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Human Capital, Fixed Capital Formation and Economic Growth: An Empirical Analysis of Endogenous Growth Drivers in Uganda

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Abstract: This research aimed to look at the effect of key endogenous variables such as GNI, Human Capital, FDI, Inflation, and GCF, which have impacted the economic growth in Uganda. This study adopted a time-series research design. Data from the study were obtained through secondary sources, including government publications, international financial databases, and reports obtained from UBOS. The econometric methods the study adopted included the ADF test for stationarity, the VIF test for multicollinearity, and the ARDL model in testing both the short-run and long-run relationships. The study found that in the long run, human capital, GCF, and inflation significantly contributed to economic growth at favorable rates, while FDI negatively influenced economic growth. In the short run, GNI, Human Capital, FDI, and Capital are significant determinants of economic growth, with an adverse short-run effect for GNI and FDI. The results emphasize that capital formation and human capital development are important for sustainable economic growth in Uganda. The study concludes that different aspects of fashion affect Uganda's economic performance, indicating the need to stabilize major macroeconomic indicators to achieve long-term growth, focusing on human capital, capital formation, and managing inflation.

Keywords: *Gross National Income (GNI), Human Capital, Foreign Direct Investment (FDI), Inflation, Gross Capital Formation (GCF), Economic Growth*

1. Background

Uganda's economic growth has undergone changes in structure over the decades, and various economic indicators have significantly influenced this change. Gross National Income, Foreign Direct Investment, Gross Capital Formation, human capital, and inflation are significant determinants that shape economic outcomes globally and within Uganda. GNI, as an aggregate measure of a country's economic output, reflects the income residents receive from abroad, and its impact on national economic growth cannot be overstated (Kaivo-Oja, Vehmas, & Luukkanen, 2022). Globally, nations with consistent GNI growth, such as China and India, have experienced rapid economic transformation. Between 2000 and 2020, China's GNI grew from approximately $1.2 trillion to over $14 trillion, underpinned by a robust manufacturing sector and high levels of investment (Anguyo, Gupta, & Kotzé, 2020). Similarly, India's GNI reached over $2.8 trillion in 2020, driven by the IT and service sectors (Byanyima et al., 2025). For Africa, countries such as Nigeria and South Africa have seen fluctuations in GNI due to resource exports and political stability issues (Adegboye et al., 2020). In Uganda, GNI has been increasing steadily; however, volatility, which is usually sparked by commodity price fluctuation and changes in political governance, is still a challenge (Barbra & Nawaz, 2021). FDI has also proved to be one of the major catalysts for economic growth, as observed in countries such as Singapore, where FDI was one of the primary reasons for the country's emergence as a global financial hub (Acquah & Ibrahim, 2020).

FDI inflows in Uganda, though modest, have gradually improved over the years from $0.3 billion in the year 2000 to $1.3 billion in 2019 (Nagawa, Wasswa, & Bbaale, 2020). Human capital, including education, health, and labor force quality, has directly correlated with economic prosperity (Fukao, Makino, & Settsu, 2021). Countries like Japan, with a high human capital index, have maintained sustained economic development (Garza-Rodriguez et al., 2020). While African countries have utilized education and healthcare reforms, like Mauritius, to spur their growth, Uganda has worked hard in such sectors, especially at the grassroots level of education and healthcare. However, inflation in Uganda may hurt economic stability (Aghaei, Rezagholizadeh, & Bagheri, 2023). For example, the hyperinflation of Zimbabwe in the late 2000s, culminating in a peak of 79.6 billion percent in November 2008, has resulted in tremendous economic dislocation (Azam & Khan, 2022). In Uganda, however, inflation has continued to oscillate between 2% and 30% over the past two decades. However, it is now under firm control, especially with recently implemented appropriately targeted monetary policies (Anguyo, Gupta, & Kotzé, 2020).

The endogenous growth theory, which emphasizes the role of internal factors such as human capital development, technological advancement, and investment in fostering long-term economic growth, provides a theoretical foundation for this study (Cvetanović, Mitrović, & Jurakić, 2019). This theory posits that economic growth is primarily driven by endogenous variables rather than external factors, highlighting the importance of policies that stimulate investment in education, infrastructure, and innovation. The new growth theory emphasizes that Uganda should invest in developing human capital and innovation and provide a favorable investment climate. During the years, these endogenous factors determined economic growth in Uganda, with spells of growth followed by reversals due to exogenous shocks, such as changes in global commodity prices and regional conflicts (Akcigit & Ates, 2021). These dynamics have been reflected in Uganda's economic trajectory from the colonial era. The economy was highly agrarian during the colonial period, with GNI heavily dependent on exports of cash crops like coffee and tea. Following independence, Uganda endured periods of instability, such as military dictatorships and civil unrest, hampering economic growth (Chandra & Chandra, 2022). However, in the 1990s, Uganda implemented economic reforms that spurred growth, with GCF, led by infrastructure development and increased investment in human capital, contributing to GDP growth (Adaramola & Dada, 2020). Over the past 20 years, Uganda's economic growth rate has fluctuated, with real GDP growth averaging around 6% annually from 2000 to 2019 (Adegboye et al., 2020).

Uganda's GNI per capita has grown from about $300 in the early 2000s to approximately $800 in 2020. Human capital indicators, like primary school enrollment, have shown remarkable improvements, although challenges in quality education and health remain. FDI inflows have increased but are way below those of other developed African economies, given Uganda's rich natural resources. Inflation rates have varied significantly from a high of 30% in the early 2000s to more stable rates of about 3-4% in recent years, contributing to a more favorable investment climate (Anguyo, Gupta, & Kotzé, 2020). These trends reflect the complex interplay through which GNI, human capital, FDI, inflation, and GCF influence the growth of the Ugandan economy. This supports the relevance of such factors in the perusal of Uganda's development challenges and opportunities, as Asongu and Odhiambo (2020) discussed.

2. Literature Review and Hypothesis Development

Theoretical Literature Review

This study is guided by the Endogenous Growth Theory, developed by Paul Romer in 1986, as a response to the limitations of neoclassical growth theories, which emphasized exogenous technological progress (Chandra & Chandra, 2022). Romer's theory posits that economic growth is primarily driven by internal factors, such as human capital, knowledge accumulation, innovation, and investment in technology, rather than external forces (Akcigit & Ates, 2021). The new growth theory developed through time, adding to it the contributions of other economists like Lucas (1988), who emphasized human capital, and Aghion and Howitt (1992), who showed growth engendered by innovation through creative destruction. (Ping, Yashuai, & Susu, 2024). More recent extensions have included the interaction with institutional and environmental factors and, therefore, the importance of governance, entrepreneurship, and sustainable use of resources for growth. (Yuan & Zhang, 2024; Rijal, Idrus, & Ahmad, 2023).

Empirical applications of endogenous growth theory have shown the relevance of the theory in different contexts. For instance, Khan and Rehman (2021) applied the theory in Pakistan to study interrelationships among economic variables. They find human capital and technology as strong determinants of growth. Ziesemer (2020) investigates its validity in conditions of zero or negative population growth and finds innovation to be the critical determinant of economic performance. Parello (2022) highlighted the importance of the theory in understanding conditional and unconditional convergence in economies globally. Further, Díaz Rodríguez and Aroche Reyes (2020) utilized the theory in Mexico by developing artificial neural networks to outline how technological innovation affects labor productivity. Wijayanto (2019) also investigated its applicability to understanding long-term economic growth trends, especially the interaction between investment and productivity. Therefore, the study will agree with endogenous growth theory by estimating internal variables like GNI, human capital, FDI, GCF, and inflation as the causes of Ugandan economic growth. By focusing on these variables, the present study integrates insights from prior studies, such as the role of human capital put forward by Rijal, Idrus, and Ahmad 2023, and the importance of innovation and capital formation highlighted by Udeogu, Amakom, and Roy-Mukherjee 2021. This theory informs this study by

providing a framework to review how knowledge, investment, and institutional dynamics interact to foster economic growth within Uganda's context. This will also be informed by the present theoretical lens, underlining the endogenous drivers of growth that identify areas for policy intervention in further improving sustainable economic performance.

Empirical Literature Review

The effect of Gross National Income (GNI) on economic growth in Uganda

The effect that Gross National Income has on Uganda's economic growth can be evaluated from its functions in driving the economy. Firstly, GNI is a comprehensive measure of the total income generated by residents and businesses within and outside the country, making it a critical indicator of national economic health (Colomer Martín, 2019). A higher GNI reflects increased production activities, enhanced labor productivity, and better income distribution, collectively stimulating economic growth (Coscieme et al., 2020). Secondly, GNI directly influences aggregate demand by boosting consumer spending, investment levels, and government revenue through taxation (Xholo & Ncanywa, 2024). These elements are vital in driving infrastructural development and improving social services, further enhancing economic growth (Ozigbu, Nchom, & Ezekwe, 2021). Thirdly, GNI impacts the accumulation of savings and capital, as higher incomes enable households and businesses to invest more, fostering innovation and entrepreneurship (Ani & Onu, 2022). This creates a positive feedback loop, where higher investment levels fuel greater economic output (Nolan, 2020). Fourthly, an increase in GNI typically corresponds to improved living standards, as individuals can afford better healthcare, education, and other essentials, leading to a more skilled and productive workforce (Vezhnovets et al., 2021). Fifthly, GNI reflects the ability of a country to attract foreign direct investment (FDI), as a growing economy often signals stability and market potential to international investors (Ani & Onu, 2022). FDI inflows bring technology transfer, job creation, and market expansion, further enhancing economic growth (Ozigbu, Nchom, & Ezekwe, 2021). Additionally, GNI influences economic resilience by providing a cushion during external shocks, such as commodity price fluctuations or global economic downturns (Colomer Martín, 2019).

Countries with higher GNI can better withstand these shocks through diversified income sources and robust fiscal capacities (Kaivo-Oja, Vehmas, & Luukkanen, 2022). The role played by GNI in the economy is also evident from its contribution to debt sustainability in Uganda (Xholo & Ncanywa, 2024). Higher levels of GNI enhance the servicing capability of a country, improving its debt-servicing capability and reducing the fiscal burden so that more resources can be put toward development projects (Nolan, 2020). Furthermore, GNI growth promotes regional integration and trade by enabling Uganda to participate more competitively in regional and international markets (Coscieme et al., 2020). As the economy grows, trade relationships strengthen, leading to greater export diversification and reduced reliance on a few sectors (Vezhnovets et al., 2021). However, the effect of GNI on economic growth is not automatic or uniform; it depends on how income is distributed and utilized (Ani & Onu, 2022). Unequal income distribution or excessive reliance on a single sector, such as agriculture, can limit the broader economic benefits of GNI growth (Colomer Martín, 2019). For Uganda, where structural challenges persist, ensuring that GNI growth translates into inclusive development requires targeted policies to address inequality, enhance industrialization, and improve infrastructure (Ozigbu, Nchom, & Ezekwe, 2021). Thus, GNI remains a crucial determinant of economic growth in Uganda, shaping the country's development trajectory and its ability to achieve sustainable progress (Kaivo-Oja, Vehmas, & Luukkanen, 2022).

The effect of Human Capital on economic growth in Uganda

Human capital's impact on Uganda's economic growth is profound, as it is vital in driving productivity, innovation, and overall economic development. Human capital includes the workforce's education, skills, health, and experience, which directly influences the efficiency and output of economic activities (Prasetyo & Kistanti, 2020). Firstly, an educated and skilled workforce enhances labor productivity by improving the quality of goods and services, thereby boosting economic output (Aghaei, Rezagholizadeh, & Bagheri, 2023). For Uganda, where sectors like agriculture, services, and emerging industries dominate, investments in human capital are essential to transitioning from low-productivity to high-productivity economic activities (Garza-Rodriguez, Almeida-Velasco, Gonzalez-Morales, & Leal-Ornelas, 2020). Secondly, human capital promotes technological adoption and innovation. Workers with advanced skills and knowledge are more likely to engage in research and development activities or effectively utilize imported technologies, which are critical for Uganda's industrialization agenda (Fukao, Makino, & Settsu, 2021). Thirdly, human capital development improves entrepreneurship by equipping individuals with the capabilities to identify business opportunities,

access credit, and manage enterprises. This fosters a vibrant private sector, a key driver of economic growth (Prasetyo & Kistanti, 2020). Additionally, human capital contributes to economic growth through improvements in health outcomes. A healthier population has more excellent physical and cognitive abilities, which decreases absenteeism and increases productivity. In Uganda, addressing challenges such as malnutrition and disease prevalence is critical to maximizing the economic potential of its workforce (Ramli, Boutayeba, & Nezai, 2022).

Moreover, human capital can facilitate social mobility and income equality by bridging socio-economic gaps through better education and healthcare access. Such is the inclusive growth model, one in which economic development is both contributed to and benefited from by all sections of society (Han & Lee, 2020). Another important impact of human capital is on the dynamics of demography. Investments in education, particularly for women, lead to lower fertility rates and better family planning, which can help Uganda manage its high population growth and channel resources into productive sectors (Amna Intisar et al., 2020). Moreover, human capital development attracts foreign direct investment (FDI), as investors are drawn to countries with skilled labor pools capable of supporting advanced operations. For Uganda, enhancing human capital can make the country more competitive in attracting FDI to manufacturing, technology, and services (Sarwar, Khan, Sarwar, & Khan, 2021). Human capital also develops the institutions of a country by ensuring that there is a knowledgeable population that demands accountability from the government and proper resource utilization. According to Mabrouki (2023), despite its great benefits, human capital impacts Uganda's economic growth, constrained by limited access to quality education, poor health infrastructures, and unemployment among the youth. These, in turn, call for targeted policy actions, such as curriculum reforms aimed at aligning education with the labor market demand. The government must also invest more in health and education, coupled with efforts to ensure public-private partnerships. Kim (2021) states that human capital is embedded in productivity, equity, and long-term development processes. Fully developing and utilizing human capital will thus ensure that Uganda achieves its economic potential, hence its national development goals, as indicated by Abdeldayem, Aldululaimi, and Kharabsheh (2021).

The effect of Foreign Direct Investment (FDI) on economic growth in Uganda

FDI in Uganda plays an important role in economic growth since it is the channel through which crucial capital inflows, technology transfer, and employment opportunities are brought into the economy. For instance, Oyegoke and Aras (2021) pointed out that FDI provides the financial resources required to complement the shortfalls in domestic savings, enabling a country to finance large development projects in infrastructure, energy, and industrial parks. This capital infusion stimulates economic activity and supports long-term growth (Acquah & Ibrahim, 2020). Secondly, FDI promotes technological advancement by introducing new machinery, processes, and skills into the host economy. Multinational corporations often bring cutting-edge technologies and management practices that local firms can adopt, thereby enhancing productivity across various sectors in Uganda. This is particularly beneficial in transforming sectors like manufacturing, which require substantial investment to move from low-value to high-value production (Nguyen, 2022).

Additionally, FDI contributes to employment generation, both directly and indirectly. Directly, foreign firms create jobs in industries like agriculture, mining, telecommunications, and manufacturing. Indirectly, they support local businesses through supply chain linkages and demand for services such as transportation and logistics (Irakoze & Yu, 2020). Foreign investors' presence will also encourage the development of human capital through the training and upskilling of available local workers to increase their employability and productivity (Osei & Kim, 2020). FDI improves the country's balance of payments. By increasing exports through production for international markets, foreign investors help reduce trade deficits and stabilize the local currency, which is vital for Uganda's economic stability. This is according to Christopher (2022).

Foreign direct investment also acts as a catalyst for market expansion and economic diversification. Through investment in underdeveloped sectors like renewable energy, tourism, and information technology, foreign entities help reduce overdependence on traditional industries like agriculture in Uganda. This is what Barbra and Nawaz (2021) have stated. Furthermore, FDI strengthens institutional frameworks and governance. Foreign investors often demand transparency, efficiency, and regulatory consistency, which can lead to broader improvements in the business environment. For Uganda, this has implications for reducing corruption and

fostering accountability (Adegboye et al., 2020). However, the impact of FDI on economic growth is not without challenges.

One concern is the repatriation of profits, which can limit the net benefit to the host economy (Yimer, 2023). Another issue is the potential for FDI to crowd out local businesses, especially if foreign firms dominate markets or receive preferential treatment. Uganda must address these challenges by implementing policies that maximize the positive effects of FDI. For example, promoting joint ventures between foreign and local firms can ensure that technology and skills are transferred to domestic entities (Asongu & Odhiambo, 2020). Strengthening local content requirements can also ensure that Ugandan businesses and workers benefit from foreign investments (Asafo-Agyei & Kodongo, 2022). Additionally, aligning FDI inflows with national development priorities, such as industrialization and export diversification, can enhance their contribution to economic growth (Mohamed, 2023). Lastly, fostering a stable macroeconomic environment, improving infrastructure, and ensuring political stability are essential to attracting and retaining high-quality FDI (Acquah & Ibrahim, 2020). Overall, FDI remains a cornerstone of Uganda's economic growth strategy, with the potential to drive innovation, create jobs, and elevate the country's position in the global economy when strategically managed (Sarwar et al., 2021).

The effect of Gross Capital Formation (GCF) on economic growth in Uganda

Gross Capital Formation is a vital factor in Uganda's economic growth. It accumulates physical capital, which significantly improves productive capacity. Firstly, GCF reflects investments in infrastructure such as roads, bridges, energy plants, and communication networks. These investments are foundational for improving economic efficiency and reducing transaction costs, enabling businesses to operate more effectively (Pasara & Garidzirai, 2020). Improved infrastructure facilitates trade, both domestically and internationally, connecting rural producers to urban markets and global supply chains, according to Ntamwiza and Masengesho (2022). The GCF contributes to industrial development by financing the acquisition of machinery, equipment, and technology needed in manufacturing and production, thus increasing output, adding value, and increasing exports, contributing to Uganda's GDP growth, agreeing with Kong et al. (2020). Another crucial role of GCF is its contribution to agricultural transformation. For instance, in Uganda, where agriculture remains a critical sector of the economy, irrigation systems, storage facilities, and modern farming equipment are essential to enhance productivity (Maune & Matanda, 2022). GCF also supports urbanization by financing residential and commercial structures, which spur real estate and related sectors (Nyamute & Barasa, 2021). Moreover, Gross Capital Formation encourages employment by creating labor demand in the construction and engineering industries, among other investment-related sectors. Reducing unemployment rates increases household incomes, which increases consumer spending and, consequently, economic activities. According to Maune et al. (2023), GCF also increases the capacity for technological progress by facilitating research and development activities. Innovation investment will help shift Uganda from low productivity to more developed and competitive sectors (Qamruzzaman, 2024).

Additionally, GCF contributes to human capital development since its funding helps construct schools, hospitals, and vocational training centers. The result is an educated and healthy workforce (NDREGJONI & NDREGJONI, n2024). The sustained economic growth comes with improved human infrastructure and a well-developed workforce (Chibuzor & Eleh, 2023).

However, the impact of GCF on Uganda's economic growth is influenced by the efficiency of capital allocation. Mismanagement, corruption, and delays in project implementation can undermine the effectiveness of investments (Qamruzzaman, 2024). Similarly, the reliance on foreign aid or loans to finance capital formation may lead to debt sustainability challenges if not strategically managed (Mahdi, 2023). To maximize the benefits of GCF, Uganda must prioritize investments with high economic returns, such as those that enhance productivity and export capacity (Pasara & Garidzirai, 2020). Encouraging public-private partnerships can also leverage private-sector expertise and resources to supplement government-led initiatives (Maune & Matanda, 2022).

Furthermore, fostering a stable macroeconomic environment with low inflation and competitive interest rates can attract domestic and foreign investors to contribute to capital formation (Qamruzzaman, 2024). Another factor is the quality of governance and institutional frameworks in facilitating GCF. Effective policies and regulatory environments ensure that resources are allocated to projects that align with Uganda's national

development plans (Ntamwiza & Masengesho, 2022). For instance, investments in renewable energy projects support economic growth and address environmental sustainability goals (Nyamute & Barasa, 2021). Lastly, the long-term impact of GCF on economic growth is closely tied to its integration with human capital and technological development. Investments in physical assets must be complemented by efforts to build a skilled workforce capable of utilizing and maintaining these assets (Maune et al., 2023). In conclusion, GCF serves as a cornerstone of Uganda's economic development, with the potential to stimulate growth, reduce poverty, and transform the economy when strategically aligned with national priorities and supported by efficient governance (Kong et al., 2020).

The effect of Inflation on economic growth in Uganda

Inflation, while often considered a regular part of economic cycles, can have significant implications for economic growth in Uganda. Generally, moderate inflation is believed to encourage spending and investment, which can stimulate economic growth (Karki, Banjara, & Dumre, 2020). However, excessive or erratic inflation can disrupt economic stability, decrease purchasing power, and undermine confidence in the currency, leading to negative consequences for growth (Sanga, Kongolo, & Mnongya, 2022). In Uganda, inflation has historically been driven by factors such as food price fluctuations, exchange rate volatility, and energy costs, which can have immediate and far-reaching economic impacts (Yemba, Kitenge, & Woodburne, 2020). Inflation erodes the real value of money, making goods and services more expensive for consumers and negatively affecting living standards (Mandeya & Ho, 2021). For Ugandan households, particularly those in rural areas, price increases for basic goods like food and fuel can lead to reduced consumption and savings, limiting their capacity to contribute to economic growth (Sanga, Kongolo, & Mnongya, 2023). Higher living costs also exacerbate income inequality, as poorer households, who spend a more significant proportion of their income on essentials, are disproportionately affected by inflationary pressures (Adaramola & Dada, 2020).

Exacerbating this problem is the decline in real wages because of rising prices, which ultimately contributes to lower consumer confidence and reduced demand for goods and services. According to Khan & Hanif 2020, inflation impacts the cost of inputs such as raw materials, labor, and capital used by businesses in production. When inflation is high, production costs may rise for firms; this will reduce profit margins or increase the price of products, thus reducing demand for goods and services. This, according to Sanga, Kongolo, and Mnongya (2022), may make it hard for businesses to compete in domestic and international markets when they cannot adjust to these price changes. In addition, inflation makes the business environment uncertain due to the inability of companies to plan long-term investments, hence scaring away foreign and domestic investments needed for economic growth and development (Mandeya & Sin-Yu, 2022). Inflation influences the financial sector, especially interest rates. Many central banks, such as Uganda's Bank of Uganda, increase interest rates to reduce inflation (Doan Van, 2020). However, higher interest rates make borrowing more expensive, which can limit access to credit for businesses and consumers (Huseynli, 2022). This reduction in credit availability can negatively affect investment in both the private and public sectors. For example, businesses may delay or cancel expansion plans, and households may reduce spending on durable goods like housing and vehicles (NGOC, 2020). The resulting slowdown in investment and consumption can hinder overall economic growth (Dinh, 2020).

However, inflation's effect on economic growth is not always adverse. Moderate inflation, often within a target range, can encourage consumption and investment as individuals and businesses seek to spend money before prices rise (Karki, Banjara, & Dumre, 2020). Additionally, inflation can help reduce the real debt burden, particularly for the government, which benefits from the reduced value of its outstanding debt in real terms (Azam & Khan, 2022). This can give the government more fiscal space to increase public spending on infrastructure and social services, potentially stimulating economic growth (Sanga, Kongolo, & Mnongya, 2023). In Uganda, inflation also interacts with the country's monetary policy framework, impacting domestic and international economic conditions (Opeyemi, 2020). For instance, inflationary pressures often arise from external shocks, such as rising global oil prices or food shortages. These external factors can complicate Uganda's efforts to maintain price stability, as domestic inflation becomes linked to global economic trends over which the country has little control (Uddin & Rahman, 2023). Therefore, Uganda's central bank must carefully manage inflationary expectations and coordinate monetary and fiscal policies to maintain economic stability (Khan & Hanif, 2020). The relationship between inflation and economic growth in Uganda is complex, with positive and negative effects depending on the inflation rate and underlying causes (Sanga, Kongolo, &

Mnongya, 2022). The key is maintaining inflation within a manageable range that supports growth while avoiding the negative consequences of hyperinflation or deflation (Mandeya & Ho, 2021). Uganda's economic growth prospects depend on its ability to control inflation through prudent fiscal and monetary policies while addressing structural factors such as food security, exchange rate stability, and energy prices (Karki, Banjara, & Dumre, 2020). Inflation targeting as a policy framework can help anchor expectations, promoting economic stability and confidence in the currency, which are essential for long-term growth (Sanga, Kongolo, & Mnongya, 2023).

3. Methodology

This study adopts a quantitative research approach to examine the relationship between key economic indicators and Uganda's economic growth, with a specific focus on Gross National Income (GNI), inflation, Foreign Direct Investment (FDI), human capital, and Gross Capital Formation (GCF) (World Bank, 2023; IMF, 2023). The study utilizes a time-series research design, analyzing data spanning several years to assess long-term and short-term dynamics (Kaggwa & Tumusiime, 2022). Data was collected from secondary sources, primarily government publications, international financial databases, and reports from the Uganda Bureau of Statistics (UBOS) (UBOS, 2023; UNCTAD, 2023). The data collection instruments included official economic reports and statistical databases (AfDB, 2023). To ensure the reliability and accuracy of the findings, various econometric techniques were employed, including the Augmented Dickey-Fuller (ADF) test for stationarity, the Variance Inflation Factor (VIF) test for multicollinearity, and the Autoregressive Distributed Lag (ARDL) model for analyzing long-run and short-run relationships (Pesaran et al., 2023; Gujarati & Porter, 2023). The ARDL model helped determine the impact of variables such as human capital, FDI, inflation, and capital formation on economic growth, while diagnostic tests ensured the robustness of the results by checking for multicollinearity and stationarity (Kumar & Nsubuga, 2023; EViews Manual, 2023).

4. Study Findings

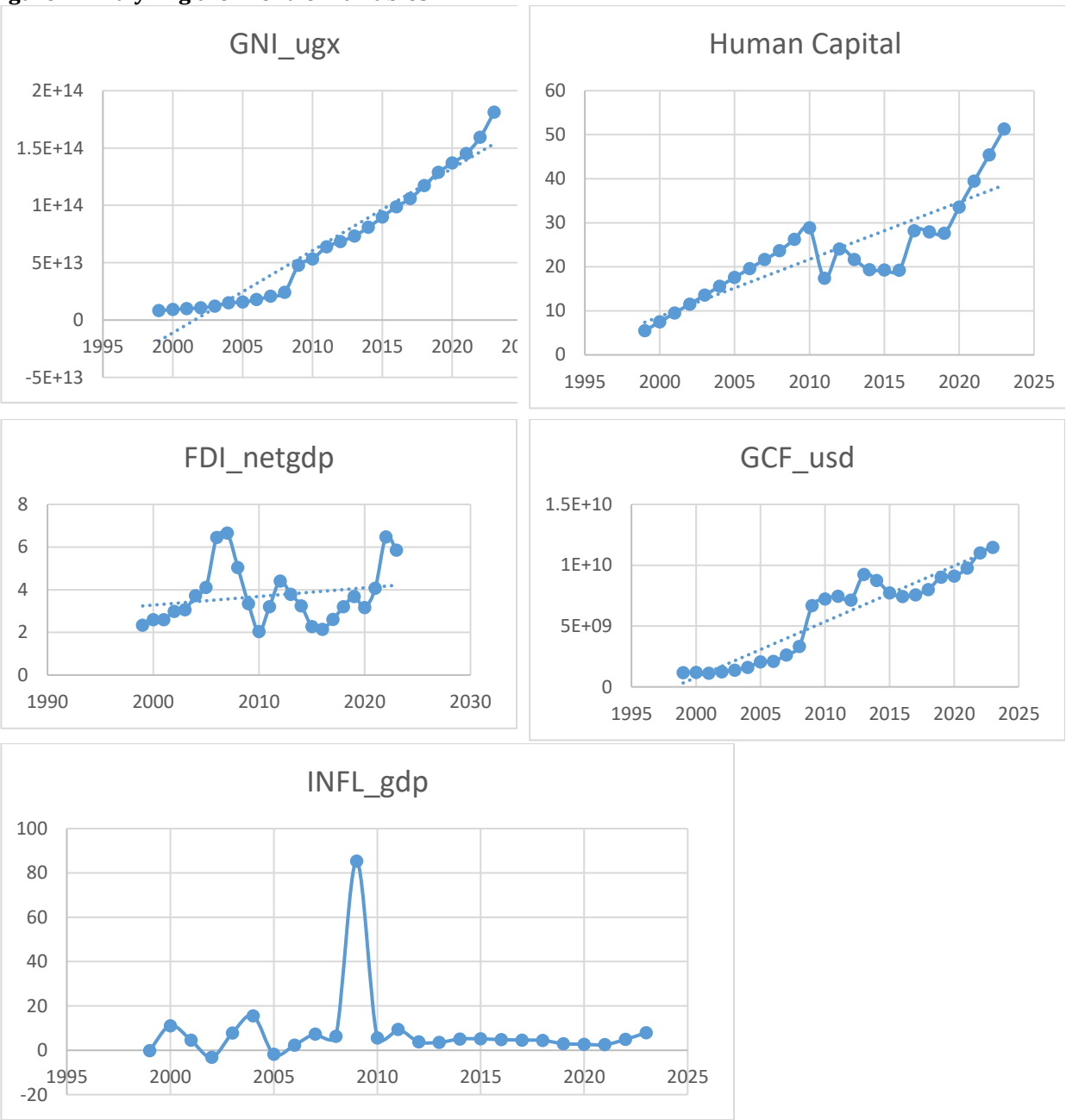
Table 1: Data observation across the study period

Stats	GNI	Human Capital	FDI	GCF	Inflation
Mean	6.77E+13	22.98774	3.724424	5.82E+09	8.12942
Sd	5.43E+13	11.04539	1.385351	3.56E+09	16.54449
Min	8.15E+12	5.465001	2.039005	1.13E+09	-3.16956
Max	1.81E+14	51.30781	6.656597	1.15E+10	85.35327

The dataset presents a statistical summary of the study's key economic indicators, including Gross National Income (GNI), Human Capital, Foreign Direct Investment (FDI), Gross Capital Formation (GCF), and Inflation. The mean values reflect moderate levels of economic performance, with GNI averaging 67.7 trillion UGX and Human Capital at 22.99, indicating steady but variable economic and social development. However, the high standard deviations highlight significant economic volatility, particularly for GNI (54.3 trillion UGX) and Inflation (16.54). The wide range of values, such as GNI spanning from 8.15 trillion UGX to 181 trillion UGX, and Inflation fluctuating between -3.17% and 85.35%, underscores periods of both growth and instability, suggesting that Uganda's economy is susceptible to internal and external shocks.

The significant variability and wide ranges in these indicators suggest possible non-normal distribution of variables like GNI, Inflation, and GCF, a potential indicator of the presence of outliers. The study variables were therefore log-transformed

Figure 1: Analyzing the Trend of Variables



The overall trends in Uganda's economic indicators reveal sustained long-term growth punctuated by significant volatility, particularly in inflation and foreign direct investment. The upward trajectories of GNI, human capital, and gross capital formation suggest structural improvements in the economy over time, while the cyclical fluctuations in FDI and the sharp spike in inflation highlight the susceptibility of Uganda's economy to external shocks and domestic policy changes. The presence of trends, especially upward linear or exponential patterns in variables like GNI and GCF, necessitates testing for unit roots with a trend option to determine the stationarity of these series. Non-stationary time series with trends can produce spurious regression results, leading to unreliable inferences in econometric models. Including a trend component allows researchers to capture the deterministic trends observed in the data, ensuring robust and accurate analysis of long-run relationships among the economic variables.

Stationarity checks for study variables

The stationarity tests were carried out using the ADF test. The trend option was considered since the variables show trends.

Table 2: Variables stationarity at levels

Variable	Test Statistic z(t)	Critical Value (5%)	P-Value	Conclusion
GNI	-1.170	-3.600	0.9165	-
Human Capital	-2.198	-3.600	0.4908	-
FDI	-2.355	-3.600	0.4037	-
GCF	-1.270	-3.600	0.8952	-
Inflation	-5.238	-3.600	0.0001	I (0)

The results demonstrate that GNI, Human Capital, FDI, and GCF are non-stationary, confirming that they possess a unit root and require differencing to achieve stationarity, classifying them as integrated of order I (1). Conversely, Inflation is stationary at its level form, making it integrated of order I (0) and ready for direct use in analysis.

Table 3: Variables stationarity at first difference

Variable	Test Statistic z(t)	Critical Value (5%)	P-Value	Conclusion
GNI	-4.418	-3.000	0.0003	I (1)
Human Capital	-5.489	-3.000	0.0000	I (1)
FDI	-3.548	-3.000	0.0068	I (1)
GCF	-3.754	-3.000	0.0034	I (1)

The results indicate that GNI, Human Capital, FDI, and GCF achieve stationarity upon first differencing, classifying them as integrated of order I(1). These findings highlight the necessity of differencing these variables before employing them in time-series models to ensure robustness and avoid spurious regression issues in econometric analysis.

Table 4: **Testing for multicollinearity**

Variable	VIF	SQRT VIF	Tolerance	R-Squared
Human Capital	5.86	2.42	0.1708	0.8292
FDI	1.84	1.36	0.543	0.457
GCF	4.68	2.16	0.2137	0.7863
Inflation	1.1	1.05	0.909	0.091
Mean VIF	3.37			

The results indicate the absence of severe multicollinearity, as all Variance Inflation Factor (VIF) values are well below the commonly accepted threshold of 10. This demonstrates that none of the variables exhibits excessively high multicollinearity. Similarly, the tolerance values, which are inversely related to VIF, confirm that the variables maintain adequate levels of independence.

Table 5: ARDL model

Variable	Coef.	Std. Err.	t	P>|t|	95% Conf. Interval Lower & Upper	
Long Run						
ECT	-0.3744375	0.0552899	-6.77	0.000	-0.4916469	-0.257228
Human Capital	0.8586368	0.1722001	4.99	0.000	0.4935889	1.223685
FDI	-0.5668895	0.13171	-4.3	0.001	-0.8461023	-0.2876767

Capital	0.808976	0.083809	9.65	0.000	0.631309	0.9866431
Inflation	0.097988	0.0438758	2.23	0.04	0.0049755	0.1910005
Short Run						
GNI	-0.5462186	0.1307831	-4.18	0.001	-0.8234664	-0.2689707
Human Capital	0.3215058	0.0786392	4.09	0.001	0.154798	0.4882135
FDI	-0.2122647	0.0584251	-3.63	0.002	-0.3361204	-0.0884089
Capital	0.3029109	0.0594313	5.1	0.000	0.1769221	0.4288997
Inflation	0.0366904	0.0127309	2.88	0.011	0.0097021	0.0636787
Constant	4.414974	0.7678755	5.75	0.000	2.787151	6.042797

The results present the long-run and short-run relationships for various variables, highlighting their coefficients, statistical significance, and confidence intervals. The Error Correction Term (ECT) in the long-run model is negative and statistically significant, indicating that deviations from the long-run equilibrium are corrected relatively quickly, supporting a stable long-run relationship among the variables.

Human Capital has a positive and statistically significant coefficient in the long run, suggesting a substantial contribution to the dependent variable. Foreign Direct Investment (FDI) has a negative and significant coefficient, implying a reduction in the dependent variable as FDI increases. Capital also exhibits a significant positive effect, while Inflation shows a more negligible, yet statistically significant, positive influence. These results highlight the distinct roles of these variables in shaping the long-run dynamics.

GNI is negatively and significantly associated with the dependent variable in the short run, suggesting a short-term adverse effect. Human Capital remains positive and significant, consistent with its long-run effect, though its magnitude is minor. Similarly, FDI has a negative and significant impact, but its effect is less pronounced compared to the long run. Capital continues to exert a positive and significant influence, though the coefficient is smaller in the short run. Inflation also has a positive and statistically significant effect, consistent with its long-run behavior, but the magnitude is reduced.

Discussion

A study analyzed Uganda's GNI and Human Capital and Foreign Direct Investment (FDI) and Gross Capital Formation (GCF) and Inflation data in a particular period. The results from descriptive statistics revealed a moderate economic performance of 67.7 trillion UGX GNI and 22.99 Human Capital scores, showing continued socio-economic development. The large standard deviations of GNI and Inflation values indicate major fluctuations that are caused by economic disruptions and world market changes (Adaramola & Dada, 2020; Anguyo et al., 2020). Log transformations were necessary to normalize the data because GNI (8.15 to 181 trillion UGX) and Inflation (-3.17% to 85.35%) had significant variations.

The trend analysis showed a positive trend for GNI and Human Capital and GCF, indicating long-term growth. FDI and Inflation followed a cyclical pattern, which shows Uganda's exposure to external factors, including investment movements and market price changes (Asongu & Odhiambo, 2020; Adegboye et al., 2020). The results demonstrate the necessity to implement strategies to handle external disruptions. The Augmented Dickey-Fuller (ADF) tests showed that GNI, Human Capital, FDI, and GCF had non-stationary properties at the level but became stationary after the first difference and Inflation was already stationary at the level. The results from Asafo-Agyei and Kodongo (2022) and Barbra and Nawaz (2021) support the use of transformation to prevent spurious regression due to alignment with their findings. The VIF results confirmed no multicollinearity issues, which supports the reliability of the model estimates (Aghaei et al., 2023).

Human Capital, together with GCF and Inflation, proved to be positive factors for economic development, while FDI produced negative results according to the ARDL model in the long run. The findings indicate that local investments and moderate levels of inflation boost economic growth, but foreign direct investments can create negative effects when there are no adequate institutional systems (Acquah & Ibrahim, 2020; Anguyo et al., 2020). The variables displayed statistical significance in the short run, but the overall effects remained

relatively small. Human Capital, GCF, and Inflation demonstrated positive effects, but GNI produced negative effects. The study supports Azam and Khan (2022), who discovered that short-term inflation effects on growth are complex. The economy showed resilience through the negative and significant Error Correction Term, which demonstrated its ability to restore long-run equilibrium after short-term disturbances (Huseynli, 2022).

5. Conclusion and Recommendations

The research demonstrates that Gross National Income (GNI), human capital development, foreign direct investment (FDI), capital formation, and inflation strongly affect the economic performance of Uganda. The economic growth of Uganda benefits from GNI, human capital, capital formation, and inflation in both short-term and long-term periods, yet FDI shows opposite effects. The observed high volatility in specific indicators demonstrates that macroeconomic stability is critical for sustainable growth. The validity of econometric results depends on the absence of non-stationary variables, and the model's reliability increases because of the absence of multicollinearity. The substantial error correction mechanism shows that Uganda's economy can recover from brief disturbances before reaching equilibrium.

Recommendations

The government should implement policies that develop human capital and domestic investment while maintaining stable inflation rates to achieve economic stability and sustainability. The attraction and regulation of foreign direct investment should be carefully considered to avoid disrupting the natural functioning of the domestic economy. Monitoring macroeconomic indicators should be improved to detect and control volatility, while economic analysis requires correct data stationarity treatment for making accurate predictions and designing policies.

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