Private Sector	DCPS	+
Gross Capital Formation	GCF	+
Broad Money Supply	BM	+
Trade Openness	TOP	+
Population Growth	POPN	-

3.3.4 Research Design and Data Collection Method.

The study assessed the effect of financial intermediation on economic development of Sierra Leone. This assessment requires quantitative research with a time series analysis from 1980 to 2023. Secondary data were collected from WDI data base. GDP per capita growth as the dependent variable, whilst domestic credit to the private sector, broad money supply, gross capital formation, terms of trade and population growth are the independent variables.

3.3.5 Techniques of Estimation and Method of Data Analysis

Data were analyzed using STATA software because of its ability to help researchers analyze research easily and efficiently (Baum, 2006). The ARDL dynamic OLS is the technique of estimation, which is applicable for stationary variables and no further co-integration test is required.

In the study, time series data covering a period of 44 years (1980-2023) were used, which in some instances may be non-stationary. It is likely that when you predict the relationship of variables which are not stationary would result to spurious regression. Thus, there is tendency to conclude that the variables are significant even when they are not significance likely due to the existence of common trend between the dependent variable and the independent variables. As a result, it is required that all variables are tested for stationarity. In that regard, the ADF and ADF-GLS tests were applied. The rule is that if the ADF test statistic is greater than the 5 percent critical value in absolute terms, we fail to reject the null hypothesis. That means the variable is stationary. On the contrary, if the ADF test statistic is less negative than the 5 percent critical value, we reject the null hypothesis and go ahead to first difference the variable and If the variable does not become stationary at first difference, we second difference until stationarity is obtained.

However, because some variables may not be stationary due to the existence of structural break, which is a false representation of the stationarity status, we further applied tests for stationarity that takes structural break into consideration. The Perron-Vogelsang test, which test for one endogenous break was applied because there is one I (1) variable with the ADF test and two I(1) variables with the ADF-GLS. Given that some variables are not stationary at level using the traditional ADF and ADF-GLS tests, which may be due to the existence of structural break points, it is thus relevant to apply the structural break test to assess whether those variables with I (1) would be stationary after accounting for structural break. The granger causality test is also applied to test whether the activities of financial intermediation in Sierra Leone depict the demand following hypothesis or the supply finance- growth hypothesis.

3.4.1 Regression Diagnostic test

The following post estimation techniques are employed prior to carrying out the co-integration analysis:

3.4.1.1 Normality test

Normality test was conducted to test if residuals are normally distributed by using Skewness and Kurtosis test, with null hypothesis:

Ho: that the distribution is normal.

if p value is less than 1%, we reject null, but we fail to reject the null if p-value is greater than 1%.

3.4.1.2 Heteroskedasticity test

Heteroskedasticity is a problem where error term does not have constant variance. The test used White's test with the null hypothesis that there is constant variance, if p value is less than 1% we reject null but we fail to reject the null if p-value is greater than 1%.

3.4.1.3 Autocorrelation test

Autocorrelation refers to the correlation of a time series with its own past and future values. Breusch-Godfrey LM test is used with Ho: no serial correlation, if p-value is less than 1% we reject null but we fail to reject the null if p-value is greater than 1%.

CHAPTER FOUR
ANALYSIS AND PRESENTATION OF FINDINGS

4.0 Introduction

This chapter present the findings of the study and the analysis is primarily based on the results. Relevant tests, including summary statistics, multicollinearity, stationarity test, autocorrelation, heteroscedasticity, normality of data, causality test and stability test were performed to ascertained that all assumptions of OLS are passed. It is also critical to validate that variables are stationary to avoid spurious result of non-stationary data and to inform robust results. This study used the ARDL dynamic OLS approach to investigate the effect of financial intermediation on economic development in Sierra Leone. The results are as following:

4.1 Descriptive Analysis and Correlation Matrix of Variables

The 4.1 below show six variables including GDP per capita growth, Domestic Credit to the Private Sector, Broad Money supply, Gross Capital Formation, Trade and Population growth with forty-four (44) observations for all the variables. The table show a summary statistic in a bid to examine the effects of financial intermediation on Economic development in Sierra Leone.

The table below show key statistics such as mean, median, standard deviation, minimum and maximum values for each of the variables.

GDP per capita growth has a mean of 0.2916, standard deviation of 7.3368, a minimum of -22.3833 and a maximum value of 19.5577. DCPS has a mean of 1.8488, a standard deviation of 2.2837, a minimum value of 0.0015 and a maximum of 7.4044. BM has a mean of 14.1524, a standard deviation of 8.6338, a minimum value of 0.02303 and a maximum value of 29.4425. GCF has a mean of 12.3184, a standard deviation of 7.4604, minimum value of -2.4244 and a maximum of 42.0752. Trade has a mean of 41.9030, a standard deviation of 13.0213, a minimum of 22.9733 and a maximum value of 68.69067 and Popn has a mean of 2.2044, a standard deviation of 1.3287, a minimum value of -1.8996 and a maximum of 5.9055

The median for domestic credit to the private sector is 0.008% and the mean is 1.85%. This infers that most of the observations on DCPS are lower than the mean. Also, we note that the median for Gross Capital Formation (11.25%) is lower that its mean (12.32%), which implies that most of the observations on GCF are below the mean. However, we observed that the median percentile exceeds the mean value for all the observations relating to GDP per capita, Broad Money supply,

Trade openness and Population growth. This suggests that most of their observations skewed above their mean values.

Table 4.1: Summary statistics

Variable	Observation	Mean	Median	Std. Dev	Min	Max
GDP_Per Capita	44	0.2916323	1.260885	7.336795	-22.38331	19.55766
DCPS	44	1.848849	0.0080237	2.28371	0.0015445	7.404427
BM	44	14.15242	15.40405	8.633814	0.0230385	29.44246
GCF	44	12.31844	11.24837	7.460398	-2.424358	42.07522
TRADE	44	41.90303	41.92131	13.0213	22.97334	68.69067
POPN	44	2.20436	2.319829	1.328684	-1.899605	5.905519

Source: Author's Compilation from Stata14.2

Table 4.2 shows the simple correlations matrix among the variables. The table shows that the simple correlation between GDP per capita growth and DCP is negative (-2.009) and insignificant. The correlation between GDP per capita growth and Broad Money is positive (0.1304) and but insignificant, between GDP per capita growth and Gross capital formation is positive (0.2562) and also insignificant. The correlation between GDP per capita growth and Trade is positive (0.0118) and insignificant. The correlation between GDP per capita and Population growth rate is positive (0.3433) and significant at the 5% level.

The correlation matrix can also be used to reveal multicollinearity problems among the independent variables. From the table it is observed that among the independent variables, the correlations are generally below the 0.70 threshold. Ideally, as a rule of thumb, when the correlation among the independent variables exceed 0.70, it raises concern for multicollinearity problems. As in this case, all other correlations among the independent variables are less than 0.5. Hence, it is safe to say that there is no multicollinearity problem among the independent variables.

Table 4.2: Pairwise Correlation of Model Variables

Variables	GDP_Per Capita	DCPS	BM	GCF	TRADE	POPN
GDP_Per Capita	1.0000					
DCPS	-2.009 (0.1909)	1.0000				
BM	0.1304 (0.3989)	0.5462 (0.0001)*	1.0000			
GCF	0.2562 (0.0932)	-0.1731 (0.2611)	0.0891 (0.5650)	1.0000		
TRADE	0.0118 (0.9392)	0.2896 (0.0566)	-0.1272 (0.4106)	0.1515 (0.3262)	1.0000	
POPN	0.3433 (0.0225)*	-0.3195 (0.0345)	0.0847 (0.5848)	0.2383 (0.1194)	-0.3770 (0.0116)	1.0000

Source: Author's Compilation from Stata14.2 Note: values in parentheses are p-values

In table 4.3, the partial correlations of all variables with GDP per capita growth are not significant at the 5% level. The table shows the partial correlation of GDP per capita growth and each regressor controlling for all the other variables.

Table 4.3: Partial Correlation of Model Variables

Variables	Partial Correlation	Partial R-Squared	P-value
DCPS	-0.2606	0.0679	0.1044
BM	0.2597	0.0675	0.1055
GCF	0.0612	0.0037	0.7076
TRADE	0.2273	0.0516	0.1585
POPN	0.2662	0.0708	0.0969

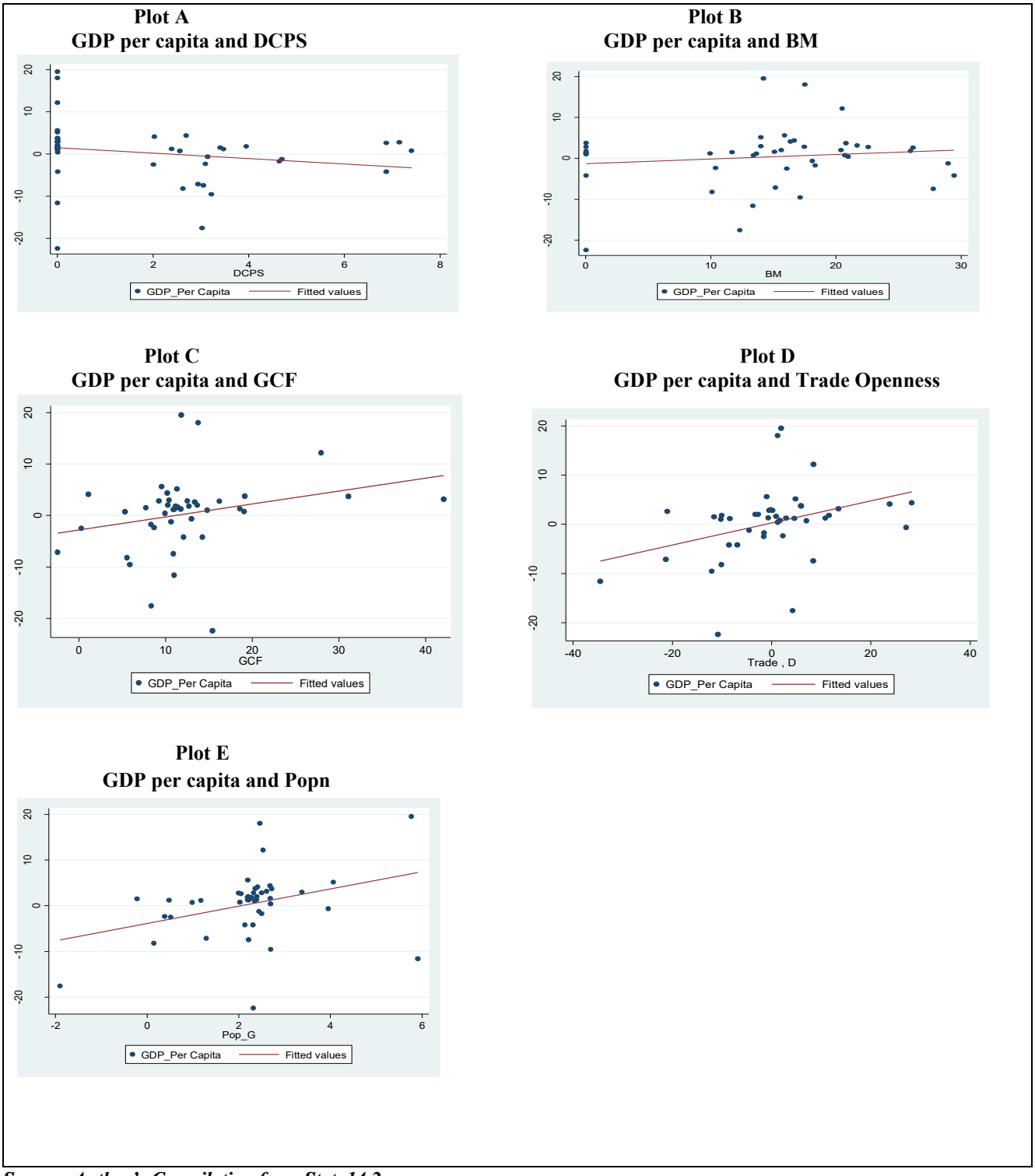
Source: Author's Compilation from Stata14.2 ***Note:*** *Dependent variable is Real GDP growth*

4.2 Stylized Facts

Figure 1 shows a scatter plot that illustrate a random display of scattered data that clustered around the regression line with either an upward or downward trend. This is evidence of a linear relationship between the dependent variable and the independent variables. Though, a transformation technique of first difference of Trade openness variable was applied to linearize the relationship with GDP per capita, otherwise, trade was found to exhibit non-linear relationship with a completely flat line along the zero line. However, it is observed that there are few outliers of data points that set apart from the regression line for almost all the variables. The existence of outliers may signal normality problems with the data set, which would later be tested using the Skewness and Kurtosis normality test.

Plot A shows that DCPS has a slightly negative relationship with GDP per capita. The inverse relationship could be attributed to several factors, including poor credit quality, high cost of borrowing and crowding out of private sectors. Yet, broad money supply displays a weak positive relationship with GDP per capita growth, whilst d1. Trade and Gross capital formation shows a moderate positive linear relationship with GDP per capita.

Figure 4.1: Scatter plot of Trend of Model Variables

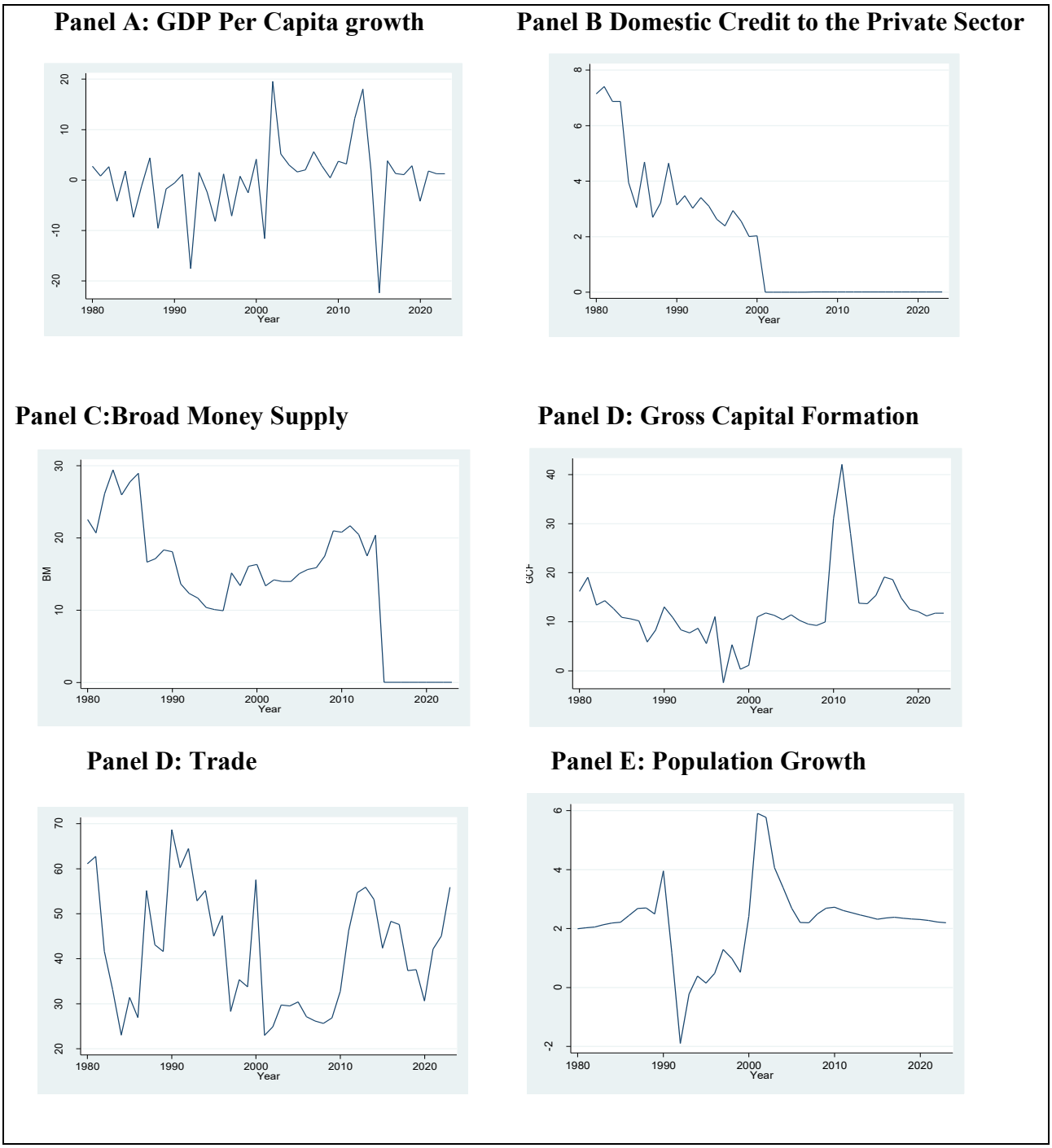


Source: Author's Compilation from Stata14.2

4.2. Trend of Model Variables

Figure 4.1 shows the graphs of all model variables. The figure shows that only nominal exchange rate has deterministic trend components, whilst all the other variables have constant graphs.

Figure4.2: Graph of Model Variables



Source: Author's Compilation from Stata14.2

4.3 Econometric Analysis

4.3.1 Stationarity Test

Stationarity test also known as the unit root test is an instrumental technique used in regression analysis, which aimed at to validate time series data in order to conform with the assumptions of OLS, especially the one dealing with constant mean, variance and co-variance for all observations. Applying regression analysis of time series data that is not stationary may lead to spurious regression and subsequently resulting to misleading conclusions. According to Granger and Newbold, (1974) stationary variables may reflect that even if a variable experienced shock over time, it is expected that the shock will not remain permanent, it dies out quickly and therefore the variable is mean reverting. Stationarity test provides a comfort not to absolutely rely on the conventional hypothesis test, confidence interval because forecast can be unreliable with non-stationary variables, which may have the tendency to affect the efficiency and consistency of estimation results.

The study intends to present robust and reliable results. In the event the data are non-stationary, there is need to take difference of the series, in order to transform the non-stationary data into stationary form. The study anticipates to use the traditional stationary test methods first before doing the structural break test. In this regard, the study employed Augmented Dickey-Fuller and Dickey-Fuller GLS test as traditional methods and the Structural break test of Perron-Vogelsang Test using STATA Software. Stationarity test of all the variables has been conducted in which results in level form and difference form is summarize below in table4.4 and Table 4.5 respectively.

4.3.1.1 Augmented Dickey-Fuller Test

The result for the unit root tests show that only Broad Money supply was found to be non-stationary at level, unless first differencing was applied before attaining stationarity at I (1). The rest of the variables were found to be stationary at level I (0).

The Dickey Fuller test was conducted by using Stata14.2 software. The graphs of all variables were drawn as indicated in figure 4.1 to determine whether they trend upwards or constant around the mean. From observations, all the variables exhibit a constant graph. Also, the Akaike Information Criterion (AIC) was determined as lag length for each variable to run the test statistics. In the interpretation of result, the test statistic value should be more negative in value compared to the critical values at 1% or 5%. When this occurs, it is reflected with significance P-values.

Table:4.4 Result for Unit Root Test Using Dickey- Fullah

Variable	Deterministic Component	Lag	Test Statistics	P-Value	Conclusion
GDP_Per Capita	Constant	0	-6.601	0.0000	I (0)
DCPS	Constant	3	-3.424	0.0008	I (0)
BM	Constant	1	-1.019	0.1572	I(1)
d.BM	Constant	0	-7.341	0.0000	
GCF	Constant	1	-3.292	0.0011	I(0)
TRADE	Constant	1	-2.843	0.0035	I(0)
POPN	Constant	4	-2.319	0.0134	I(0)
Critical Values					
Constant **1%:** -2.421 **5%:** -1.683					

Source: Author's Compilation from Stata14.2

4.3.1.2 Augmented Dickey-Fuller GLS Test

The ADF-GLS test was applied as a modification of the ADF test due to its advantage of having better size and power compared to the ADF test. Here, lag 4 was selected as default with the Schwarz Information Criterion chosen as lag length. From the result in table 4.5, it is indicated that DCPS and BM became only stationary after first differencing, whilst the rest of the variables are stationary at level.

Table 4.5: Shows Result for Unit Root Test with DF-GLS (Max Lag of 4 and lag chosen with SIC)

Variable	Deterministic Component	Lag	Test Statistics	Conclusion
GDP_Per Capita	Constant	1	-4.254	I(0)
DCPS	Constant	3	0.029	I(1)
D.DCPS	Constant	2	-5.193	
BM	Constant	1	-0.887	I(1)
D.BM	Constant	1	-4.364	
GCF	Constant	1	-3.026	I(0)
TRADE	Constant	1	-2.099	I(0)
POPN	Constant	3	-2.962	I(0)
Critical Value				
Constant 1%: -2.630% 5%: -1.950%				

Source: Author's Compilation from Stata14.2

4.3.1.3 Structural Break Test with Perron Vogelsang

Structural break is applied to variables that are not stationary after using the traditional test like ADF or ADF-GLS tests. It is expected that if the traditional test results show that a variable is stationary, whilst the structural break test revealed that the same variable is not stationary, it is then appropriate to adopt the result of the of the traditional test that said the variable is stationary. This suggest that if the traditional method show that the variables are stationaries, then the result may be true even if there is no further structural break test conducted. However, this study intends not to solely rely on results from the traditional unit root tests to avoid the possibility of false or wrong outcome.

The Peron-Vogelsang (PV) is a one break test that can either be a sudden break or a gradual break. A gradual break variable occurs when there is a gradual increase or change in a variable growth. Whiles a sudden break occurs when there is an automatic increase or change of a variable growth. It is noted that if the variables are stationary using single break test, then there is no need to use the multiple break method.

Table 4.6: Result for Unit Root Using Structural Break Test (Perron Vegelsang)

Variable	Additive Outlier (Immediate Break)			Innovative Outlier (Gradual Break)			Conclusion
	Breakpoint	P-Value for Break	Test Statistic	Breakpoint	P-value for Break	Test Stat	
GDP_Per Capita	1999	0.068	-2.850	2000	0.067	-3.463	
D.GDP_Per Capita	2013	0.584	-9.879	2014	0.583	-10.409	I(1)
DCPS	1998	0.000[b]	0.236	1997	0.000[b]	-5.391**	I(0)
BM	2012	0.000[b]	-1.169	2013	0.000[b]	-4.317**	I(0)
GCF	2009	0.000[b]	-4.846**	2008	0.006[b]	-4.603**	I(0)
TRADE	1988	0.974	-1.211	1989	0.653	-3.410	
D.TRADE	1985	0.252	-3.102	1986	0.074	-9.507	I(1)
POPN	1997	0.029	2.756	1998	0.017	-4.106	
D.POPN	1999	0.661	1.892	2000	0.523	-4.073	
D2.POPN	1989	0.951	-4.093	1990	0.463	-6.167	I(2)
5% Critical Values **Additive Outlier: -3.560** **Innovative Outlier: -4.270**							

Source: Author's Compilation from Stata14.2: * means stationary at 5%, **means stationary at 1%, **a** means break is significant at 5% and **b** means break is significant at 1%

GDP per capita growth is not stationary at level for both immediate and gradual break point. Also, after first differencing we found that there is no breakpoint for both immediate and gradual

breakpoints because the P-values are not significant. However, the test statistics for gradual breakpoint maintained higher negative value than its critical value. Hence, GDP per capita was found to be stationary after accounting for structural break, the variable is I (1).

Domestic Credit to the Private sector is having a significant P value with an immediate break point in 1998 and with a gradual break point in 1997. Since, the test statistics is of higher negative value than the critical value, we can conclude that DCPS is stationary at level after accounting for both immediate and gradual structural break.

Broad Money supply also maintained significant P-values with an immediate break point in 2012 and with a gradual break point in 2013. Hence, BM is stationary at level after accounting for both immediate and gradual structural break.

Gross Capital Formation have an immediate breakpoint in 2009 and a gradual breakpoint in 2008 supported with significant P-values. Also, given that the test statistics in absolute terms exceed the critical value, GCF was found to be stationary at level after accounting for both immediate and gradual structural break.

Trade openness is not stationary at level for both immediate and gradual break point. Also, after first differencing, no immediate and gradual breakpoints were found as the P-values are not significant. However, Trade was found to be stationary after first differencing, I (1).

Population growth was found not stationary at level and even after first differencing for both immediate and gradual break points. Also, no immediate and gradual breakpoints were found as the P-values were not significant. However, with the test statistic exceed the critical value in absolute terms, Population growth was only found to be stationary after second differencing, the variable is I (2).

4.3.1.4 Summary Result DF-GLS and Perron-Vogelsang Test

The unit root tests for GDP per capita show that according to the ADF GLS test, it is stationary in level while according to the Perron Vogelsang test which accounts for structural break endogenously, it is not stationary except after first differencing. Hence, we can conclude that the variable is I (0) because if it is indeed not stationary, that should show up in the ADF-GLS test.

Domestic Credit to the Private sector and Broad Money supply were found stationary after first differencing using the ADF-GLS unit root test, but both were stationary at level after accounting for structural break with the PV test. We therefore conclude that DCPS and BM are I(0).

Gross Capital Formation is stationary according to both tests. Hence, we conclude it is stationary at level. Trade openness is stationary in level under the ADF-GLS test, while according to the Perron Vogelsang test which accounts for structural break endogenously, it is not stationary except after first differencing. Hence, we can conclude that the variable is I (0) because if it is indeed not stationary, that should show up in the ADF-GLS test.

Population growth is stationary at level, according to the ADF-GLS test. However, according to the PV test, it is stationary after second differencing after accounting for the structural break with both immediate and gradual breakpoints.

Table 4.7 Summary Result ADF Test and Perron-Vogelsang Test

Variables	**DF-GLS**	**Perron-Vogelsang**	**Conclusion**
GDP_Per Capita	I (0)	I (1)	I (0)
DCPS	I (1)	I (0)	I (0)
BM	I (1)	I (0)	I (0)
GCF	I (0)	I (0)	I (0)
TRADE	I (0)	I (1)	I (0)
POPN	I (0)	I(2)	I(0)

Source: Author's Compilation from Stata15

4.3.1.5 Optimal Lag Selection

For the aim of efficient estimates, it is imperative that the study identify the highest number of lags to be included within the model. As a result, Lag-length selection criteria like sequential modified LR test statistic (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Hanna-Quinn information criterion (HQ) and Schwarz Information Criterion (SC), were employed to work out the appropriate lag length. The test results of the various lag selection methods are reported within table 4.8. The result shows that the optimal lag length supported the lag length selection criteria is lag 1 using the SIC. Thus, this study uses one lag for every of the variables.

Table 2.8: **Optimal Lag Selection Result**

Lag	LogL	LR	FPE	AIC	HQIC	SIC
0	-690.596	NA	5.4e+07	34.8298	34.9214	35.0831
1	-581.746	217.7	1.4e+06	31.1873	31.8285	32.9606*
2	-550.781	61.931	2.1e+06	31.439	32.6298	34.7324
3	-518.384	64.792	3.6e+06	31.6192	33.3596	36.4325
4	-428.773	179.22*	545480*	28.9387*	31.2286*	35.272

Source: Author's Compilation from Stata14.2

4.3.2 ARDL Ordinary Least Square Results

The applied ARDL model represent a dynamic OLS when all the variables are stationary at levels. This approach is significance to the point that a parsimonious model is directly estimated to account for the influence of explanatory variables on GDP per capita. Since all variables are I (0), there is no need to conduct a co-integration test, because there is already a long-run relationship established when all explanatory variables are I(0).

The table below provides regression results covering 1980 to 2023 dataset. The results below show the parsimonious OLS results.

Table 4.9: The Estimated Parsimonious ARDL Model of GDP per capita

GDP-per capit	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
gdp_pc						
L1.	-.2732526	.1398424	-1.95	0.059	-.557764	.0112588
dcps						
--.	-.8922416	.7156395	-1.25	0.221	-2.348221	.5637379
bm						
--.	.7076603	.2558158	2.77	0.009	.1871991	1.228121
L1	-.5502924	.2300082	-2.39	0.023	-1.018248	-.0823371
gcf						
--.	-.2601495	.1764374	-1.47	0.150	-.6191142	.0988152
L1	.4928346	.1751524	2.81	0.008	.1364843	.8491848
trade						
--	.2469116	.0927142	2.66	0.012	.0582832	.545168
L1.	-.2095958	.0983047	-2.13	0.041	-.4095983	-.0095934
popn						
--	1.969584	.7935206	2.48	0.018	.3551544	3.584014
_cons	-8.829397	5.410041	-1.63	0.112	-19.83621	2.177413

ARDL (1,0,1,1,1,0) for gdp per capita, dcps, bm, gcf, trade and popn with max lag of 1 with optimal lag selected by sic using Ordinary Least Square (OLS) approach

Sample:	1981 - 2023	Number of obs	= 43
		F (9, 33)	= 4.18
		Prob > F	= 0.0011
		R-squared	= 0.5325
		Adj R-squared	= 0.4050
Log likelihood =	-130.30543	Root MSE	= 5.7188

Source: Author's Compilation from Stata14.2

Table 4.10 shows a summary model of GDP per capita displaying coefficients of explanatory variables, p-values and the output results. The R-square is a measure of goodness of fit for the model. From the result, R-square is 0.5325, which implies that about 53% of the variation in GDP per capita growth is explained by the independent variables in the model. However, given that the R-square may be highly influenced by the number of explanatory variables, it then important to

rely on the Adjusted R-square in multiple regression, because it can only increase when the explanatory variables add value to the regression and help to get rid-off insignificant variables. Thus, the Adj. R-square is a good measure for the explanatory power of the independent variables. It is shown that about 40% of the explanatory variables add value to the regression.

The F-statistic performed a similar function as the R-square, as it assesses how well a set of independent variables as a group explain the variation in a dependent variable. The Global F-statistics revealed that at least one of the coefficients of the predictors is significant in explaining the dependent variable. In this case, the F-statistics is recorded as 0.0011, which indicates that as a group, at least one among the five (5) independent variables have a significant coefficient at the 1% level of significance. This means that overall, the model is statistically significant.

Also, the Root Mean Square Error (standard errors) is a significant part in regression analysis as it measures the dispersion, of the observed values around the line of regression for a given value of independent variables. (Lind et al., 2023). The result indicates a Root MSE value of 5.7188, which infers minimal deviation and support the accuracy of the model.
The intercept term is -8.83. It represents the value of GDP per capita income growth when all the independent variables are zero.

The lag of the dependent variable is taken to account for delay effect and to assess the impact of persistency of GDP per capita income growth. The lag 1 of the GDP per capita shows a negative relationship and insignificance. The contemporaneous value for DCPS shows a negative relationship with GDP per capita but not significant to impact the dependent variable.

The results show a positive relationship between GDP per capita and the current value for Broad money supply with a significant level at 1%. This suggest that a unit increase in Broad money supply, will positively impact GDP per capita to increase by 0.7077 units. However, the lag 1 of broad money supply shows an inverse relationship with GDP per capita and significant at the 5% level. It explains that in one-year lag period when broad money increase by one unit, GDP per capita would fall by 0.55, everything being equal.

The current value of Gross capital formation maintains a negative relationship with GDP per capita and not significance. Though, the one-year lag period shows a positive association with GDP per

capita and also significance at the 1% level. This propose that in the previous one-year a unit increase in investment, will positively impact GDP per capita to increase by 0.49.

The unlagged value of Trade openness sustains a positive correlation with GDP per capita and also significance at the 5% level. This supposes that a unit increase in Trade, will subsequently influence GDP per capita to rise by 0.25. In contrary, the lag1 value shows a negative association with GDP per capita and significance at 5% level. During the lag period, a unit rise in trade has the tendency to depress GDP per capita by 0.21.

The contemporaneous value for population growth shows a correlation and significance at 5%. This propose that a unit increase in population growth is strong enough to impact a 1.97 unit rise in GDP per capita income growth.

Table 4.10. Summary Dynamic Model of GDP per capita

Variables	Coefficients and Probability Values of Model Variables	
	Coefficient	P-Value
Gdp_pc(t-1)	-0.2732526	0.059
dcps	-0.8922416	0.221
bm	0 .7076603	0.009***
Bm (t-1)	-0.5502924	0.023**
gcf	-0.2601495	0.150
Gcf (t-1)	0.4928346	0.008***
Trade	0.2469116	0.012**
Trade (t-1)	-0.2095958	0.041**
Popn	1.969584	0.018**
Constant	-8.829397	
Prob > F	0.0011	
Observations	43	
R-squared	0.5325	
Adj.R-square	0.4050	
Root MSE	5.7188	

Note: * means significant at 1%, ** means significant at 5%**

Table4.11: Result of the Granger Causality Tests

Hypothesis	Lag	P-Value	Conclusion
GDP_pc does not Granger Cause DCPS	1	0.388	Uni-directional relationship
DCPS does not Granger Cause GDP_pc	1	0.030**	
GDP_pc does not Granger Cause BM	1	0.453	No granger causality relationship
BM does not Granger Cause GDP_pc	1	0.215	

Note *, ** and *** indicates that the null hypothesis is rejected at 1%, 5% and 10% level of significance respectively.

The result of the Granger causality test in table 4.11, indicates that only DCPS granger causes GDP_pc at 5% level of significance, and GDP_pc does not granger cause DCPS. As a result, we fail to reject the null hypothesis that GDP_pc does not Granger Cause DCPS, whilst we reject the null that DCPS does not Granger Cause GDP_pc. The result further revealed that there is no causality between GDP_pc and BM. Hence, in both cases we fail to reject the null hypothesis.

The granger causality test result validates that DCPS, which measured the financial depth and efficiency of financial intermediation granger causes economic development in Sierra Leone, and that Economic development does not granger cause domestic credit to the private sector. The causality test further revealed that economic development and broad money supply (size of financial intermediaries) do not have any causality relationship.

Table 4.12: Residual Diagnostic Tests for the Parsimonious ARDL Model

Test	Type of Test	Test Statistics	P-Value
Normality	Skewness/Kurtosis tests	Chi2 (2) = 0.44	0.8026
Serial-Correlation (second order)	Breusch Godfrey test	Chi2(1)= 7.420	0.0245
Heteroscedasticity	White's test	Chi2(1) =43.00	0.4282

Source: Author's Compilation from Stata14.2

Table 4.11 displayed post estimation diagnostic test to ascertained that the regression meets the criteria of the OLS assumptions that the residuals are normal, the residuals are independent and have constant variance.

4.3.3 Residual Diagnostic Tests

4.3.3.1 Normality test:

H0: the residuals are normal

H1: the residuals are not normal

The result from the skewness and kurtosis test revealed that the p-value exceed the 1% significance level, hence there is enough evidence not to reject the null hypothesis. We conclude that the residuals of the model are normal.

4.3.3.2 Serial Correlation test

H0: there is no serial correlation

H1: there is serial correlation

The Breusch Godfrey test was applied to test for second order serial correlation with a p-value higher that 1%. Hence, we fail to reject the null as there is sufficient evidence at lag 2 to conclude that there is no serial correlation.

4.3.3.3 Heteroscedasticity test

H0: there is constant variance

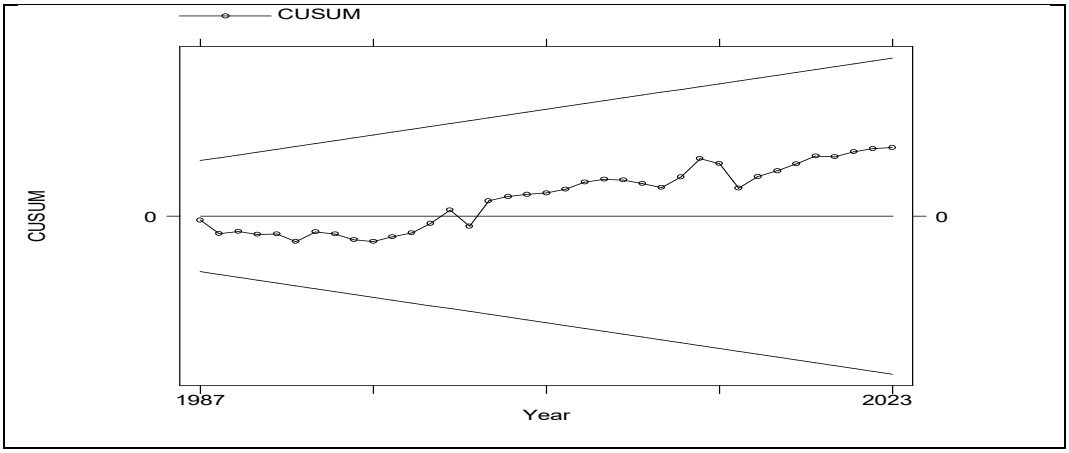
H1: the variance is not constant

The White's test was applied to test for constant variance. Here, the p-value is higher than the 5% significance level. We fail to reject the null and conclude that the variance of the residuals is constant.

4.3.4 The CUSUM test for Stability

From figures 4.2 below, the result of the CUSUM stability tests show that the regression equation appears to be stable because the test statistic lies within the 5 percent critical bound.

Figure4.3 CUSUM test for Stability



Source: Author's Compilation from Stata14.2

CHAPTER FIVE
SUMMARY, DISCUSSION OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.0 Summary

The study examined the effect of financial intermediation on economic development in Sierra Leone with a particular focus on banks as the key financial intermediaries responsible for mobilizing deposits and transmit these funds as loans or other financial instruments to raise investment levels and boost economic growth. Financial intermediaries are well known for resource allocation, cost reduction, minimizing liquidity risk and information asymmetry, improve diversification and develop risk management techniques.

The multiple regression model was built with a number of predictor variables to establish a logical relationship with the predicted variable (GDP per capita). Given that there are a number of possible predictor variables that may influence GDP per capita, and thus, the model brings out a parsimonious result that reasonably predict economic development in Sierra Leone. A simultaneous model building approach was applied, where all the independent variables, such as DCPS, BM, GCF, TOP and POPN are entered into the model and the model was tested. Such method was deemed relevant when there is no theoretical basis for any of the selected variable to be more significance than the other.

The study applied the ARDL dynamic OLS model using secondary annual data from 1980 to 2023 to capture the effect of the regressors on GDP per capita. The variables used in the model were all tested for stationarity using the ADF test, ADF- GLS test, and the Perron-Vogelsang test, which tests for unit root by accounting for one endogenous break date. The summary unit roots test concludes that all the variables are stationary at levels, thus, there was no need to conduct co-integration test.

The data collected from WDI were analyzed using STATAs software. The regression results explained that about 53% variation of GDP per capita in Sierra Leone was explained by the explanatory variables, holding everything constant (ceteris paribus), while the remaining 47% could be accounted for other variables or factors not included in the model. The Global F-statistics further validates that as group, at least one among the five (5) independent variables have a significant coefficient at the 1% level of significance. This means that overall, the model is a good fit and statistically significant. The Root MSE value of 5.7188, confirmed minimal deviation and

support the accuracy of the model. The intercept term is -8.83. It represents the value of GDP per capita income growth when all the independent variables are zero.

5.1 Discussion of Findings:

The estimated model results revealed the following:

i. The unit root result of the ADF test shows that all the variables are stationary at levels except BM, which was found stationary after first differencing. The ADF-GLS test result indicates that all variables are stationary at levels except for DCPS and BM. After the endogenous break points was accounted for, DCPS, BM and GCF were stationary at levels, whilst GDP per capita was stationary after first differencing and population growth was stationary after second differencing.

ii. The summary unit root result combined both the ADF-GLS test and the Perron-Vogelsang test based on the idea that we select I (0) from ADF-GLS even if the Perron Vogelsang test shows that the variable is I(1). Also, we select I(0) from Perron Vogelsang in the case the ADF-GLS test is not I(0).

iii. The lag(t-1) of the dependent variable account for delay effect on the current value of GDP per capita and then assessed the impact of persistency of GDP per capita income growth. A significance positive persistency effect or inertia relates that if GDP per capita was high in the previous period, it may tend to be also high in the current period. Equally, a negative significance persistency may incline that a high value of GDP per capita in the previous period, may lead to a low current value of GDP per capita. The result indicates that GDP per capita (t-1) shows a negative relationship but insignificance. This implies that there is no persistence effect and that the previous values of GDP per capita in Sierra Leone does not predict the current GDP per capita value. This gives an indication that the other independent variables in the model may exert greater influence on GDP per capita.

iv. The contemporaneous value for DCPS shows a strong negative (-0.89) relationship with GDP per capita but not significant to impact economic development in Sierra Leone. This is consistent with John and Nwekemezie, (2019). This suggest that despite a unit increase in DCPS is associated to a massive decline of 0.89 units of GDP per capita, we cannot reject the null that the coefficient of DCPS has no effect on GDP per capita. The result contradicts a prior expected sign and other claims that DCPS support development in Sierra Leone. This could be attributed to poor management of domestic credits, diversion of funds to unproductive sectors and possibly crowding out effect of public sector investments.

v. The current value for broad money supply shows a strong positive (0.71) association with GDP per capita with a significant level at 1%. This is in line with the a priori expectation of the variable and suggest that a unit increase in broad money supply, will positively impact GDP per capita to increase by 0.71 unit. This reflect that in the short run, the monetary policy in Sierra Leone is significance to create economic growth with the expectation that increase money supply would lower interest rates, boost investments, increase employment and higher productivity in the economy. However, the lagged (t-1) of broad money supply shows an inverse (-0.55) relationship with GDP per capita and significant at the 5% level. This is consistent with Yakubu *et. al*. (2021) and Tongurai and Vithessonthi, (2018). It explains that in one-year lagged period when broad money increase by one unit, GDP per capita would fall by 0.55 units. The negative lagged period echoed the long-run reversal effect from the unsustainable gains in the short run period of the monetary policy. This normally occurs if the short run gains in monetary policy is not supported by real sector growth, with assumption that inflation engulf current growth.

vi. DCPS, granger causes economic development in Sierra Leone, but Economic development does not granger causes DCPS. This result is consistent with Croitoru, (2012), Levine, R. (1997), Yakubu *et. al*. (2021), Forgha, *et.al.,* (2016) and Tarawally. *et.al.,* (2015) that economic development is supported by financial development. However, the result indicates that economic development and broad money supply do not have any causality relationship. This is consistent with Toby and Dibiah (2022),.

vii. The current value of GCF maintains a weak negative (-0.26) relationship with GDP per capita but not significance to impact economic development in Sierra Leone. Thus, we cannot conclude that increase in current investment thwart economic development, since the null hypothesis cannot be rejected that the coefficient of GCF is zero. Though, the one-year lagged period shows a moderate positive (0.49) association with GDP per capita and significance at the 1% level. This proposed that 'all things being equal' in the previous one-year a unit increase in investment, will positively impact GDP per capita to increase by 0.49 units. The lagged sign is in line with the a priori expectation of investment, which subsequently relate that the effect of investment may not show up early in the short-run, as it normally takes time for investments to translate to real productive outputs and successively impact economic development.

viii. The unlagged value of trade openness sustained a weak positive (0.25) correlation with GDP per capita and also significance at the 5% level. This supposed that 'all things being

equal', a unit increase in trade openness, will subsequently influenced GDP per capita to rise by 0.25 units. This is consistence to economic theories that support the benefit of trade to economic development. Contrary, the lagged (t-1) of trade openness value shows a weak negative (-0.21) association with GDP per capita and significance at 5% level. During the lagged period, a unit rise in trade has the tendency to depress GDP per capita by 0.21 units.

ix. The contemporaneous value for population growth shows a positive correlation and significance at 5%. This proposed that 'all things being equal' a unit increase in population growth is strong enough to influence a 1.97 unit rise in GDP per capita income growth. This is an intriguing findings that contradict the a priori expectation of the variable. Sierra Leone as a developing economy has enormous demographic potential in terms of its youthful population, which may have indications of positive impact on economic development in the country.

5.2 Conclusion

Based on the findings**,** answers to the research questions were obtained and the narrative is stated below:

i. It was revealed that financial intermediation in terms of DCPS, which measure financial depth and efficiency is weak and insignificant to impact growth. Likely attributed to poor management of domestic credits, high non-performing loans, diversion of funds to unproductive sectors and possibly crowding out effect of public sector investments. However, financial intermediation measured by broad money supply positively impact economic development in the short run but negative effect in the long run. This suggest that expansionary monetary policy trigger economic development but prone to long-run reversal due to unsustainable short-run growth.

ii. The granger causality test result validates that economic development and broad money supply do not have any causality relationship. However, DCPS granger causes economic development, but Economic development does not granger cause DCPS. It is then concluded that Sierra Leone depicts the finance-growth hypothesis.

iii. The study concludes that the effect of investment may not show up early in the short-run, as it normally takes time for investments to translate to real productive outputs and successively impact economic development in the long run.

Also, the current value of trade openness shows a positive impact on economic development. This support the idea that trade boost economic development. Contrary, the lagged (t-1) of trade openness value shows a weak negative impact on development as a rise in trade depress GDP per capita.

Population growth shows a surprisingly positive impact on economic development. This result may reflect the country's demographic potential of its youthful population that has the potential to project economic development.

5.3 Recommendations

Based on the results obtained from the study, the following recommendations are proposed for policy makers in Sierra Leone to implement and promote the transformation of financial intermediaries in the country.

5.4.1. Boast a productive Private sector growth

The findings of the study propose that domestic credit to the private sector generated by the financial intermediaries is insufficient to stimulate economic development in Sierra Leone. This may be attributed to mismanagement of funds, poor credit quality leading to diversion to unproductive and high risks investments, which may result to negative economic returns. The Government of Sierra Leone (G0SL) should implement viable strategies that would allocate resources to productive sectors like Agriculture, Small Medium Enterprises (SMEs) and Manufacturing to encourage private sector growth and development. GoSL should consider to develop the capital market in Sierra Leone, which is currently lacking to facilitate bonds and equity transaction as supplement to long term financing and to improve the efficiency of capital allocation to sectors with the potential to yield the maximum returns.

Also, GoSL should strenthen the legal and regulatory framework for financial institutions, and reinforce contract agreements. This would encourage intermediaries to release more funds to the private sector with the assurance that the law will take its course in the event of default.

Moreover, fiscal dominance may pose as a key challenge, which may lead to crowding out effect triggered by the increased appetite of public borrowing. This has the tendency to increase interest rates and making borrowing expensive for the private sector. Based on this, BSL should implement

an appropriate monetary policy rate that would encourage financial deepening and private sector lending, which has the propensity to boost investments, create more jobs and generate significance expansionary growth in the economy.

5.4.2. Prudent monetary stability policy in tandem with rationalize public spending

Money supply in Sierra Leone has a significant impact on economic growth in the short-run, despite these gains, the result quickly reverses in the subsequent period with a negative effect likely due to inflationary pressure exceeding real growth. The result is consistent with the quantity theory of money, which generally assert that increased volumes of money leads to high price levels. Based on this, the BSL should be cautioned on monetary growth, because the impact of increased money supply is not sustainable and subsequently impede economic growth in the long run. Further, BSL should maintained prudent monetary stability policy in tandem with rationalize public spending to reduce inflationary pressure from the fiscal policy arm. The result directs that the short run gains in monetary policy is not supported by real sector growth, as inflationary weight exceed real growth. It is therefore recommended that Government to create the enabling environment to encourage investors and scale up the productive capacity in the country.

5.4.3. Government to reinforce Trade Liberalization, Regional and International Trade Agreements

Given that the short run growth impact of trade is not sustainable it is therefore recommended that GoSL should continue implementing trade liberalization policies and foster regional and international trade agreements. This could reduce gross trade inefficiencies, lower associated trade costs, diversify production to mitigate primary commodity price decline and broaden new trade partners and international markets to attract a favorable trade balance and long-run economic growth.

5.4.4. Government to encourage Financial deepening and infrastructure development

Given that mobilizing savings to fund basket of investment projects is one of the objectives of financial intermediation, it is therefore recommended that government and policy makers should formulate policies that would develop the financial intermediaries to expand on financial deepening, garner more deposits, and attract investors to boast the investment climate and subsequently drips down to economic development. Again, GoSL should provide support to state owned banks to deepen financial intermediation, and also focus her spending pattern to

infrastructure development like good roads, electricity, healthcare facilities, which would motivate both local and foreign investors to invest and in turn enhance economic growth.

5.4.5. Government to concentrate on capacity building programs for the youthful population

It is therefore recommended that Government initiate and implement policies that will capacitate the youths, by providing technical skills in various craftsmanship like tailoring, masonry, carpentry, driving, electrical, as well as, career professional programs to the level of university. It is expected that empowerment of the youth will successively promote employment, increase bank deposits, promote investments and economic development in the country.

Finally, a deep dive study is required to investigate the broader spectrum of the financial sector landscape that will consider the non-bank financial sector in the country.

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APPENDICES

Appendix table 1: Data Variables

Year	GDP per capita growth (annual %)	Domestic credit to private sector by banks (% of GDP)	Broad money (% of GDP)	Gross capital formation (% of GDP)	Trade (% of GDP)	Population growth (annual %)
Year	GDP_Per Capita	DCPS	BM	GCF	Trade	Pop_G
1980	2.7436616	7.1458243	22.5694505	16.2094331	61.0817828	1.9937113
1981	0.7971947	7.4044266	20.7111902	19.0914719	62.7534437	2.0224772
1982	2.6292369	6.8756622	26.1539420	13.3811156	41.6889997	2.0525913
1983	-4.1934459	6.8722350	29.4424604	14.2796226	33.1059112	2.1325866
1984	1.8077791	3.9490749	25.9662942	12.7056237	23.0298589	2.1906437
1985	-7.4114058	3.0481098	27.7812129	10.9232526	31.4318442	2.2142861
1986	-1.2270216	4.6913032	28.9634888	10.6364097	26.9269777	2.4419354
1987	4.3806882	2.6923283	16.6750627	10.1860099	55.1530794	2.6817348
1988	-9.5620879	3.2201429	17.1359863	5.8941843	43.1161651	2.6996958
1989	-1.7632786	4.6441833	18.3503696	8.3255681	41.5884173	2.4979482
1990	-0.6217505	3.1427337	18.1101884	13.0059155	68.6906674	3.9561390
1991	1.1180577	3.4761311	13.6295716	10.9088699	60.2440496	1.1711242
1992	-17.5706784	3.0203951	12.3187894	8.3697742	64.4928753	-1.8996051
1993	1.5132422	3.4028114	11.6901978	7.7481143	52.8598376	-0.2219261
1994	-2.3851386	3.0982516	10.3728806	8.6637705	55.1600675	0.3835431
1995	-8.1954057	2.6271561	10.0947389	5.5728661	45.0292504	0.1454453
1996	1.2103132	2.3878958	9.9259121	11.0360043	49.5955307	0.4781597
1997	-7.1090683	2.9365995	15.1749274	-2.4243579	28.2780240	1.2896541
1998	0.7569326	2.5581479	13.4020517	5.3134753	35.3326796	0.9841356
1999	-2.5305945	2.0066088	16.0766965	0.2928698	33.7491637	0.5167981
2000	4.1185545	2.0322557	16.3574533	1.0968104	57.5299629	2.4154041
2001	-11.6100017	0.0015445	13.3750173	10.9930815	22.9733446	5.9055188
2002	19.5576575	0.0019484	14.2049575	11.8061521	24.8775013	5.7697012
2003	5.1706257	0.0028423	13.9859971	11.3298828	29.6907242	4.0649901
2004	2.9684666	0.0034519	13.9877465	10.4298355	29.5152907	3.3806157
2005	1.5992105	0.0032766	15.0742810	11.4096086	30.3948838	2.6894728
2006	2.0135632	0.0033798	15.6331659	10.2735622	27.1234823	2.2066694
2007	5.6242171	0.0043490	15.9053599	9.5505986	26.1440617	2.1961143
2008	2.8099406	0.0056593	17.4784217	9.2492907	25.6146730	2.4970221
2009	0.4233331	0.0082763	20.9883672	9.9411131	26.8701473	2.6933686
2010	3.7074994	0.0077711	20.8084149	31.0874730	32.7773049	2.7215086

2011	3.1932151	0.0076488	21.6926057	42.0752210	46.2492579	2.6097826
2012	12.2116152	0.0054905	20.5012420	27.9490243	54.6629703	2.5325949
2013	18.0146535	0.0047148	17.5205626	13.7613157	55.9039002	2.4572573
2014	1.9846348	0.0048434	20.3977866	13.6890610	53.1759878	2.3890583
2015	-22.3833148	0.0052164	0.0239642	15.4071391	42.3688497	2.3181940
2016	3.8045376	0.0054382	0.0250908	19.1427430	48.2965495	2.3545734
2017	1.2719495	0.0050171	0.0237469	18.5932108	47.6151372	2.3857895
2018	1.0547690	0.0055921	0.0230385	14.8283740	37.3774603	2.3473104
2019	2.8267631	0.0060934	0.0232312	12.5320342	37.5619530	2.3214646
2020	-4.1965510	0.0058816	0.0295230	12.1008430	30.6117871	2.3084720
2021	1.7968795	0.0070902	0.0324418	11.1668653	42.1536157	2.2746302
2022	1.2325528	0.0061270	0.0354639	11.7369913	45.0667938	2.2259846
2023	1.2498198	0.0054267	0.0333824	11.7410802	55.8689763	2.1952426

Source: WDI, 2025

Appendix table 2: Descriptive Statistics

```
. summarize gdp_percapita dcps bm gcf trade pop_g

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
gdp_percap~a |         44    .2916323    7.336795  -22.38331   19.55766
        dcps |         44    1.848849     2.28371   .0015445   7.404427
          bm |         44    14.15242    8.633814   .0230385   29.44246
         gcf |         44    12.31844    7.460398  -2.424358   42.07522
       trade |         44    41.90303     13.0213   22.97334   68.69067
-------------+---------------------------------------------------------
       pop_g |         44     2.20436    1.328684  -1.899605   5.905519
```

Source: Author's computation

Appendix table 3: Pairwise Correlation of Model Variables

```
. pwcorr gdp_percapita dcps bm gcf trade pop_g , sig star(5)

             | gdp_pe~a     dcps       bm      gcf    trade    pop_g
-------------+------------------------------------------------------
gdp_percap~a |   1.0000
             |
             |
        dcps |  -0.2009   1.0000
             |   0.1909
             |
          bm |   0.1304   0.5462*  1.0000
             |   0.3989   0.0001
             |
         gcf |   0.2562  -0.1731   0.0891   1.0000
             |   0.0932   0.2611   0.5650
             |
       trade |   0.0118   0.2896  -0.1272   0.1515   1.0000
             |   0.9392   0.0566   0.4106   0.3262
             |
       pop_g |   0.3433* -0.3195*  0.0847   0.2383  -0.3770*  1.0000
             |   0.0225   0.0345   0.5848   0.1194   0.0116
```

Source: Author's computation

Appendix table 4: Partial Correlation of Model Variables

Partial and semipartial correlations of gdp_percapita with

Variable	Partial Corr.	Semipartial Corr.	Partial Corr.^2	Semipartial Corr.^2	Significance Value
dcps	-0.2606	-0.2370	0.0679	0.0562	0.1044
bm	0.2597	0.2362	0.0675	0.0558	0.1055
gcf	0.0612	0.0538	0.0037	0.0029	0.7076
trade	0.2273	0.2049	0.0516	0.0420	0.1585
pop_g	0.2662	0.2425	0.0708	0.0588	0.0969

Source: Author's computation

Appendix table 5: Optimal Lag Selection Result

```
. varsoc gdp_percapita dcps bm gcf trade pop_g

   Selection-order criteria
   Sample:  1984 - 2023                        Number of obs      =        40
```

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-690.596				5.4e+07	34.8298	34.9214	35.0831
1	-581.746	217.7	36	0.000	1.4e+06	31.1873	31.8285	32.9606*
2	-550.781	61.931	36	0.005	2.1e+06	31.439	32.6298	34.7324
3	-518.384	64.792	36	0.002	3.6e+06	31.6192	33.3596	36.4325
4	-428.773	179.22*	36	0.000	545480*	28.9387*	31.2286*	35.272

```
   Endogenous:  gdp_percapita dcps bm gcf trade pop_g
    Exogenous:  _cons
```

Source: Author's computation

Appendix table 6: The Estimated Parsimonious ARDL Model of GDP per capita

```
. ardl gdp_percapita dcps bm gcf trade pop_g, maxlag(1)

ARDL(1,0,1,1,1,0) regression

Sample: 1981 - 2023                             Number of obs     =         43
                                                F(   9,     33)   =       4.18
                                                Prob > F          =     0.0011
                                                R-squared         =     0.5325
                                                Adj R-squared     =     0.4050
Log likelihood = -130.30543                     Root MSE          =     5.7188
```

gdp_percapita	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
gdp_percapita						
L1.	-.2732526	.1398424	-1.95	0.059	-.557764	.0112588
dcps	-.8922416	.7156395	-1.25	0.221	-2.348221	.5637379
bm						
--.	.7076603	.2558158	2.77	0.009	.1871991	1.228121
L1.	-.5502924	.2300082	-2.39	0.023	-1.018248	-.0823371
gcf						
--.	-.2601495	.1764374	-1.47	0.150	-.6191142	.0988152
L1.	.4928346	.1751524	2.81	0.008	.1364843	.8491848
trade						
--.	.2469116	.0927142	2.66	0.012	.0582832	.43554
L1.	-.2095958	.0983047	-2.13	0.041	-.4095983	-.0095934
pop_g	1.969584	.7935206	2.48	0.018	.3551544	3.584014
_cons	-8.829397	5.410041	-1.63	0.112	-19.83621	2.177413

Source: Author's computation

Appendix table 7: Vector Autoregressive (VAR) Tests

```
. var gdp_percapita dcps bm, lags(1/1)

Vector autoregression

Sample:  1981 - 2023                            Number of obs     =         43
Log likelihood =  -305.3323                     AIC               =   14.75964
FPE            =   516.7868                     HQIC              =   14.94089
Det(Sigma_ml)  =   295.2648                     SBIC              =   15.25114

Equation           Parms      RMSE     R-sq      chi2     P>chi2
------------------------------------------------------------------
gdp_percapita          4   7.29924   0.0999   4.772045   0.1893
dcps                   4   .752596   0.8870   337.6582   0.0000
bm                     4   4.14343   0.7863   158.1971   0.0000
------------------------------------------------------------------
```

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
gdp_percapita						
gdp_percapita L1.	-.139373	.1545697	-0.90	0.367	-.4423241	.163578
dcps L1.	-1.276492	.5869437	-2.17	0.030	-2.426881	-.1261038
bm L1.	.1952538	.1575266	1.24	0.215	-.1134926	.5040002
_cons	-.1405123	2.142327	-0.07	0.948	-4.339397	4.058372
dcps						
gdp_percapita L1.	-.0137696	.0159371	-0.86	0.388	-.0450057	.0174665
dcps L1.	.8813417	.0605175	14.56	0.000	.7627296	.9999537
bm L1.	-.002588	.0162419	-0.16	0.873	-.0344216	.0292456
_cons	.0995976	.2208869	0.45	0.652	-.3333328	.5325279
bm						
gdp_percapita L1.	.0658816	.0877419	0.75	0.453	-.1060894	.2378526
dcps L1.	.4058784	.3331802	1.22	0.223	-.2471428	1.0589
bm L1.	.8341617	.0894204	9.33	0.000	.658901	1.009422
_cons	1.091819	1.216098	0.90	0.369	-1.291689	3.475327

Source: Author's computation

Appendix table 8: Granger Causality test

```
. vargranger

  Granger causality Wald tests
```

Equation	Excluded	chi2	df	Prob > chi2
gdp_percapita	dcps	4.7298	1	0.030
gdp_percapita	bm	1.5364	1	0.215
gdp_percapita	ALL	4.7308	2	0.094
dcps	gdp_percapita	.74649	1	0.388
dcps	bm	.02539	1	0.873
dcps	ALL	.93806	2	0.626
bm	gdp_percapita	.56379	1	0.453
bm	dcps	1.484	1	0.223
bm	ALL	1.6213	2	0.445

Source: Author's computation

Appendix table 9: Normality test (Skewness/Kurtosis tests)

```
. sktest mol_resid

                    Skewness/Kurtosis tests for Normality
                                                              ------- joint -------
    Variable |        Obs  Pr(Skewness)  Pr(Kurtosis) adj chi2(2)    Prob>chi2
-------------+-------------------------------------------------------------------
   mol_resid |         43      0.5119        0.9998        0.44          0.8026
```

Source: Author's computation

Appendix table 10: Serial-Correlation (Breusch Godfrey test)

```
. estat bgodfrey, lags(1 2)

Breusch-Godfrey LM test for autocorrelation
```

lags(*p*)	chi2	df	Prob > chi2
1	7.289	1	0.0069
2	7.420	2	0.0245

H0: no serial correlation

Source: Author's computation

Appendix table 11: Heteroscedasticity (White's test)

```
. estat imtest, white

White's test for Ho: homoskedasticity
         against Ha: unrestricted heteroskedasticity

         chi2(42)     =     43.00
         Prob > chi2  =    0.4282

Cameron & Trivedi's decomposition of IM-test

---------------------------------------------------
              Source |       chi2     df       p
---------------------+-----------------------------
  Heteroskedasticity |      43.00     42    0.4282
            Skewness |      12.40      9    0.1915
            Kurtosis |       0.35      1    0.5566
---------------------+-----------------------------
               Total |      55.75     52    0.3357
---------------------------------------------------
```

Source: Author's computation