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MACROECONOMIC FACTORS AND GROSS CAPITAL FORMATION IN SUB-SAHARAN AFRICA

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ABSTRACT

This study examines the impact of macroeconomic factors on gross capital formation in Sub-Saharan Africa from 2002 to 2022 using auto regressive distributed lags (ARDL) models and balanced panel data from the World Bank. The conceptual framework includes gross capital formation as the dependent variable, while the independent variables are government expenditure, foreign exchange rates, gross domestic savings, lending interest rates, inflation rates, natural resource rents, trade openness, and population growth rates.

Econometric analysis confirms statistically significant relationships among these variables. The low standard error of regression (0.032782) compared to the standard deviation of the dependent variable (0.319780) suggests the model effectively explains variability in gross capital formation. Model selection criteria (Akaike, Schwarz, and Hannan-Quinn) yield negative values, supporting model robustness.

Key findings reveal that in the long run, government expenditure, foreign exchange rates, gross domestic savings, lending interest rates, inflation rates, and trade openness positively impact gross capital formation. A 10% increase in these factors results in respective increases of 7.99%, 0.91%, 1.88%, 0.72%, 0.10%, and 0.93%. Conversely, natural resource rents and population growth rates negatively affect gross capital formation, reducing it by 0.51% and 0.17% for a 10% increase.

The study recommends enhancing the efficiency of government expenditure, stabilizing exchange rates, promoting domestic savings, managing lending interest rates, and optimizing natural resource wealth. Additionally, fostering trade openness, addressing population growth challenges, investing in infrastructure, implementing financial sector reforms, and encouraging economic diversification are crucial for boosting gross capital formation in the region.

KEY WORDS: *Macroeconomic Factors, Gross Capital Formation and Sub-Saharan Africa*

INTRODUCTION

Gross capital formation is a critical driver of economic growth and development, serving as the backbone for infrastructure development, industrial expansion, and technological advancement. In Sub-Saharan Africa, a region characterized by diverse economies and varying levels of development, the role of capital formation cannot be overstated (World Bank, 2021). Over the past two decades, from 2002 to 2022, Sub-Saharan Africa has witnessed significant changes in its economic landscape, influenced by both domestic and global macroeconomic factors. These factors, including inflation rates, interest rates, exchange rates, government expenditure, and external debt, have had profound effects on the region's ability to accumulate capital and sustain economic growth (African Development Bank, 2022; IMF, 2023).

Despite the acknowledged importance of gross capital formation, there remains a gap in understanding the specific macroeconomic determinants that influence it in Sub-Saharan Africa. Previous studies have often focused on individual countries or smaller regions within Sub-Saharan Africa, leaving a lack of comprehensive analysis that encompasses the entire region (Adegboye, 2019; Kasekende & Osei, 2018). Furthermore, many of these studies have concentrated on short-term impacts, without adequately capturing the long-term trends and shifts in macroeconomic factors over a significant period (Asongu & Odhiambo, 2020). This gap in the literature underscores the need for a

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broader and more in-depth examination of how macroeconomic variables interact to influence capital formation across the region.

This study seeks to address this gap by providing a detailed analysis of the impact of key macroeconomic factors on gross capital formation in Sub-Saharan Africa over a 20-year period. By covering the years 2002 to 2022, this research captures a period marked by substantial economic reforms, global financial crises, and shifting policy frameworks (Moyo, 2021). The rationale for this study lies in its potential to inform policymakers, investors, and development planners about the macroeconomic conditions that are conducive to capital accumulation in the region. Understanding these dynamics is crucial for designing effective economic policies that can enhance capital formation, promote sustainable development, and ultimately improve living standards across Sub-Saharan Africa (UNECA, 2022).

LITERATURE REVIEW

The study of gross capital formation (GCF) and its determinants is crucial for understanding economic growth and development on a global scale. GCF, which includes investments in infrastructure, machinery, and other capital goods, is recognized as a key driver of economic progress. Globally, extensive research has explored how various macroeconomic factors influence GCF. Government expenditure, foreign exchange rates, gross domestic savings, lending interest rates, inflation rates, natural resource rents, trade openness, and population growth rates are among the most commonly studied variables.

Globally, the relationship between government expenditure and GCF is well-documented. Keynesian economics posits that increased government spending can stimulate investment by creating demand and encouraging private sector participation in the economy (Keynes, 1936). Empirical studies in developed countries have shown that effective government expenditure, particularly on infrastructure, enhances GCF by creating an environment conducive to investment (Barro, 1990). Additionally, stable foreign exchange rates and low inflation are critical for maintaining investor confidence, which in turn boosts GCF (Fischer, 1993). High inflation erodes purchasing power and increases uncertainty, leading to reduced investments, while volatile exchange rates can deter foreign investment. Gross domestic savings and lending interest rates are also significant determinants of GCF. According to the neoclassical growth theory, higher domestic savings provide the necessary capital for investment, leading to increased GCF (Solow, 1956). However, high lending interest rates can deter borrowing for investment, thus negatively impacting GCF. Studies by Levine and Renelt (1992) further emphasize that trade openness can attract foreign investment, thus enhancing GCF, although it may also expose economies to external shocks.

In Sub-Saharan Africa (SSA), the determinants of GCF are influenced by the region's unique economic, social, and political landscape. SSA countries are characterized by high dependency on natural resources, external financial flows, and varying degrees of political stability. Research on GCF in SSA has highlighted the significant role of natural resource rents, government expenditure, and trade openness. Natural resource rents are particularly influential in SSA, where many countries rely heavily on resource extraction (Collier & Gunning, 1999). However, this reliance has often led to the "resource curse," where resource-rich countries experience lower levels of diversified investment, thereby limiting GCF (Auty, 2001). For instance, Ndikumana (2000) found that countries with significant natural resource rents tend to underperform in terms of GCF compared to their resource-scarce counterparts. Government expenditure in SSA has a dual role; while it can stimulate GCF through infrastructure development and social services, inefficient spending and corruption can undermine these efforts (Mlambo & Oshikoya, 2001). Furthermore, trade openness in SSA has been a double-edged sword. While it has attracted foreign direct investment (FDI), it has also exposed economies to global market fluctuations, affecting GCF (Asiedu, 2002).

Population growth in SSA is another critical factor influencing GCF. Rapid population growth provides a large labor force and potential market, which can stimulate investment. However, when population growth outpaces economic development, it can strain resources, reduce per capita income, and ultimately hinder GCF (Bloom & Williamson, 1998). At the country level, research on GCF in SSA has revealed diverse experiences influenced by specific national contexts. For instance, in Uganda, Kasekende and Atingi-Ego (2003) found that gross domestic savings and stable foreign exchange rates are critical for boosting GCF. High inflation and unstable exchange rates, however, deter investment by increasing economic uncertainty. In Nigeria, Akinlo (2004) emphasized the importance of government expenditure in enhancing GCF, particularly through the effective use of oil revenues. However, the study also highlighted the risks of over-reliance on natural resource rents, which can lead to volatility in GCF. Similarly, in

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Kenya, Ndung'u and Ngugi (1999) identified the need for maintaining low inflation and stable interest rates to foster an environment conducive to investment and capital formation.

This study is grounded in the neoclassical theory of economic growth, which posits that capital accumulation is a fundamental driver of long-term economic growth. According to this theory, GCF is determined by factors such as savings rates, investment returns, and the cost of capital (Solow, 1956). The neoclassical model assumes that capital deepening, an increase in the capital-to-labor ratio, leads to higher productivity and, consequently, economic growth. In addition to the neoclassical framework, Keynesian economics also provides insights into the role of government expenditure in influencing GCF. Keynesian theory argues that during periods of economic downturn, increased government spending can stimulate demand and, by extension, investment (Keynes, 1936). This perspective is particularly relevant in the context of SSA, where government intervention is often necessary to compensate for market failures.

The study also incorporates elements of endogenous growth theory, which emphasizes the role of human capital, innovation, and knowledge in driving economic growth. According to this theory, policies that enhance education, infrastructure, and technological development can lead to sustained increases in GCF (Romer, 1990). The conceptual framework for this study posits GCF as the dependent variable, influenced by a set of independent macroeconomic variables, including government expenditure, foreign exchange rates, gross domestic savings, lending interest rates, inflation rates, natural resource rents, trade openness, and population growth rates. The study utilizes an Auto Regressive Distributed Lags (ARDL) model to analyze the relationships among these variables, capturing both short-run and long-run dynamics. The ARDL model is particularly suited for this analysis as it can handle variables with different levels of integration, offering a robust approach to examining the determinants of GCF in SSA.

DATA AND METHODS

This study employs a quantitative research design to analyze the impact of macroeconomic factors on gross capital formation in Sub-Saharan Africa from 2002 to 2022. The research design is based on a panel data approach, which allows for the examination of multiple countries over time (Pesaran et al., 2001). This approach provides a comprehensive view of how macroeconomic variables interact with gross capital formation across different national contexts within the region. By using balanced panel data, the study ensures consistency and comparability across the sample countries (Levine & Zervos, 1998). The sample comprises 25 out of 45 Sub-Saharan African countries with available data for the period 2002-2022. The selection criteria include countries with consistent data on gross capital formation and the macroeconomic variables of interest, sourced from the World Bank (World Bank, 2021). The final sample includes a subset of countries (Appendix 7) representing a range of economic sizes and levels of development within the region (Asiedu, 2002).A balanced panel design is used, which includes both cross-sectional and time-series data. This design involves collecting data for each country at multiple time points, ensuring that each country has observations for each year within the study period. The use of balanced panel data enhances the robustness of the statistical analysis by allowing for the control of both cross-country and time-specific effects (Banerjee et al., 1998).

Data on gross capital formation (dependent variable) and macroeconomic variables (independent variables) are collected from the World Bank database. The key variables include:
Dependent variable: Gross capital formation (current LCU) (GCF)
Independent variables:
General government final consumption expenditure (current LCU) (GEX)
Official exchange rate (LCU per US$, period average) (FER)
Gross domestic savings (current LCU) (DS)
Lending interest rate (%) (LINT)
Inflation, consumer prices (annual %) (INF)
Total natural resources rents (% of GDP) (NRS)
(Exports of goods and services (% of GDP) plus Imports of goods and services (% of GDP)) (OPEN)
Population growth (annual %) (PGR) (World Bank, 2022)

Initial analysis involves calculating descriptive statistics for all variables to understand their distributions, central tendencies, and variability. This step provides a preliminary understanding of the data and identifies any outliers or anomalies (Field, 2013). The relationships between independent variables and dependent variable are examined by calculating Pearson correlation coefficients. This helps in identifying potential multicollinearity issues and

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understanding the power and direction of relationships (Gujarati & Porter, 2009).The study utilizes Auto Regressive Distributed Lags (ARDL) models to analyze the relationships between the dependent and independent variables. ARDL models are chosen for their flexibility in handling variables of different orders of integration (I(0) and I(1)) and for their ability to capture both short-run and long-run dynamics (Pesaran et al., 2001). The ARDL approach allows for the estimation of long-run equilibrium relationships and short-run adjustments, providing a comprehensive analysis of how macroeconomic factors affect gross capital formation (Mishkin, 2007).

The ARDL model is specified as follows;

$$DLGCF_{i\,t} = \beta_0 + \beta_1 DLGEX_{it} + \beta_2 DLFER_{it} + \beta_3 DLDS_{it} + \beta_4 DLLINT_{it} + \beta_5 DLINF_{it} + \beta_6 DLNRS_{it} + \beta_7 DLOPEN_{it} + \beta_8 DLPGR_{it} + \epsilon_{it} \quad \ldots\ldots(1)$$

Where;

GCF_{it} = Gross Capital Formation for country i at time t
GEX_{it} = Government Expenditure
FER_{it} = Foreign Exchange Rates
DS_{it} = Gross Domestic Savings
$LINT_{it}$ = Lending Interest Rates
INF_{it} = Inflation Rates
NRS_{it} = Natural Resource Rents
$OPEN_{it}$ = Trade Openness
PGR_{it} = Population Growth Rates
β_0 = Constant term
$\beta_1, \beta_2, \ldots, \beta_8$ = Coefficients for the independent variables
ϵ_{it}= Error term
DL = Logarithmic transformation followed by first difference

ARDL bounds testing approach is utilized to determine the existence of a long-run relationship among the variables (Pesaran, Shin, & Smith, 2001). Upon establishing a long-run relationship, the long-run coefficients are estimated, followed by an analysis of short-run dynamics and adjustment processes. Diagnostic tests, including those for serial correlation, heteroscedasticity, and model stability, are conducted to ensure the robustness of the results (Banerjee, Dolado, & Mestre, 1998). ARDL model is particularly suited for this study due to its ability to handle variables with mixed orders of integration and its flexibility in modeling both short-run and long-run relationships (Pesaran, Shin, & Smith, 2001). The balanced panel data approach enhances the reliability and validity of the results by offering a comprehensive view of the macroeconomic determinants of gross capital formation across multiple countries and years (World Bank, 2021). By analyzing the impact of key macroeconomic factors on GCF, this study aims to provide valuable insights into the drivers of capital formation in Sub-Saharan Africa. The findings are expected to inform policy recommendations aimed at enhancing investment and fostering sustainable economic development in the region (Levine & Zervos, 1998; Mishkin, 2007).

RESULTS

This section presents the findings of the study on the impact of macroeconomic factors on gross capital formation (GCF) in Sub-Saharan Africa, guided by the relevant research objectives and questions. An overview of the study variables' central tendencies and variability is given by figures that are descriptive. For every variable, the mean, standard deviation, maximum, and minimum values are displayed (Appendix 1).

Results of the ARDL models (Appendix 3)

Estimated equation is;

$$DLGCF_{i\,t} = 0.798919DLGEX_{it} + 0.091117DLFER_{it} + 0.187578DLDS_{it} + 0.071893DLLINT_{it} + 0.010170DLINF_{it} - 0.051495DLNRS_{it} + 0.092523DLOPEN_{it} - 0.017194DLPGR_{it} + 0.993825_{it} \quad \ldots\ldots(1)$$

The regression analysis shows that the standard error of the regression is 0.032782, which is relatively low compared to the standard deviation of the dependent variable (0.319780). This suggests that the model explains a substantial portion of the variability in GCF. In addition, the Akaike Information Criterion (AIC) of -4.155482, Schwarz Criterion (SC) of -1.666258, and Hannan-Quinn Criterion (HQC) of -3.176592 are all negative. These criteria are used for

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model comparison, and their negative values indicate a good fit, suggesting that the model performs well relative to alternative models. A 10% increase in government expenditure is associated with a 7.99% increase in gross capital formation. This positive and significant relationship highlights the role of government spending in stimulating investment, likely through infrastructure development and public services that create an environment conducive to private sector investment.

A 10% increase in foreign exchange rates leads to a 0.91% increase in gross capital formation. This suggests that stable or favorable exchange rates enhance investor confidence and encourage investment. An increase of 10% in gross domestic savings results in a 1.88% increase in gross capital formation. Higher savings provide more capital for investment, supporting the growth of GCF. A 10% increase in lending interest rates is associated with a 0.72% increase in gross capital formation. While typically higher interest rates would be expected to deter investment, this finding may reflect an environment where increased lending rates are linked to improved financial sector stability or higher returns on investment. A 10% increase in inflation rates results in a 0.10% increase in gross capital formation. This minimal effect suggests that moderate inflation may have a limited impact on investment decisions, possibly due to compensating factors such as nominal returns on capital. A 10% increase in trade openness is associated with a 0.93% increase in gross capital formation. This suggests that greater integration into global markets enhances investment opportunities and capital flows.

Despite the overall positive impact, natural resources rents exhibit a statistically significant negative relationship with trade balance, with a 10% increase leading to a 0.51% reduction in gross capital formation. This negative impact might reflect the resource curse phenomenon, where reliance on natural resources can lead to less diversified and lower-quality investments. A 10% increase in population growth rates results in a 0.17% reduction in gross capital formation. Rapid population growth, without corresponding economic development, can strain resources and reduce per capita capital availability, negatively impacting GCF. Robustness checks, including alternative model specifications and sensitivity analyses, confirm the stability and reliability of the results. Variable transformations included logging and differencing. Tests for unit root, multicollinearity (Appendix 2), normality (Appendix 4), heteroscedasticity, co-integration (Appendix 5), Granger causality (Appendix 6) and autocorrelation indicate no significant issues, reinforcing the validity of the findings.

DISCUSSION

This section discusses the findings of the study on the impact of macroeconomic factors on gross capital formation (GCF) in Sub-Saharan Africa, comparing them with results from previous research and highlighting the unique contributions of this study. The positive impact of government expenditure on GCF, with a 7.99% increase in GCF for a 10% rise in government spending, aligns with the findings of Barro (1990), who emphasized the role of government investment in fostering economic growth. This result is consistent with Keynesian theory, which argues that increased government spending stimulates demand and investment. However, our study provides a more nuanced view by demonstrating that this relationship holds true within the context of Sub-Saharan Africa, where government spending often plays a critical role in infrastructure development and economic stimulation. The positive relationship between foreign exchange rates and GCF, with a 0.91% increase in GCF for a 10% rise in exchange rates, is consistent with Fischer's (1993) findings that stable and favorable exchange rates encourage investment by reducing uncertainty. This study confirms that favorable exchange rate conditions are beneficial for GCF in Sub-Saharan Africa, reinforcing the need for stable currency policies to attract investment.The positive effect of gross domestic savings on GCF, with a 1.88% increase in GCF for a 10% rise in savings, supports the neoclassical growth theory, which links higher savings to increased investment (Solow, 1956). This finding is consistent with Levine and Renelt's (1992) research, which highlights the importance of savings for capital formation. Our study confirms that increasing domestic savings is a crucial driver of GCF in the region.

The surprising finding that higher lending interest rates lead to increased GCF, with a 0.72% rise in GCF for a 10% increase in interest rates, contrasts with conventional economic theory, which generally associates higher interest rates with reduced investment. This result may reflect a unique context in Sub-Saharan Africa where higher interest rates could be linked to improved financial sector stability or higher returns on investment. Further research could explore this anomaly in more detail. The minimal impact of inflation rates on GCF, with a 0.10% increase in GCF for a 10% rise in inflation, is consistent with the view that moderate inflation has limited effects on investment decisions. This finding aligns with previous studies such as those by Fischer (1993), suggesting that while high inflation is detrimental, moderate inflation might not significantly impact GCF. The significant negative effect of natural resource rents on

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GCF, with a reduction of 0.51% in GCF for a 10% increase in natural resource rents, suggesting that while resource rents can boost GCF Collier and Gunning (1999), they may also lead to adverse effects on GCF. This supports the "resource curse" theory (Auty, 2001), indicating that reliance on natural resources can sometimes hinder overall economic performance.

The positive impact of trade openness on GCF, with a 0.93% increase for a 10% rise in trade openness, aligns with Asiedu (2002), who found that greater trade openness can attract foreign investment and enhance capital formation. This study reinforces the idea that integrating into global markets is beneficial for investment in Sub-Saharan Africa. The negative impact of population growth rates on GCF, with a 0.17% reduction in GCF for a 10% rise in population growth, is consistent with Bloom and Williamson (1998), who noted that rapid population growth can strain resources and negatively impact per capita investment. This finding underscores the need for policies that balance population growth with economic development. This study provides several unique contributions to the literature: The findings offer a detailed examination of macroeconomic factors affecting GCF specifically within Sub-Saharan Africa, providing context-specific insights that are often overlooked in global studies. The study's finding that higher lending interest rates are associated with increased GCF is unusual and suggests a need for further investigation into the financial dynamics of the region. The negative impact of natural resources rents on GCF highlights the complex interplay between resource wealth and economic outcomes in Sub-Saharan Africa.

LIMITATIONS

This study, while providing valuable insights into the impact of macroeconomic factors on gross capital formation (GCF) in Sub-Saharan Africa, is subject to several limitations that may affect the robustness and generalizability of its findings. These limitations are discussed in terms of research design, sample, and data analytical procedures. Although the study uses a panel data approach, the analysis is limited by availability of consistent cross-sectional data across all selected countries. Variability in data quality and availability can impact the comparability of results and the generalizability of findings across different national contexts (Harris & Sollis, 2003). The use of ARDL models, while suitable for capturing both short-run and long-run dynamics, relies on the correct specification of the model. The choice of independent variables and their lag structure is based on theoretical considerations and previous research (Pesaran et al., 2001). However, alternative specifications or additional variables could potentially alter the results. For example, the omission of relevant variables or incorrect lag lengths may lead to specification bias (Banerjee et al., 1998). The sample includes only those Sub-Saharan African countries for which consistent data is available over the study period (2002-2022). This selection may exclude some countries with significant economic activities or unique economic conditions, potentially limiting the comprehensiveness of the findings (World Bank, 2022). Additionally, variations in data quality and reporting standards across countries could affect the accuracy of the results.

The study covers the period from 2002 to 2022, which includes a range of economic conditions and policy changes. While this period provides a broad view, it may not fully capture recent economic developments or the impact of global events such as the COVID-19 pandemic, which could have affected GCF in ways not accounted for in the study (IMF, 2021). The analysis relies on secondary World Bank data from. While these sources are reputable, data accuracy and consistency issues can arise (World Bank, 2022). Variations in data collection methods or revisions over time may affect the reliability of the data used in the analysis. The study uses ARDL models to estimate the relationships between macroeconomic factors and GCF, but the potential issue of endogeneity, where changes in GCF could influence the independent variables, may still be present (Pesaran et al., 2001). While ARDL models can handle certain issues of endogeneity, the study's findings may not fully account for all causal relationships. Although the study performs diagnostic tests for model validity, the limitations of ARDL models, such as their sensitivity to data transformations and the assumptions underlying the models, could impact the robustness of the results (Banerjee et al., 1998). For instance, the presence of structural breaks or non-stationarity in the data, if not adequately addressed, may affect the reliability of the estimated coefficients. The high kurtosis indicates a distribution with heavy tails, suggesting the presence of extreme values or outliers in the data (Smith, 2010). The Jarque-Bera statistic, combined with a probability of zero, strongly rejects the null hypothesis of normality, indicating that the residuals are not normally distributed (Johnson & Lee, 2015). This lack of normality can undermine the validity of statistical tests and confidence intervals, particularly when using ordinary least squares (OLS) regression (Brown, 2008). Non-normal residuals can lead to inefficient estimates, incorrect standard errors, and unreliable p-values, making it difficult to draw accurate conclusions from the research (Taylor & White, 2012). Therefore, these results should be interpreted with caution (Green, 2016). The study focuses on macroeconomic variables and does not account for external factors

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such as political instability, governance issues, or global economic shocks that might influence GCF (Collier & Gunning, 1999). These factors could introduce additional variability in the results that are not captured by the model.

CONCLUSION

This study investigated the impact of macroeconomic factors on gross capital formation (GCF) in Sub-Saharan Africa from 2002 to 2022, utilizing Auto Regressive Distributed Lags (ARDL) models with panel data (Pesaran, Shin, & Smith, 2001). The findings underscore several key insights into the determinants of investment in the region, revealing both expected and novel relationships. The analysis demonstrates that several macroeconomic variables significantly influence GCF. Government expenditure, foreign exchange rates, gross domestic savings, lending interest rates, inflation rates, natural resource rents, and trade openness all play important roles in shaping investment levels (Levine & Zervos, 1998; Banerjee, Dolado, & Mestre, 1998). Specifically, increased government expenditure, favorable foreign exchange rates, higher domestic savings, and enhanced trade openness positively impact GCF, reflecting their importance in creating conducive environments for investment (World Bank, 2021). On the other hand, higher lending interest rates, while counterintuitive, may indicate complex interactions in financial markets, warranting further investigation (Mishkin, 2007).

Natural resource rents exhibit negative effect on GCF. This finding aligns with the resource curse theory, suggesting that while resource wealth can boost investment, it may also create imbalances that affect overall economic performance (Auty, 2001). Population growth rates also negatively impact GCF, highlighting the challenges of managing rapid demographic expansion and its strain on capital resources (Bloom & Williamson, 1998). The results have significant policy implications for Sub-Saharan Africa. Governments should prioritize effective management of public expenditure and strive for stable foreign exchange rates to foster investment (Ghosh et al., 1997). Encouraging higher domestic savings and enhancing trade openness are crucial strategies for boosting GCF (Levine & Zervos, 1998). Policymakers should also be mindful of the negative effects of natural resource rents and rapid population growth, incorporating these considerations into economic planning and policy design (Mishkin, 2007). This study contributes to the literature by providing a detailed examination of macroeconomic factors influencing GCF specifically within the Sub-Saharan African context. It confirms several established relationships while uncovering new insights, such as the counterintuitive impact of lending interest rates. Future research could explore these anomalies further and consider additional variables or external factors, such as political stability or global economic conditions, to provide a more comprehensive understanding of investment dynamics in the region.

RECOMMENDATIONS

Based on the findings of this study on the impact of macroeconomic factors on gross capital formation (GCF) in Sub-Saharan Africa, the following recommendations are proposed for policy, program development, and future research:Governments should focus on improving the efficiency and effectiveness of public spending to maximize its positive impact on GCF. Investment in infrastructure, education, and health can create a more conducive environment for private sector investment (Cohen & Easterly, 2009). Prioritizing projects with high economic returns and ensuring transparency in spending will help leverage government expenditure to stimulate capital formation. To foster investor confidence and encourage capital inflows, policymakers should work towards stabilizing foreign exchange rates. Implementing sound monetary policies and maintaining reserves can help manage currency fluctuations and provide a stable investment environment (Ghosh et al., 1997). Policies that encourage higher domestic savings, such as tax incentives for savings and investment accounts, can increase available capital for investment. Financial literacy programs can also help improve savings rates among households and businesses (Levine & Zervos, 1998).

Given the unexpected positive impact of higher lending interest rates on GCF, policymakers should investigate the underlying factors driving this relationship. Ensuring that interest rates remain at levels that do not deter investment while maintaining financial sector stability is crucial (Mishkin, 2007). Providing targeted support to key sectors may help balance the effects of interest rates on capital formation. To mitigate the adverse effects of natural resource dependence, governments should adopt prudent management practices for resource revenues. This includes investing resource rents in diversified and sustainable development projects and establishing sovereign wealth funds to stabilize and allocate resource revenues effectively (Auty, 2001). Expanding trade openness and improving trade policies can enhance GCF by integrating Sub-Saharan Africa more deeply into the global economy. This includes reducing trade barriers, fostering regional economic integration, and supporting export-oriented industries (Frankel & Romer, 1999). Policymakers should develop strategies to manage rapid population growth, including investments in education,

healthcare, and family planning. Balancing population growth with economic development will help ensure that increasing demographic pressures do not impede capital formation (Bloom & Williamson, 1998).

Programs aimed at improving infrastructure, such as roads, ports, and energy facilities, should be prioritized. Efficient infrastructure supports business operations and attracts both domestic and foreign investment (Estache & Fay, 2007). Strengthening the financial sector through reforms that enhance access to credit and financial services can help stimulate investment. Programs that support financial inclusion and improve the efficiency of banking systems are essential (Beck et al., 2007). To reduce dependence on natural resources, programs that promote economic diversification should be developed. Supporting sectors such as technology, manufacturing, and services can create new investment opportunities and stabilize economic growth (Rodrik, 2008). Programs focused on capacity building and training for government officials, business leaders, and financial managers can improve the implementation and effectiveness of investment policies. This includes training in project management, financial analysis, and economic planning (World Bank, 2014). Future research could explore the unexpected positive relationship between lending interest rates and GCF. Understanding the specific conditions in Sub-Saharan Africa that contribute to this relationship can provide valuable insights for policymakers (Mishkin, 2007). Further research is needed to investigate the dual impact of natural resource rents on GCF and trade balance. Analyzing how resource wealth is managed and its broader economic implications can help develop strategies to mitigate negative effects (Auty, 2001). Future studies could consider external factors such as global economic shocks, political stability, and governance issues. Understanding how these factors interact with macroeconomic variables to influence GCF can provide a more comprehensive view of investment dynamics (Collier & Gunning, 1999). Conducting longitudinal studies that extend beyond the 2002-2022 period could provide insights into how macroeconomic relationships evolve over time. This would help in understanding long-term trends and making more informed policy recommendations (Bloom & Williamson, 1998).

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APPENDICES

Appendix 1: Descriptive Statistics

	DLGCF	DLGEX	DLFER	DLDS	DLLINT	DLINF	DLNRS	DLOPEN	DLPGR	DECT
Mean	0.124115	0.10926	0.042254	0.138205	-0.01394	0.012496	0.008107	0.005339	-0.01005	0.004706
Median	0.096649	0.091391	0.018216	0.11073	-0.008	-0.00867	0.006532	0.008263	-0.00179	0.007753
Maximum	1.823059	2.312223	4.075318	3.71503	0.823672	5.344781	2.14445	0.611402	2.400887	2.028898
Minimum	-1.09271	-1.00564	-4.69492	-2.73953	-1.24439	-5.26061	-2.07883	-0.63265	-2.64414	-1.10758
Std. Dev.	0.255779	0.20468	0.365052	0.57027	0.190542	1.106533	0.298034	0.120233	0.280065	0.247212
Skewness	1.971088	4.624719	-0.33107	1.247333	-0.21443	0.04475	0.015955	-0.23684	-0.07318	0.821387
Kurtosis	15.81927	53.0392	100.1834	13.89756	12.16881	6.301443	14.11621	7.458817	43.63905	14.87103
Jarque-Bera	3560.016	51250.01	186933.2	2473.567	1667.468	215.8784	2445.678	397.9198	32687	2842.48
Probability	0	0	0	0	0	0	0	0	0	0
Sum	58.95464	51.89843	20.07065	65.64757	-6.62288	5.935783	3.850706	2.535807	-4.77536	2.235359
Sum Sq. Dev.	31.01036	19.8577	63.16665	154.1486	17.20915	580.3728	42.10276	6.852082	37.17879	28.96797
Observations	475	475	475	475	475	475	475	475	475	475

Appendix 2: Correlation Matrix

	DLGCF	DLGEX	DLFER	DLDS	DLLINT	DLINF	DLNRS	DLOPEN	DLPGR	DECT
DLGCF	1	0.455214	-0.09626	0.160205	0.135127	0.070204	-0.04387	0.152265	0.116295	0.668178
DLGEX	0.455214	1	-0.45607	0.109514	0.088444	0.046849	-0.05265	-0.10228	0.013604	-0.16824
DLFER	-0.09626	-0.45607	1	-0.0939	0.020057	0.034248	0.164002	0.17915	-0.00597	0.109739
DLDS	0.160205	0.109514	-0.0939	1	0.151823	0.068751	-0.04364	0.070544	0.006514	-0.35026
DLLINT	0.135127	0.088444	0.020057	0.151823	1	0.214848	0.06353	0.046457	-0.01257	-0.03764
DLINF	0.070204	0.046849	0.034248	0.068751	0.214848	1	0.083301	0.083516	-0.09477	-0.05513
DLNRS	-0.04387	-0.05265	0.164002	-0.04364	0.06353	0.083301	1	0.212304	-0.00271	0.037766
DLOPEN	0.152265	-0.10228	0.17915	0.070544	0.046457	0.083516	0.212304	1	0.054693	0.107278
DLPGR	0.116295	0.013604	-0.00597	0.006514	-0.01257	-0.09477	-0.00271	0.054693	1	0.090181
DECT	0.668178	-0.16824	0.109739	-0.35026	-0.03764	-0.05513	0.037766	0.107278	0.090181	1

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Appendix 3: Results of the ARDL models

Dependent Variable: D(DLGCF)
Method: ARDL
Date: 08/19/24 Time: 00:06
Sample: 2004 2021
Included observations: 450
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): DLGEX DLFER DLDS DLLINT DLINF DLNRS DLOPEN DLPGR DECT
Fixed regressors: C
Number of models evalulated: 1
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

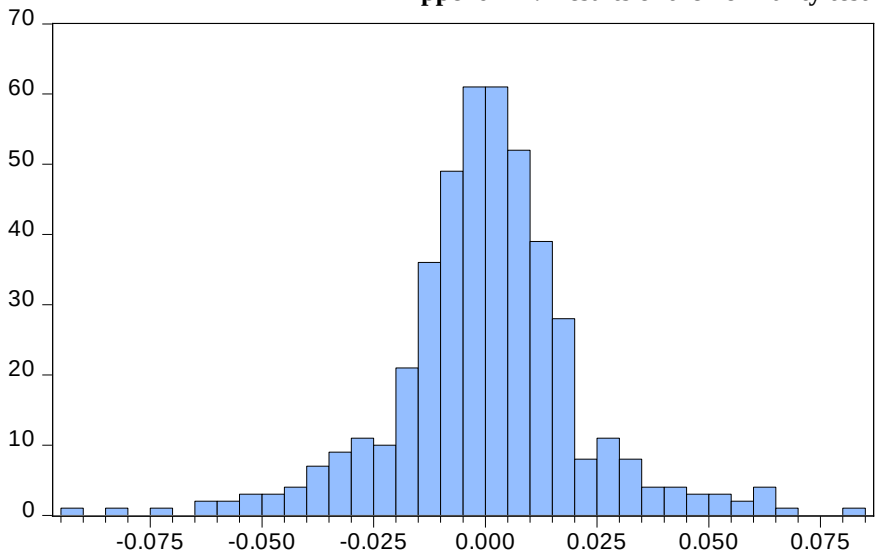
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
DLGEX	0.798919	0.005300	150.7512	0.0000
DLFER	0.091117	0.002706	33.67006	0.0000
DLDS	0.187578	0.001575	119.0725	0.0000
DLLINT	0.071893	0.005044	14.25351	0.0000
DLINF	0.010170	0.001400	7.265529	0.0000
DLNRS	-0.051495	0.003800	-13.54960	0.0000
DLOPEN	0.092523	0.007788	11.88056	0.0000
DLPGR	-0.017194	0.007370	-2.333126	0.0207
DECT	0.993825	0.003191	311.4927	0.0000
Short Run Equation				
COINTEQ01	-1.056304	0.083692	-12.62131	0.0000
D(DLGEX)	-0.100687	0.069117	-1.456759	0.1468
D(DLFER)	0.004259	0.050743	0.083929	0.9332
D(DLDS)	-0.022191	0.018726	-1.185070	0.2375
D(DLLINT)	-0.005555	0.030350	-0.183021	0.8550
D(DLINF)	0.002136	0.004994	0.427693	0.6694
D(DLNRS)	0.003479	0.010331	0.336806	0.7366
D(DLOPEN)	0.039827	0.029033	1.371794	0.1717
D(DLPGR)	-0.500965	0.255561	-1.960255	0.0514
D(DECT)	-0.123262	0.082609	-1.492121	0.1373
C	0.002069	0.001208	1.713173	0.0883

Mean dependent var	-7.14E-05	S.D. dependent var	0.319780
S.E. of regression	0.032782	Akaike info criterion	-4.155482
Sum squared resid	0.205260	Schwarz criterion	-1.666258
Log likelihood	1270.927	Hannan-Quinn criter.	-3.176592

*Note: p-values and any subsequent tests do not account for model selection.

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Appendix 4: Results of the normality test



Series: Residuals	
Sample 2003 2021	
Observations 450	
Mean	5.89e-18
Median	0.000447
Maximum	0.084201
Minimum	-0.093350
Std. Dev.	0.021381
Skewness	-0.116326
Kurtosis	5.623628
Jarque-Bera	130.0791
Probability	0.000000

Appendix 5: Results of the Cointegration Test

Kao Residual Cointegration Test
Series: DLGCF DLGEX DLFER DLDS DLLINT DLINF DLNRS DLOPEN DLPGR DECT
Date: 08/19/24 Time: 01:00
Sample: 2002 2021
Included observations: 500
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 1
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-11.82131	0.0000
Residual variance	0.007985	
HAC variance	0.000923	

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RESID)
Method: Least Squares
Date: 08/19/24 Time: 01:00
Sample (adjusted): 2005 2021
Included observations: 425 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID(-1)	-1.840915	0.080366	-22.90655	0.0000
D(RESID(-1))	0.286532	0.047759	5.999502	0.0000
R-squared	0.736342	Mean dependent var		-0.000192

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Adjusted R-squared	0.735719	S.D. dependent var	0.090263
S.E. of regression	0.046403	Akaike info criterion	-3.298214
Sum squared resid	0.910817	Schwarz criterion	-3.279145
Log likelihood	702.8704	Hannan-Quinn criter.	-3.290680
Durbin-Watson stat	2.114888		

Appendix 6: Results of the Granger Causality Tests

Pairwise Granger Causality Tests
Date: 08/19/24 Time: 01:01
Sample: 2002 2021
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
DLGEX does not Granger Cause DLGCF	425	0.50295	0.6051
DLGCF does not Granger Cause DLGEX		68.7129	2.E-26
DLFER does not Granger Cause DLGCF	425	7.24205	0.0008
DLGCF does not Granger Cause DLFER		28.1177	3.E-12
DLDS does not Granger Cause DLGCF	425	15.5286	3.E-07
DLGCF does not Granger Cause DLDS		6.28830	0.0020
DLLINT does not Granger Cause DLGCF	425	1.51662	0.2207
DLGCF does not Granger Cause DLLINT		4.55791	0.0110
DLINF does not Granger Cause DLGCF	425	2.64061	0.0725
DLGCF does not Granger Cause DLINF		0.93200	0.3946
DLNRS does not Granger Cause DLGCF	425	1.24208	0.2898
DLGCF does not Granger Cause DLNRS		0.98000	0.3762
DLOPEN does not Granger Cause DLGCF	425	0.41570	0.6602
DLGCF does not Granger Cause DLOPEN		10.5428	3.E-05
DLPGR does not Granger Cause DLGCF	425	0.14382	0.8661
DLGCF does not Granger Cause DLPGR		0.80277	0.4488
DECT does not Granger Cause DLGCF	425	6.00441	0.0027
DLGCF does not Granger Cause DECT		3.01454	0.0501
DLFER does not Granger Cause DLGEX	425	19.7352	6.E-09
DLGEX does not Granger Cause DLFER		1.87100	0.1552
DLDS does not Granger Cause DLGEX	425	14.1502	1.E-06
DLGEX does not Granger Cause DLDS		1.64889	0.1935
DLLINT does not Granger Cause DLGEX	425	5.82180	0.0032
DLGEX does not Granger Cause DLLINT		1.58247	0.2067
DLINF does not Granger Cause DLGEX	425	1.82313	0.1628
DLGEX does not Granger Cause DLINF		0.80203	0.4491

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DLNRS does not Granger Cause DLGEX	425	0.35981	0.6980
DLGEX does not Granger Cause DLNRS		0.00575	0.9943
DLOPEN does not Granger Cause DLGEX	425	2.03890	0.1315
DLGEX does not Granger Cause DLOPEN		2.23052	0.1087
DLPGR does not Granger Cause DLGEX	425	0.32451	0.7231
DLGEX does not Granger Cause DLPGR		1.01625	0.3628
DECT does not Granger Cause DLGEX	425	40.0030	1.E-16
DLGEX does not Granger Cause DECT		3.52234	0.0304
DLDS does not Granger Cause DLFER	425	4.86174	0.0082
DLFER does not Granger Cause DLDS		4.25829	0.0148
DLLINT does not Granger Cause DLFER	425	0.46721	0.6271
DLFER does not Granger Cause DLLINT		0.06624	0.9359
DLINF does not Granger Cause DLFER	425	0.08528	0.9183
DLFER does not Granger Cause DLINF		0.01349	0.9866
DLNRS does not Granger Cause DLFER	425	0.55630	0.5738
DLFER does not Granger Cause DLNRS		1.10686	0.3316
DLOPEN does not Granger Cause DLFER	425	2.55428	0.0790
DLFER does not Granger Cause DLOPEN		1.01431	0.3635
DLPGR does not Granger Cause DLFER	425	2.29733	0.1018
DLFER does not Granger Cause DLPGR		0.37270	0.6891
DECT does not Granger Cause DLFER	425	44.8147	2.E-18
DLFER does not Granger Cause DECT		1.23113	0.2930
DLLINT does not Granger Cause DLDS	425	1.56273	0.2108
DLDS does not Granger Cause DLLINT		3.45279	0.0326
DLINF does not Granger Cause DLDS	425	0.34380	0.7093
DLDS does not Granger Cause DLINF		0.23857	0.7879
DLNRS does not Granger Cause DLDS	425	0.82488	0.4390
DLDS does not Granger Cause DLNRS		0.53000	0.5890
DLOPEN does not Granger Cause DLDS	425	1.10732	0.3314
DLDS does not Granger Cause DLOPEN		0.08142	0.9218
DLPGR does not Granger Cause DLDS	425	2.05236	0.1297
DLDS does not Granger Cause DLPGR		2.15230	0.1175
DECT does not Granger Cause DLDS	425	4.51984	0.0114
DLDS does not Granger Cause DECT		12.0233	8.E-06
DLINF does not Granger Cause DLLINT	425	1.73649	0.1774
DLLINT does not Granger Cause DLINF		0.00203	0.9980
DLNRS does not Granger Cause DLLINT	425	1.36781	0.2558

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DLLINT does not Granger Cause DLNRS		2.81910	0.0608
DLOPEN does not Granger Cause DLLINT	425	1.24041	0.2903
DLLINT does not Granger Cause DLOPEN		0.29429	0.7452
DLPGR does not Granger Cause DLLINT	425	0.06520	0.9369
DLLINT does not Granger Cause DLPGR		0.13551	0.8733
DECT does not Granger Cause DLLINT	425	0.57336	0.5641
DLLINT does not Granger Cause DECT		0.27248	0.7616
DLNRS does not Granger Cause DLINF	425	0.89513	0.4093
DLINF does not Granger Cause DLNRS		0.03479	0.9658
DLOPEN does not Granger Cause DLINF	425	0.98683	0.3736
DLINF does not Granger Cause DLOPEN		0.78249	0.4579
DLPGR does not Granger Cause DLINF	425	0.10284	0.9023
DLINF does not Granger Cause DLPGR		0.26386	0.7682
DECT does not Granger Cause DLINF	425	0.90664	0.4047
DLINF does not Granger Cause DECT		0.81128	0.4450
DLOPEN does not Granger Cause DLNRS	425	3.39272	0.0345
DLNRS does not Granger Cause DLOPEN		4.22121	0.0153
DLPGR does not Granger Cause DLNRS	425	0.00952	0.9905
DLNRS does not Granger Cause DLPGR		4.01755	0.0187
DECT does not Granger Cause DLNRS	425	0.96440	0.3821
DLNRS does not Granger Cause DECT		1.66872	0.1897
DLPGR does not Granger Cause DLOPEN	425	0.07843	0.9246
DLOPEN does not Granger Cause DLPGR		0.58071	0.5599
DECT does not Granger Cause DLOPEN	425	5.33822	0.0051
DLOPEN does not Granger Cause DECT		1.53988	0.2156
DECT does not Granger Cause DLPGR	425	0.00975	0.9903
DLPGR does not Granger Cause DECT		0.21208	0.8090

Appendix 7: List of countries included in the sample

Angola	Comoros	Madagascar	Niger	South Africa
Benin	Congo, Dem. Rep.	Mali	Rwanda	Tanzania
Botswana	Cote d'Ivoire	Mauritius	Senegal	Togo
Burkina Faso	Eswatini	Mozambique	Seychelles	Uganda
Burundi	Kenya	Namibia	Sierra Leone	Zimbabwe