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Macroeconomic Dynamics in Uganda: Investigating the Relationships among GDP Growth, Gross Capital Formation, Population Growth and FDI

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Abstract: This paper sought to investigate Uganda's macroeconomic dynamics, informed by the objective of studying relationships among GDP growth, Gross Capital Formation (GCF), population growth, and net inflows of Foreign Direct Investment (FDI) by applying the endogenous growth theory. These key variables include GDP growth, GCF, population growth, and FDI net inflows; secondary data from national databases and international organizations were collected from 2000 to 2022. In this regard, the study follows a quantitative approach by adopting a descriptive and econometric design to investigate the relationship among the aforementioned variables. The methodological tools were Descriptive statistics, stationarity tests, multicollinearity testing, cointegration testing, and ARDL model estimation. These range from relative stability in GDP growth to the highly volatile GCF growth and smooth population growth trends to negative net inflows indicated by FDI. This confirms the long-run cointegration between the variables, whereby GCF proves to be firmly and positively related to GDP through an ARDL model. In contrast, variables FDI and population growth become influential after due lags. The results show that Uganda needs domestic and foreign investment to maintain economic growth; however, it has to deal with disinvestment challenges and an increasing population for long-term stability. This study finds that capital formation and foreign investment are integral to the Ugandan economy and can, if managed appropriately, ensure continued growth by overcoming these challenges in demography and investment.

Keywords: *Macroeconomic Dynamics, Uganda, GDP Growth, Gross Capital Formation, Population Growth, FDI*

1. Background

Macroeconomic dynamics encompass the interdependent variables influencing a nation's overall economic performance, including GDP growth, gross capital formation, population growth, and foreign direct investment (FDI) inflows (Adam, 2021). These variables are intricately connected, influencing the others in complex ways that ultimately shape a country's economic trajectory (Asongu, 2013). For instance, population growth contributes to economic output by increasing labor and boosting domestic demand (Alam, Nur Alam, & Hoque, 2020). Simultaneously, GDP growth fosters improvements in capital formation, as a growing economy attracts more investment into infrastructure and productive assets (Koskei, Buigut, & Kibet, 2013). The relationship between GDP and FDI is particularly significant, as FDI brings capital, technology, and managerial expertise, further driving economic expansion and enhancing productivity (Edwards, Naanwaab, & Romero, 2017). In regions like Africa, while population growth presents opportunities and challenges, such as expanding labor forces that can drive consumption, it also necessitates substantial investments in infrastructure and education to harness its full potential (Chirwa & Odhiambo, 2018). Over the past two decades, many African countries, including Uganda, have struggled to fully capitalize on these dynamics due to gaps in infrastructure and capital formation (Hasnawati et al., 2024). Statistical evidence highlights Uganda's population growth rate, which, while high, has not been matched with a commensurate increase in investment or GDP growth, thus limiting the country's ability to absorb and utilize its expanding workforce effectively (Kirby, 2022). The implication is that strategic investments in capital formation should occur, as improving infrastructure and regulatory frameworks have accommodated stronger FDI inflows and higher GDP growth in other economies (Kosztowniak, 2016).

To better understand these macroeconomic dynamics, it is best viewed through the endogenous growth theory, which emphasizes internal factors such as human capital, innovation, and technology for sustained economic growth. Jones (2019 has propounded a similar view. This theory postulates that a nation's growth is induced by external factors such as capital investment and internal factors in its capacity to generate and adapt new ideas and technologies that augment productivity (Howitt, 2010). This framework is particularly relevant to Uganda, whose population growth, while rewarding an increase in the labor force, needs simultaneous

investments in education, technological development, and infrastructure to make the labor force productive enough to contribute meaningfully to GDP growth (Schilirò, 2019). Recent studies indicate that while FDI inflows have increased in Uganda, these investments have not fully translated into higher economic growth due to insufficient human capital and technological capacity to utilize these investments effectively (Qamruzzaman, 2024). This situation is characteristic of findings in other African countries, where capital formation, such as in education and infrastructure, would improve returns on FDI and ensure the growing population gets integrated into the formal economy. As Kanu & Ozurumba 2014 note, the critical areas on which to focus in Uganda involve improving infrastructure along with human capital development to keep pace with population growth. However, the studies indicate that, whereas Uganda's capital formation is improving, its effect on GDP is minimal due to incomplete engagement of the private sector and sluggish progress of technological change, as observed by Achar et al. in 2024. The endogenous growth theory, therefore, informs this study by providing a framework to assess the possibility of Uganda exploiting its increasing population and external investments to realize more sustainable economic development, as Yuan and Zhang noted in 2024. In conclusion, understanding the interplay between population growth, capital formation, FDI, and GDP growth is vital for developing effective strategies to stimulate and sustain Uganda's economic growth (Adam, 2021; Sendi, Mayanja, & Nyorekwa, 2021).

2. Literature Review

Theoretical literature review

This study is founded on the Endogenous Growth Theory, developed by Paul Romer in the 1980s. The theory emphasizes the internal factors that explain long-term economic growth, such as human capital, knowledge, and innovation, rather than dependence on external factors (Howitt, 2010). According to Romer, economic growth stems from the accumulation of knowledge and the increasing returns to scale associated with investments in human capital and innovation (Jones, 2022). In this study, the theory helps to explain the relationships between key macroeconomic variables, such as GDP growth, Gross Capital Formation (GCF), Foreign Direct Investment (FDI), and population growth, that are integral to Uganda's economic dynamics. The theory postulates that GCF and FDI contribute to long-term sustainable economic growth by increasing productive capacity. In contrast, population growth is a source of labor supply, where its contribution to output highly depends on the extent of human capital utilization (Chirwa & Odhiambo, 2018). This paper, therefore, explores the interaction of these variables within the context of endogenous growth that perpetuates Uganda's economic performance as a whole.

Previous literature has applied the Endogenous Growth Theory to different contexts for some insight into its applicability. Bolkol (2023) analyzed regional income convergence in Turkey and found that human capital and innovation investments were key to reducing regional disparities. Yuan and Zhang (2024) assessed the role of entrepreneurship and technological progress in sustaining growth in resource-dependent economies, illustrating the importance of endogenous factors like knowledge and human capital. Acs and Sanders (2021) explored regional extensions of the theory, emphasizing that localized investments in human capital and technology were central to fostering economic development. Zhang (2018) investigated the relationship between capital, knowledge, and institutions, confirming the theory's role in driving long-term economic growth. Despite its strengths, the Endogenous Growth Theory has limitations, such as simplifying knowledge and human capital's impact, failing to fully consider institutional constraints, or the complexities of technological diffusion (Jones, 2019).

Additionally, it struggles to explain why some economies, despite investing in these endogenous factors, do not experience commensurate growth (Chirwa & Odhiambo, 2018). This paper remedies these shortcomings by analyzing Uganda's institutional context. It discusses the interaction of domestic policies, infrastructure, and exogenous factors like FDI that determine the potency of endogenous drivers of growth. It enriches the understanding of their interactions in influencing Uganda's macroeconomic performance.

Empirical literature review

The Relationships Among GDP growth, Gross capital formation, Population Growth, and FDI net inflows.

In understanding the relationships among GDP growth, gross capital formation, population growth, and FDI net inflows, the interaction of these variables with one another will determine the macroeconomic dynamics

of a country. First, there is a strong linkage between population growth and GDP. A growing population increases the labor force, which, if skilled and employed in productive sectors, may contribute to higher GDP (Kitov, 2008). However, if population growth outpaces economic output, it can strain resources, leading to lower per capita income and reduced living standards (Cai & Lu, 2013). This dynamic is especially relevant for Uganda, where rapid population growth has not consistently translated into higher GDP due to a lack of adequate investments in human capital (Kirby, 2022). For this reason, comprehension of how population growth affects GDP is important in developing policies to boost productivity in labor and economic growth (Lianos, Pseiridis & Tsounis, 2023). Gross capital formation is another crucial factor in linking population growth and macroeconomic performance. Generally, a growing population increases the need for infrastructure, housing, and other forms of services, hence encouraging capital formation by raising physical and human capital investments (Sijabat, 2022). However, this may not always be the case, as in countries like Uganda, population increase has outgrown capital formation, where the capital deficit impeded economic growth because of a lack of capital formation, according to Ntamwiza & Masengesho, 2022. Therefore, depending on the investment environment, population growth may further enhance capital formation or worsen the problem of inadequate investment in vital sectors. Hasnawati et al. (2024) support this. Other studies, such as those by Asongu (2013) in Africa, indicate that population growth can stimulate or impede capital formation, depending on government policies and the general investment climate. This gap in how population growth influences capital formation in Uganda presents an important area for further research.

GDP growth and FDI inflows are often positively correlated, as FDI can stimulate economic activity by enhancing industrial capacity, transferring technology, and increasing productivity (Agrawal & Khan, 2011). A higher GDP growth rate can also attract FDI, as foreign investors are generally more likely to invest in growing economies with a higher potential for returns (Sengupta & Puri, 2020). However, while FDI inflows contribute to GDP growth, the relationship can be more complex in developing countries like Uganda, where FDI has not always led to proportional economic growth. The impact of FDI on Uganda's GDP depends on factors such as the efficiency of investments and the ability of the economy to be absorptive (Sadikova, Faisal & Resatoglu, 2017). This, therefore, presents a research gap in understanding how FDI inflows can be optimized to contribute more effectively to the growth of Uganda's GDP. Koskei et al. (2013) pointed out that different types of FDI, especially those channeled into agricultural and technological sectors, are expected to contribute a great deal to the overall GDP growth of Uganda. The correlation between population growth and FDI inflows is, however, mixed. A growing population may attract more FDI inflows due to the increase in market size, which presents an opportunity for a foreign investor regarding consumer demand and labor force availability, as Aziz and Makkawi (2012) pointed out. However, rapid population growth may lead to higher resource competition, political instability, and infrastructure bottlenecks, deterring FDI (Koskei, Buigut & Kibet, 2013). In Uganda, population growth has not always been correlated with a significant increase in FDI, with factors such as political instability, weak infrastructure, and inadequate policies identified as barriers to attracting foreign investment (Koskei et al., 2013). Again, the effect points to a complex relationship between population growth and FDI, hence more effective targeted policies to attract investment given Uganda's demographic trends by Alam, Nur Alam & Hoque, 2020. This study now tries to determine the interaction of the population growth variable with FDI and its eventual consequences for economic growth in Uganda.

Another important determinant of economic growth is the relationship between FDI and gross capital formation. FDI inflows stimulate capital formation by bringing in foreign capital, which is crucial in financing infrastructure and industrial development (Xia, Qamruzzaman & Adow, 2022). In Uganda, FDI could decisively help with the capital shortage by investing in basic infrastructure, such as energy and technology-related areas, which are essential for long-run economic growth (Kumari & Sharma, 2018). However, there are issues: the capacity to attract a sufficient volume of foreign investment, together with providing a suitable investment climate for private capital accumulation in Uganda, has meant the contribution of FDI towards capital formation remains weak (Sijabat, 2022). Understanding how FDI can enhance capital formation in Uganda is an important aspect of this study, as it will help policymakers design strategies to improve the capital investment climate and accelerate economic growth (Alam, Nur Alam & Hoque, 2020). The relationship between GDP and gross capital formation is one of the most well-established in economic theory, with gross capital formation being a primary driver of GDP growth (Kumari & Sharma, 2018). Increased investment in infrastructure, machinery, and technology enhances the productive capacity of an economy, leading to higher output and, consequently, higher GDP (Koskei et al., 2013). However, despite the potential for higher GDP growth through capital

formation in Uganda, the country faces significant challenges in mobilizing sufficient capital for investment (Ntamwiza & Masengesho, 2022). Inadequate capital formation has constrained Uganda's ability to reach its growth potential, presenting a key gap in the literature (Asongu, 2013). This study tries to establish the contribution of gross capital formation to GDP growth in Uganda and how targeted investments in key sectors unlock higher GDP growth. According to Qamruzzaman (2024), the interaction between GDP growth, gross capital formation, population growth, and FDI inflows is an interplay of complex relationships determining a country's macroeconomic performance. While these variables are interlinked and reinforcing, the magnitude of their effects is contextual, given the policy environment, level of economic development, and structural factors. Lianos et al. (2023) present that, in Uganda, the exact nature of these relationships has not been fully explored, and this study tries to fill these gaps by investigating the specific dynamics between these variables in the Ugandan context. Therefore, this study seeks to develop actionable insights through which Uganda's economic policy and development strategy could be informed by understanding the interplay between population growth, capital formation, FDI, and GDP (Sadikova, Faisal & Resatoglu, 2017).

3. Methodology

This study employs a quantitative approach with a descriptive and econometric design to analyze the relationships among GDP growth, Gross capital formation, population growth, and FDI net inflows in Uganda. The population comprises Uganda's economic indicators from 2000 to 2022, with secondary data from national databases and international organizations. Data collection methods include gathering annual data on GDP growth, Gross Capital Formation (GCF), population growth, and Foreign Direct Investment (FDI) net inflows. Validity was ensured by carefully selecting relevant variables and reliable data sources, while reliability was tested through consistency in data over the study period. Data analysis involved descriptive statistics, stationarity tests (ADF), multicollinearity checks, cointegration tests, and ARDL model estimation. Limitations of the study include potential data constraints, such as missing or inaccurate values in FDI flows and the assumption that the relationships observed over time remain constant. Additionally, the study does not account for potential external shocks or policy changes that may influence economic dynamics.

4. Study Findings

Table 1: Data View and Descriptive Analysis

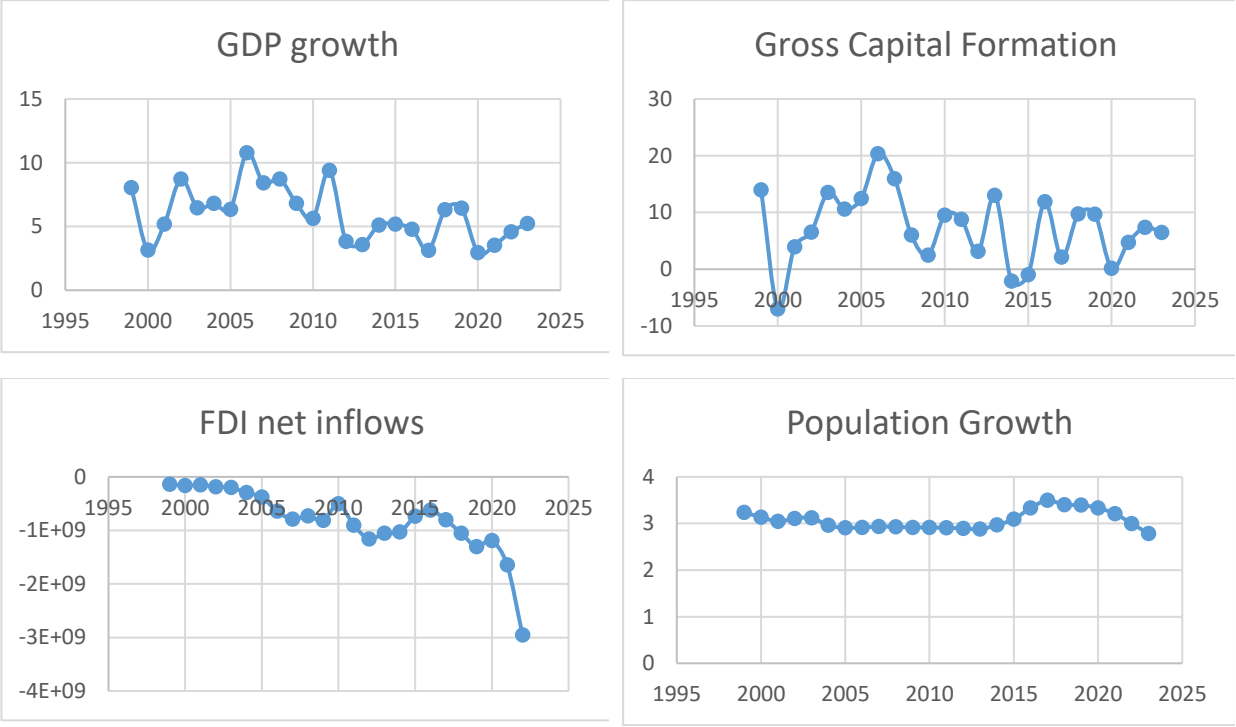
Statistics	GDP growth rate	Gross Capital Formation	Population growth	FDI net inflows
Mean	5.965734	7.289664	3.072289	-8.11E+08
Standard Deviation	2.138052	6.25831	0.197636	6.14E+08
Min	2.951306	-6.98748	2.78161	-2.95E+09
Max	10.78474	20.34784	3.496469	-1.40E+08

The descriptive statistics provide a detailed overview of the distribution and variability of the study variables, highlighting their central tendencies and dispersion. The GDP growth rate has a mean of 5.97%, with a standard deviation of 2.14%, indicating moderate variability around its average, and a range spanning from a minimum of 2.95% to a maximum of 10.78%. This relatively stable distribution suggests consistent economic growth with occasional peaks and troughs. Similarly, Gross Capital Formation (GCF) shows more significant variability, with a mean of 7.29%, a standard deviation of 6.26%, and a wide range from -6.99% (indicating disinvestment) to 20.35%. This wide range reflects fluctuations in Uganda's investment levels, likely driven by economic cycles or external factors.

Population growth has a mean of 3.07% with a low standard deviation of 0.20%, indicating minimal variation around the average and suggesting a stable demographic trend. In contrast, FDI net inflows have a negative mean value of -811 million, indicating consistent net outflows over the period analyzed, with a standard deviation of 614 million. The range of FDI spans from -2.95 billion to -140 million, reflecting significant variability in foreign investment trends. These distributions indicate that the variables provide meaningful variation and patterns necessary for robust econometric analysis, with no extreme outliers or unrealistic values

that would compromise the validity of the preceding statistical models. The data appears well-suited for regression or time series analysis, as it reflects realistic economic and demographic dynamics over the observed period.

Figure 1: Trend analysis of study variables



The trend analysis of the study variables reveals distinct patterns over the years. GDP growth shows significant fluctuations, peaking in the mid-2000s before stabilizing at lower levels post-2015, indicating periods of economic volatility followed by moderate growth. Gross Capital Formation (GCF) exhibits cyclical behavior, with sharp increases in the early 2000s and notable dips around 2015, suggesting intermittent investment growth and contraction periods. FDI net inflows present a downward trend, starting with relatively stable inflows around 2000 but declining sharply after 2020, reflecting potential disinvestment or reduced foreign investor confidence. Population growth remains relatively stable, peaking slightly around 2015 before experiencing a gradual decline, which may indicate demographic or fertility trend shifts. These trends provide key insights into Uganda's economic and demographic landscape dynamics.

Therefore, the trend option is included in the stationarity test to account for the deterministic trends observed in variables like GDP growth, GCF, and FDI. These variables exhibit systematic changes over time, and ignoring this component could lead to false conclusions about non-stationarity. Incorporating the trend ensures accurate testing and reliable model specification.

Table 2: Stationarity tests at variable levels

Variable	Test Conducted	Null Hypothesis	Test Statistic z(t)	Critical Value (5%)	P-Value	Conclusion
GDP	ADF (with trend)	Has a unit root	-3.682	-3.600	0.0236	Stationary (trend)
GCF	ADF (with trend)	Has a unit root	-4.334	-3.600	0.0028	Stationary (trend)
FDI	ADF (with trend)	Has a unit root	-3.67	-3.34	0.02	Stationary (trend)

Population	ADF (with drift)	Has a unit root	-1.937	-1.734	0.0343	Stationary (drift)

The results of the Augmented Dickey-Fuller (ADF) stationarity tests indicate that GDP, Gross Capital Formation (GCF), and Foreign Direct Investment (FDI) are all stationary when a trend is included in the model, as their test statistics are below the critical values at the 5% level, with corresponding p-values below 0.05. This implies that these variables exhibit a deterministic trend and do not require further differencing to achieve stationarity. On the other hand, the Population is stationary with a drift, as the ADF test statistic is below the critical value at the 5% level with a p-value of 0.0343. This suggests that while the Population lacks a deterministic trend, it is stationary around a mean with a constant drift. These findings validate that all variables are appropriately stationary at their levels under the given conditions, making them suitable for inclusion in the econometric model to be estimated. Variables were log-transformed and tested for multicollinearity

Table 3: Multicollinearity check

Variable	VIF	1/VIF
Gross Capital Formation	1.02	0.985195
Population	1.01	0.985281
FDI	1.00	0.999317
Mean VIF	1.01	

These results confirm that the independent variables (Gross Capital Formation, Population, and FDI) are not highly collinear, providing distinct information to explain variations in the dependent variable. This strengthens the reliability of the estimated coefficients and ensures that the model is not compromised by multicollinearity. Consequently, the model's inferences about the relationship between GDP growth and the explanatory variables are valid.

Table 4: Test for cointegration

Statistic	Observed Value	Critical Value (I0, 5%)	Critical Value (I1, 5%)	Decision (5%)
F-statistic	6.003	4.101	5.865	Reject H_0
t-statistic	-4.65	-2.963	-3.977	Reject H_0

At the 5% significance level, the Pesaran, Shin, and Smith (2001) bound test results provide evidence of a long-run relationship among the variables. The F-statistic (6.003) exceeds the critical bounds for I(0) and I(1) at 5% (4.101 and 5.865, respectively), leading to the rejection of the null hypothesis of no level relationship. Similarly, the t-statistic (-4.650) is more extreme than the I(1) critical value at 5% (-3.977), confirming a significant adjustment mechanism toward equilibrium in the long run.

These findings indicate that the variables in the model are cointegrated at the 5% level, implying that they share a stable long-run relationship. These results support further analysis of the short-run and long-run dynamics using the ARDL model.

Table 5: ARDL model estimation

D.GDP	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
ECT	-1.68578	0.362566	-4.65	0.001	-2.47575	-0.89582
Long Run						
GCF	0.303186	0.063394	4.78	0.000	0.165063	0.441309
Population	-1.27875	0.619129	-2.07	0.061	-2.62772	0.070218
FDI	0.125922	0.052033	2.42	0.032	0.012553	0.239291

Short Run						
GDP_{LD}	0.818871	0.270709	3.02	0.011	0.229046	1.408695
D.GCF	-0.28852	0.114888	-2.51	0.027	-0.53884	-0.0382
GCF_{LD}	-0.19421	0.073241	-2.65	0.021	-0.35379	-0.03463
D.FDI	0.063571	0.300586	0.21	0.836	-0.59135	0.718491
FDI_{LD}	0.957547	0.324156	2.95	0.012	0.251273	1.663821
Constant	8.922826	2.335299	3.82	0.002	3.834645	14.01101

In the short run, GCF hurts GDP growth in Uganda, suggesting that initial investments may introduce inefficiencies or adjustment costs before generating returns. This finding is consistent with results from low-income countries, where capital formation often faces challenges such as delays in implementation and absorption of funds (Topçu et al., 2020). However, in the long run, GCF demonstrates a strong positive effect on GDP, reflecting its role in expanding Uganda's productive capacity. Similar results were found in Rwanda, where GCF significantly influenced GDP growth in both the short and long run, highlighting the critical role of investments in fostering economic development (Ntamwiza & Masengesho, 2022). For Uganda, this suggests that prioritizing infrastructure and industrial investments can create a foundation for sustained economic growth, aligning with the exogenous growth theory's emphasis on capital accumulation as a growth driver.

Population growth shows no significant impact on GDP growth in the short run, likely reflecting the time needed to integrate an expanding labor force into productive economic activities. However, in the long run, it has a marginally significant negative impact on GDP, suggesting that rapid population growth may strain Uganda's limited resources and infrastructure. Similar patterns are observed in developing regions where high population growth dilutes the benefits of capital formation and imposes pressure on existing economic systems (Topçu et al., 2020). This underscores the importance of addressing structural constraints, as highlighted in studies emphasizing that population growth must be complemented by investments in education, health, and employment to convert demographic trends into a growth advantage (Aslan & Altinoz, 2021).

FDI shows no significant impact on GDP growth in the short run. It is consistent with findings that foreign investments often have delayed effects as they require time to integrate into the local economy. However, lagged FDI positively influences GDP growth, and in the long run, it has a significant positive impact, aligning with evidence from African economies where FDI contributes to technological transfer, industrial development, and market integration (Pasara & Garidzirai, 2020). For Uganda, this indicates the potential of FDI to act as a catalyst for sustainable growth if paired with policies that foster a stable investment climate. Additionally, studies in developing economies suggest that FDI's effectiveness is enhanced when coupled with domestic reforms and infrastructure development to maximize productivity spillovers (Ntamwiza & Masengesho, 2022).

Post-model estimation diagnostics
Normality test for residuals

Table 6: Shapiro-Wilk test for normal data

Variable	Obs	W	V	z	Prob>z
Residuals	22	0.98298	0.431	-1.705	0.95593

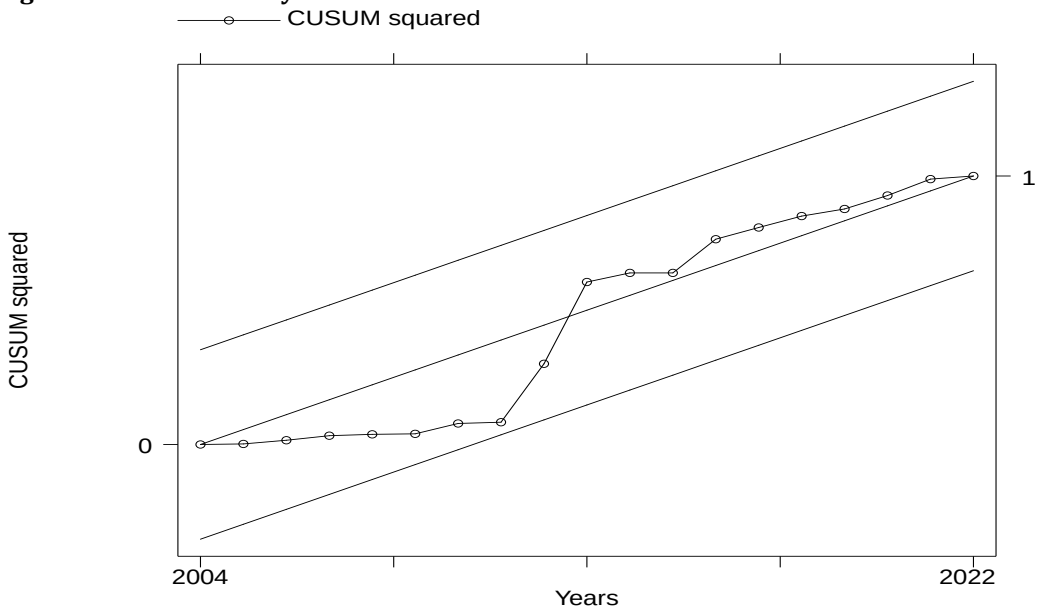
The results of the Shapiro-Wilk test suggest that the residuals conform to the assumption of normality. The test statistic (W = 0.98298) is close to 1, indicating a strong alignment with a normal distribution, while the p-value (P > z = 0.95593) far exceeds the conventional significance threshold of 0.05. Consequently, the null hypothesis of normality cannot be rejected, providing robust evidence that the residuals exhibit a normal distribution, which supports the validity of this assumption in the model.

Table 7: Heteroscedasticity test

Test Statistic	Value	P-value	Hypothesis
Chi-squared (1)	0.08	0.784	H0: Constant variance (homoskedasticity)

The results of the Breusch-Pagan/Cook-Weisberg test for heteroskedasticity indicate that the null hypothesis of constant variance (homoskedasticity) cannot be rejected, as the test statistic (Chi-square (1) = 0.08 yields a p-value of 0.784, which is far above the conventional significance levels of 0.05. This implies that there is no evidence of heteroskedasticity in the residuals, and the assumption of constant variance is satisfied

Figure 2: Model Stability Test



The results suggest that the model's parameters are stable over time, as the CUSUM squared line remains within the critical boundaries throughout the observed period (2004–2022). There is no evidence of structural instability in the model.

Discussion

Analysis of Uganda's economic indicators gives an overall understanding of the inter-relationship between GDP growth, Gross Capital Formation, population growth, and FDI inflow. The descriptive statistics show that, on average, the GDP growth rate for Uganda is 5.97% with a moderate dispersion, which stipulates that the nation's economic performance has remained relatively stable but unpredictable. GCF is highly volatile and reflects sensitivity to investment cycles. Population growth is steady with minimal fluctuation, as is expected in a developing economy. FDI shows negative net inflows, reflecting disinvestment, a pattern seen in other developing economies. This also aligns with the work of Sadikova et al. (2024), who studied the impact of energy use, FDI, and population growth on unemployment in Russia. According to them, countries receiving unstable foreign investment flows will likely suffer from poor economic growth. Similarly, Sengupta and Puri (2020), in their study of the effects of FDI on GDP in India and its neighboring countries, found that countries receiving irregular capital inflows are more likely to suffer from increased economic instability. Trend analysis of the study variables shows cyclical behaviors, with GDP growth and GCF demonstrating fluctuations over time.

This is highly evident by the drop in FDI in recent years. It corroborates the arguments of Xia et al. (2022) on how remittance-driven human capital development is related to FDI. According to these authors, FDI streams are susceptible to changes both in external market conditions and in the implementation of domestic policy. Indeed, the analysis of the effect of FDI and GCF on economic growth in Rwanda, done by Ntamwiza and Masengesho (2022), showed that regional and global factors cause fluctuations in FDI. Population growth

peaked around 2015 and has been in decline ever since, thus supporting the argument of Yuan and Zhang 2024, who, while studying the relationship between natural resources, sustainable growth, and entrepreneurship in the context of population dynamics and economic expansion, concluded that countries that have stable or declining population growth usually face slower long-term economic growth. Stationarity tests conducted for the data in this study confirm that the GDP, GCF, and FDI are trend stationary, while population growth is difference stationary; hence, the data are suitable for further econometric analysis.

The Pesaran, Shin, and Smith bounds test results support the presence of long-run relationships among the variables, confirming that GDP, GCF, FDI, and population growth share a stable long-run equilibrium. This result also supports Qamruzzaman (2024), who examined the nexus of FDI, GCF, financial development, and renewable energy consumption and found that, in developing countries, these variables are interrelated and will move to attain their long-run equilibrium over time. Furthermore, the estimation of the ARDL model indicates that GCF has a negative short-run impact on GDP but has a strong positive effect in the long run. This shows that capital investment yields a return in a lagging manner. This is also the finding of Kanu and Ozurumba (2024) in their work on capital formation and economic growth in Nigeria, where the researchers established that capital investments show their complete effect later in increasing GDP. The diagnostic tests further corroborate the model's strength, as the normal distribution of residuals is confirmed by the Shapiro-Wilk test, no heteroscedasticity was detected by the Breusch-Pagan test, and the stability of the model is confirmed by the CUSUM squared test.

The results further assure the model's integrity in depicting an underlying relationship within the variables identified in Uganda's economic setting. There is no repetition of variables that could show perfect multicollinearity; hence, the VIF test results ensure that each factor contributes uniquely. This result is in line with the approach Sijabat (2022) followed while analyzing the relationship between economic growth, foreign aid, FDI, and GCF in Indonesia; he found that the absence of multicollinearity increased the accuracy and interpretability of econometric models. The latter fact was put forth in a parallel paper dealing with FDI-GCF and their effects on the economy's growth rate, undertaken by Koskei et al. (2023). Their argument stated that policy recommendations need confirmation by diagnostic tests that assert the soundness of such a model.

5. Conclusion

In conclusion, Uganda's economic performance is shaped by a complex interaction between GDP growth, Gross Capital Formation (GCF), population growth, and Foreign Direct Investment (FDI). The analysis reveals that while GDP growth is relatively stable with occasional fluctuations, GCF demonstrates considerable volatility, reflecting the nation's sensitivity to investment cycles. Population growth remains steady, with minimal fluctuations, while FDI shows negative net inflows, indicating disinvestment trends common in developing economies. The study's findings align with endogenous growth theory, which emphasizes the critical role of investment and capital formation in driving long-term economic growth. The positive long-term impact of GCF on GDP supports the idea that sustained capital accumulation fosters economic expansion. However, the short-term adverse effects highlight delays in realizing investment returns. Similarly, while FDI shows no immediate short-term impact on GDP, its positive long-term influence suggests that foreign investment can significantly contribute to economic development if coupled with supportive policies. These findings reinforce the importance of domestic and foreign investment as key growth drivers in Uganda's economic landscape while highlighting the challenges posed by disinvestment and demographic changes.

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