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Effect of Real Interest Rates on Domestic Private Investment in Uganda: Evidence from ARDL Bounds Testing Approach to Cointegration Analysis

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Abstract

Real interest rates are believed to have a significant influence on domestic private investment. In recent years, few studies have examined the impact of real interest rates on domestic private investment, despite their crucial role in promoting growth in this area. Focusing on Uganda, this paper is the first to investigate the impact of real interest rates on the growth of domestic private investment. The primary objective is to empirically examine the impact of real interest rates on domestic private investment in Uganda from 1983 to 2022. The Autoregressive Distributed Lag (ARDL) bounds testing approach to cointegration was employed to analyze the data. Findings suggest a long-term relationship between domestic private investment and real interest rates, as well as other factors. Specifically, the results indicate that real interest rates have a positive impact on domestic private investment in the long run, at a 1% significance level. Additionally, the analysis shows that real GDP growth, general government final consumption expenditure, external debt, gross national expenditure, money supply, trade openness, and gross national savings collectively determine domestic private investment in Uganda. Based on the empirical results, policies aimed at stabilizing real interest rates by implementing favorable strategies that promote economic activities and encourage private investment in the country are highly recommended. Therefore, policies such as creating an enabling business environment through the provision of supportive economic infrastructure related to low power tariffs, improved road networks, and increased business confidence as well as honouring the rule of law and ensuring solid macroeconomic management through low inflation rates and a stable exchange rate, can help facilitate domestic private investment in Uganda.

Keywords: Real Interest Rate; Uganda; ARDL; ADF; PP; Domestic Private Investment

1. Introduction

The ideal capital stock is directly related to output and negatively related to the cost of capital. Thus, a decrease in the real interest rate decreases the opportunity cost of capital and, therefore, increases the desired stock of capital and investment expenditure. The role of investment in augmenting the economic growth of a particular economy can barely be overstated (Chhibber and Kalloor, 2016). It is averred that both economic theories and empirical evidence have resolved and present a positive relationship between investment and economic growth (Blanchard et al., 1984; Hansen and Seshadri, 2013). Consequently, policymakers and scholars are frequently concerned with the factors driving the level of investment in a

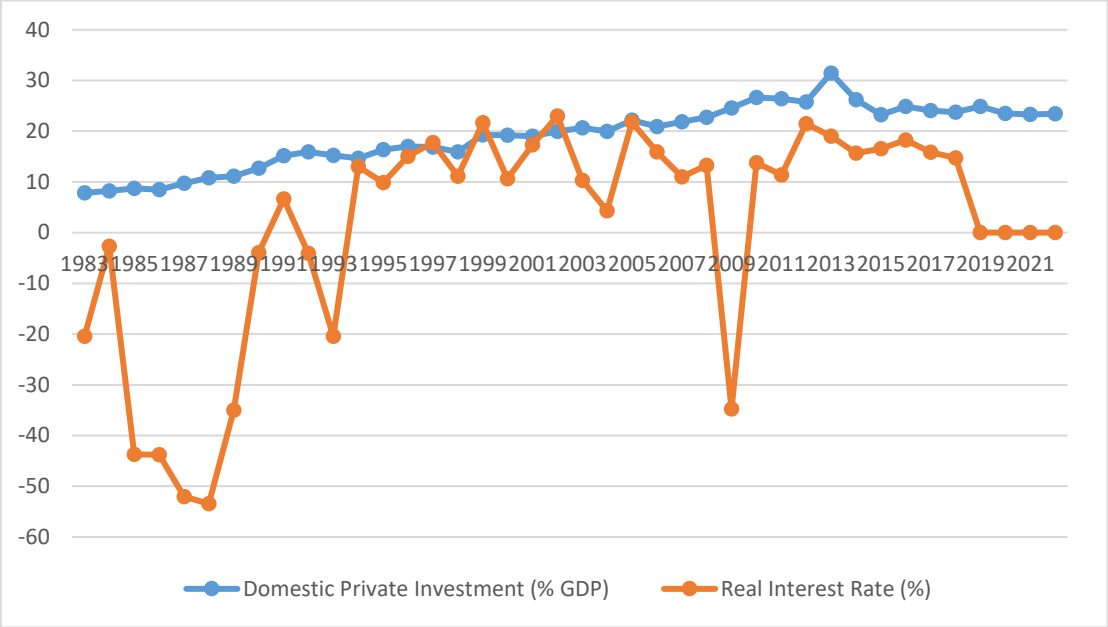
given economy. Among these factors that derive greater effect on investment is the real interest rate. The link between investment and real interest rate has captivated significant and sensational debates in economic theory. As a result, the real interest rate plays a considerable role in the monetary policy transmission mechanism, and the link between the real interest rate and investment is considered to be of great importance to scholars and policymakers (Ofori and Asumadu, 2018).

The neoclassical theory of investment assumes an inverse relationship between investment and the real interest rate, in that a rise in the real interest rate increases the real cost of capital and consequently decreases the investment level. Nevertheless, a fall in the real interest rate reduces the real cost of capital and therefore increases the investment level (Haavelmo, 1960; Jorgenson, 1963). Accordingly, there are two conflicting views regarding the influence of real interest rate on the level of private investment. A high level of interest rate increases the real cost of capital and therefore reduces the level of private investment. Additionally, underdeveloped financial markets in developing countries and limited access to foreign financing for most private projects suggest that private investment is largely hampered by domestic savings. These, in theory, are estimated to react positively to higher real interest rates (Ofori & Asumadu, 2018).

In Uganda, bank lending to households and businesses continues to play a significant role in the monetary policy transmission channel that affects the economy. Commercial bank lending interest rates for shilling-denominated loans decreased to 17.7% in April 2024, compared to 19.3% in April 2023. Meanwhile, interest rates on the domestic debt market remained stable, averaging 11.2% on one-year government Treasury Bills (MoFPED, 2024). The continued decrease in the shilling-denominated lending rate is indicative of the accommodative monetary policy position instituted by the Bank of Uganda, which lowered the Central Bank Rate from 10.25% to 10% as of August 2024 (MoFPED, 2024). Commercial bank lending interest rates remained relatively high, averaging 18.85% in May 2024, compared to an average of 17.74% in April 2024 (BOU, 2024). Average lending rates on US dollar-denominated loans remained largely high at 10.2% as of June 2024 (MoFPED, 2024). Over the same period, the weighted average shilling deposit rate also remained stable at 11.54%, while the foreign currency deposit rate averaged 1.4% in June 2024, lower than the 1.5% reported in December 2023 (BOU, 2024).

Similarly, growth in private sector credit remained strong, though slightly lower than the one realized in the previous financial year, generally driven by a reduction in economic activity, an increase in the Central Bank Rate of 10.25% as of July 2024, and a fall in asset quality as indicated by a high rate of non-performing loans. The year-on-year growth in private sector credit, on average, decreased to 7.7% as of March 2024 for the financial year 2023/2024, lower than the 10.0% realized in the financial year 2022/2023. The growth in private sector credit was primarily driven by shilling-denominated loans, which increased by 9.6% in March of the financial year 2023/2024, compared to 12.0% in the previous financial year 2022/23 (MoFPED, 2024). Foreign currency-denominated loans also reduced, recording a year-on-year decline of 3.7% in March of the financial year 2023/24 compared to 4.7% registered in the financial year 2022/2023 (MoFPED, 2024). Figure 1 illustrates the trends in private investment and the real interest rate between 1983 and 2022.

Figure 1: Trends of Domestic Private Investment and Real Interest Rate (1983 – 2022)



Source: WDI 2024

It is observed that the real interest rates highlighted in this study largely explain the growth trends in private sector investment in Uganda. This indicates that a decline in real interest rates leads to a substantial increase in domestic private investment, as shown by the trend in the figure above. Consequently, this paper aims to empirically analyze the relationship between real interest rates and domestic private investment in Uganda from 1983 to 2022.

Over the years, achieving sustainable growth and development in Uganda has been a challenge. There exist low levels of savings and investment, instability in monetary and fiscal Policies, dwindling crude Oil Prices in the international market, rising interest rates, and poor infrastructural development, inter alia. Consequently, the Government, through the International Monetary Fund (IMF), adopted the Structural Adjustment Programmes in 1986 to restructure the economy's productivity and consumption patterns. This involved removing price distortions and reducing dependency on crude oil exports, as well as the import of raw materials and consumer goods. Before the introduction of the Structural Adjustment Programme in 1986 in Uganda, the Bank of Uganda dictated the interest rates with an explicit range between deposit and lending rates. Commercial banks were required by law to allocate a specific percentage of their credits to the priority sectors of the economy, to wit: agriculture and industry. Despite these measures implemented by the Ugandan government, promoting the productive sectors of the economy has not been achieved. Interest rates have been uneven, and high levels of Investment have not been obtained. To my understanding, there is a scarcity of evidence-based studies that attempt to explain the relationship between real interest rates and domestic private investment in Uganda. Thus, the broad objective of this paper is to empirically examine the relationship between real interest rates and domestic private investment in Uganda from 1983 to 2022.

The remainder of the paper is structured as follows. Section 2 provides the related literature, and Section 3 presents the theoretical framework, methodology, and data sources. Section 4 presents the results and findings, and Section 5 presents the conclusion and policy recommendations.

2. Literature Review

2.1.Theoretical Overview

It is highly recommended that domestic private investment plays a crucial role in stimulating the overall level of output, employment, and changes in economic activity (Keynes, 1936). For instance, it is observed that when interest rates decrease, the financial sustainability of numerous projects cannot be overstated. In contrast, increasing interest rates can lead to the rescheduling or cancellation of some projects. This occurs due to higher interest rates on loans used to finance investments. Consequently, according to Keynes, since investment changes and depends on firms' positions or the prospects of the profitability of their investment, the anticipated return on that investment outpaces the interest rate; therefore, new investment will follow. Keynes, therefore, negated the notion that investment is wholly based on the technological prominence of output per unit of fixed production assets (fixed capital), but instead stated that monetary factors, finance, and uncertainty are the ultimate factors that influence the level of investment (Fazzari, 1989).

The rigid accelerator theory, developed by Kalecki (1935) and later refined by Clarke (1917), posits that investment is positively related to changes in the level of output. This implies that the rigid accelerator theory links investment to demand volatility and contends that an increase in a firm's quantity of goods and services produced results in an equal increase in capital stock. In simple terms, the theory posits that variations in overall demand or output levels affect investment, as well as fluctuations in the stock of capital.

The MacKinnon and Shaw (1973) hypothesis asserts that most economies, especially developing economies, experience financial crises that, if properly addressed, can lead to increased savings and investment, thereby promoting economic growth. Clearly, savings are highly sensitive to interest rates; thus, a rise in the savings rate would indicate higher levels of investment, resulting in faster growth. Likewise, the nature of investment projects is seen as irreversible (Pindyck, 1993). Recent evidence indicates that elements of uncertainty are present in investment decision-making, including risks related to inflation and interest rates.

The loanable funds theory, as developed by Robertson and Ohlin (1931), is centered on the market interest rate. According to this approach, the market interest rate is determined by the demand for and supply of loanable funds. The term loanable funds signifies all forms of credit, such as loans, bonds, or savings deposits. According to the loanable funds hypothesis, the equilibrium rate of interest occurs when there is equilibrium between the demand for and supply of loanable funds. Hence, the equilibrium interest rate is established at a point where the demand for loanable funds curve intersects the supply curve of loanable funds.

Finally, my empirical model is closely tied to the neoclassical flexible accelerator model, which is widely regarded as the standard theory of investment. The model states that investment depends on the level of output and the user cost of capital, with the latter typically influenced by the price of capital goods, the depreciation rate of capital assets, and real interest rates. This theory suggests that fiscal policy can influence monetary policy, such that if expansionary fiscal policy involves higher taxes, such as an investment tax credit, investment in a specific economy will increase. Likewise, expansionary fiscal policy raises income levels and expected output of firms, which increases the desired capital stock and promotes investment. Similarly, expansionary monetary policy reduces interest rates and, consequently, lowers the rental costs of capital; this increase in the desired capital stock also encourages investment (Olweny & Chiluwe, 2012; Mundia, 2014; Hassan & Nassar, 2015). Therefore, the combined effect of fiscal and

monetary policies, along with their transmission mechanisms, influences both short-term and long-term interest rates, ultimately promoting investment levels in the economy (Kinyanjui et al., 2020).

2.2.Empirical Review

Several studies have attempted to examine the impact of real interest rates on investment and economic growth. Here, my concern is with the studies that have established the relationship between real interest rates and domestic private investment.

Ofori and Asumadu (2018) assessed the variants in interest rate and investment determination in Ghana using annual time series data for the period 1990-2014, employing unit root and cointegration tests to establish the order of integration of the variables. The study revealed that variations in interest rates played a negative and highly significant role in the economy's investment decisions, and the demand for credit also had a negative and significant influence on interest rate variations in both the short and long run.

Furthermore, George-Anokwuru (2017) examined the relationship between Interest rate and Domestic Private Investment in Nigeria from 1980 to 2015 using the Ordinary Least Squares Regression technique. The findings indicated that the real and prime lending rates are negatively related to Private Domestic Investment and are statistically significant at the 5% level. Additionally, Afful and Kamasu (2020) investigated the effect of interest rate on private investment. They established the threshold level beyond which an interest rate is viewed as disadvantageous to private investment in Ghana, using annual time series data from 1986 to 2016. This was achieved by employing the autoregressive distributed lag (ARDL) model, the quadratic function, and conditional least squares procedures to estimate the interest rate threshold. The findings from the ARDL model revealed a positive long- and short-run effect of the interest rate on private investment, thereby confirming the McKinnon and Shaw hypothesis in Ghana. Nevertheless, the results from the quadratic function and the conditional least squares model revealed thresholds of 23.59% and 24%, respectively, beyond which the interest rate negatively influences private investment in Ghana.

In a related study, Agu (2015) assessed the factors influencing private investment in Nigeria from 1970 to 2012 using the Error Correction Model (ECM) technique and found that infrastructure and interest rates positively influence private investment. Similarly, Kinyanjui et al. (2020) investigated the relationship between short-term interest rates, long-term interest rates, and private domestic investment in Kenya, using quarterly time series data from 1997 to 2018 and employing the Vector Autoregressive model to estimate the relationship. Their findings indicate that the central bank rate and lending rate have a significant impact on private domestic investment.

In a related study, Mehrara and Karsalari (2011) examined the nonlinear relationship between the real interest rate and private investment in developing countries from 1970 to 2007, using a threshold dynamic panel approach. The findings of their study indicate that real interest rates have a positive influence on private investment below the threshold level. However, above the estimated threshold, real interest rates have a negative impact on private investment. The results indicate that the threshold of the real interest rate above which interest rates significantly slow growth is around 5% to 6% for these economies. Suhendra and Anwar (2017) assessed the factors affecting private investment in Indonesia over the period 1990-2011 using a multiple regression methodology on panel data, employing variables such as interest rate, public investment, growth rate of gross domestic product, funds to the private sector, inflation, and exchange rate. The results from their study indicated that public investment, the growth rate of GDP, funds allocated to the private sector, and the exchange rate have a positive influence on private investment, while interest rates and inflation were reported to have a negative effect on private investment.

Relatedly, Muhammad et al. (2013) examined the real interest rate and its impact on investment in Pakistan from 1964 to 2012, considering income levels, interest rates, and investment, and using the Johansen Cointegration test to establish the long-run relationship among the study variables. Their findings align with economic theory and other studies indicating that investment has a significant inverse relationship with the real interest rate in Pakistan. Similarly, Li and Khurshid (2015) studied the impact of interest rates on investment in Jiangsu Province, China, using the Johansen Cointegration test and the vector error correction model (VECM) to analyze the short-run relationship during 2003 to 2012. The results revealed a long-run association among the variables, with interest rates negatively related in the long term but positively correlated in the short term.

Additionally, Malawi and Bader (2010) examined the influence of the real interest rate on investment levels in Jordan from 1990 to 2000 using Johansen cointegration analysis and employed two-unit root tests—the Phillips-Perron test and the Augmented Dickey-Fuller test—to determine the order of integration of the variables. The authors used variance decomposition and impulse response functions to establish dynamic relationships among the variables. The results align with economic theory and other studies, indicating that the real interest rate has a negative impact on investment, while income levels have a positive effect.

Furthermore, Musyoka and Ocharo (2018) examined the effect of real interest rates, exchange rates, inflation, and competitiveness on Foreign Direct Investment in Kenya by using annual time series data from 1970 to 2016 and employing the ordinary least squares regression technique to determine the impact of these factors on FDI. The results indicated that real interest rates and exchange rates have a negative and significant influence on FDI inflows into Kenya. At the same time, competitiveness was found to have a positive and significant effect on foreign direct investment. However, inflation had an insignificant impact on FDI. Using the Johansen cointegration technique, Nelson and Emase (2018) examined the impact of interest rates on domestic private investment in Kenya from 1963 to 2014. Their findings showed that deposit rates, lending rates, and real interest rates negatively affect domestic private investment.

As a result, several studies have been reviewed; however, most of these focus on the relationship between interest rates and domestic private investment in various countries. They present diverging views on the connection between the real interest rate and domestic private investment (Malawi & Bader, 2010; Mehrara & Karsalari, 2011; Muhammad et al., 2013; Musyoka & Ocharo, 2018; Afful and Kamasa, 2020; Kinyanjui et al., 2020). To my knowledge, no study has specifically examined the role of real interest rates in promoting domestic private investment in Uganda, which this study aims to address.

3. Methodology and Data

3.1.Theoretical Framework

We adopt the flexible accelerator theory of investment, where the stock of capital is adjusted to its desired level. Thus, the firm's net investment is proportional to changes in the desired capital stock (Latruffe, 2004). The theory is essentially a partial adjustment theory, like the adaptive expectations theory, which is an extension of the accelerator theory (Gujarati, 2003). With respect to the partial adjustment process, the stock of capital is changed only to its ideal level because the adjustment is not instantaneous. We assume the existence of an optimal equilibrium amount of capital stock required to produce a particular level of output for a given state of technology and a given level of interest rate. The demand for capital rises with the rising demand for output, and therefore, the accelerator theory (Latruffe, 2004).

We follow Reinikka and Svensson (2001) to estimate the cost of instantaneous net investment given by

$C(I)$ in which I is net investment and C is the cost function with $C(0) = 0$, and because the ideal capital is the stock of capital a firm holds if the adjustment costs were vehemently eliminated (Chun & Mun, 2005). Therefore, $C^{'}(I)$, $C^{''}(I) = 0$ for all $I > 0$. The firms are expected to maximize profits, as defined by the profit function, $\pi = \pi(t, K)$ is concave in the stock of capital. Therefore, $\pi_k^{'}(t, K) > 0$ and $\pi_k^{''}(t, K) < 0$, where t denotes time. We further assume that firms are price and product takers, and therefore, at constant relative prices, investment is presented as follows.

$I_t = \gamma(K^* - K_t)$…… (3.1)

Where K^* denotes the ideal capital stock, K is the actual stock of capital in the present period and γ is the adjustment coefficient so that $0 < \gamma < 1$. Investment is assumed to be proportionate to the gap between the ideal and the actual stock of capital. Therefore, investment is significant if the ideal capital stock exceeds the actual capital stock. Similarly, if the anticipated future demand for output is Q^*, then $K_t^* = \alpha Q_t^*$ where $0 < \alpha < 1$. Thus, the ideal capital stock is proportional to expected demand for output, suggesting a fixed proportions technology and α is driven by relative prices. Therefore, equation 3.1 can be represented as follows.

$I_t = \gamma(\alpha Q_t^* - K_{t-1})$……..… (3.2)

The demand expectations are presumed to be a linear function of the existing output level and therefore, it is given as;

$I_t = \gamma(\alpha\delta Q_t - K_{t-1})$……..…….. (3.3)

By noting that $I_{t-1} = K_{t-1} - K_{t-2}$ and the first-order differencing equation 3.3 suggests that equation 3.3 becomes.

$I_t = \emptyset_1 \Delta Q + (1 - \gamma) I_{t-1}$…….... (3.4)

Where $\emptyset_1 = \gamma\alpha\delta$ and ΔQ is the change in the level of output. Thus, Equation 3.4 represents the Neoclassical flexible accelerator model, in which variations in sales attract investment.

In order to assess the role of real interest rates on domestic private investment, we formulate a model based on the flexible accelerator theory, which is a variant of Malawi and Bader (2010); Mohrara and Karsalari (2011); Muhammad et al. (2013); George-Anokwuru (2017); Afful and Kamasa (2020), and Kinyanjui et al. (2020). Particularly, the modification sought to scrutinize the role of real interest rates on domestic private investment in Uganda, following the theoretical basis of the flexible accelerator model, which is adopted in this paper, and is a diverse form of the flexible accelerator model intended to detect some of the key private investment performance in Uganda. Here we take domestic private investment as a function of real interest rate, income proxied by GDP growth, government spending, broad money, trade openness, gross national expenditure, external debt stock, gross national saving, inter alia. Therefore, the proposed model is presented in the following equation;

$I = f((R\ Y\ G\ M3\ \text{TO}\ GNE\ EXD\ \text{GNS})$…….....(3.4)

Empirically, the model employed in this study is given below;

$\text{Pr}\_Inv_t = \beta_0 + \beta_1 R\_INT_t + \beta_2 GDP_t + \beta_3 GS_t + \beta_4 M_{3t} + \beta_5 TO_t + \beta_6 GNE_t + \beta_7 EX\_DEBT_t + \beta_8 GNS_t + \varepsilon_t$…….. (3.5)

Where; Pr $\_Inv$ is domestic private investment proxied by gross fixed capital formation as a percentage of GDP, R_INT is real interest rate, GDP growth is a proxy for income, GS denotes general government consumption expenditure, M_3 denotes annual broad money growth, TO is trade openness, GNE is gross national expenditure, EX_DEBT is external debt stock, GNS is gross national saving, ε is the stochastic error term and t is the time specific component.

3.2.Empirical Model Estimation and Data Sources

The stationarity components of the data and the presence of a unit root in time series variables are checked using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. After understanding that the variables are integrated of both order zero I(0) and order one I(1) and that none of the study variables is integrated of order two I(2), we confidently estimated the long run and short run ARDL model proposed by Pesaran and Shin (1995) and later by Pesaran et al. (2001) due to its advantages over other estimation methods including but not limited to (i) ARDL approach is more reliable for small sample (ii) ARDL model engenders estimation of both the short run and long run jointly (iii) ARDL model accounts for the effects of shocks in regression equation (iv) the ARDL method generates unbiased estimates even in cases of endogenous covariates (Harris & Sollis, 2003) and (v) ARDL approach allows for different variables to have different optimal number of lags. The typical ARDL model estimated in this paper is presented in the following equation;

$$\Delta Pr - Inv_t = \beta_0 + \beta_1 GCF_{t-1} + \beta_2 R\_INT_{t-1} + \beta_3 GDP_{t-1} + \beta_4 GS_{t-1} + \beta_5 M3_{t-1} + \beta_6 TO_{t-1} + \beta_7 GNE_{t-1} + \mu_1 \sum_{i=0}^{p-1} \Delta GCF_{t-1} + \mu_2 \sum_{i=0}^{q-1} \Delta R\_INT_{t-1} + \mu_3 \sum_{i=0}^{q-1} \Delta GDP_{t-1} + \mu_4 \sum_{i=0}^{q-1} GS_{t-1} + \mu_5 \sum_{i=0}^{q-1} \Delta M3_{t-1} + \mu_6 \sum_{i=0}^{q-1} \Delta TO_{t-1} + \mu_7 \sum_{i=0}^{q-1} \Delta GNE_{t-1} + \mu_8 \sum_{i=0}^{q-1} \Delta EXD_{t-1} + \mu_9 \sum_{i=0}^{q-1} \Delta GNS_{t-1} + \theta_i ECT_{t-1} + \varepsilon_t \quad (3.6)$$

In the estimated model above, α_0, $\beta_1 \ldots . \beta_9$ and ε denote the short-run coefficients, long-run coefficients, and the stochastic disturbance error term, respectively. Δ denotes the first difference operator, t is the time period while p and q represent the maximum number of lags for the dependent variable and explanatory variables, respectively. This model is estimated using STATA 15 and the maximum lag of each independent variable (q) is selected by minimizing the Akaike Information Criteria.

The current paper uses annual time series data for Uganda from 1983 to 2022, sourced from the World Bank's Database of World Development Indicators. The dependent variable is domestic private investment, measured as the ratio of gross capital formation to GDP. The real interest rate is a key explanatory variable, and its coefficient is expected to have a negative impact on domestic private investment. Other control variables include real GDP growth, which is expected to influence domestic private investment positively; general government consumption expenditure as a percentage of GDP, also expected to relate to domestic private investment positively; the money supply as a percentage of GDP, expected to have a positive effect; openness to trade as a percentage of GDP, anticipated to affect domestic private investment positively; gross national expenditure as a percentage of GDP, expected to influence it positively; external debt stock as a percentage of GNI, expected to impact domestic private investment negatively; and gross national saving as a percentage of GNI, expected to have a positive effect.

4. Analysis of Results and Discussion

4.1.Descriptive Statistics

The behaviour of the data employed is analysed. As a result, Table 1 presents the descriptive statistics of the data employed. These results indicate that the mean values obtained are a good measure of central tendency, as for all variables, the mean values lie between the minimum and maximum values.

Table 1: Descriptive Statistics

	(1)	(2)	(3)	(4)	(5)
VARIABLES	N	mean	sd	min	max

Pr_Inv	40	19.07	6.050	7.856	31.47
R_INT	36	1.528	23.07	-53.44	23.00
RGDP	40	5.644	2.894	-3.306	11.52
GE	40	10.78	2.915	6.585	16.79
MS	40	16.01	4.440	7.288	23.62
TO	40	35.05	6.981	22.30	56.26
GNE	40	109.1	3.960	101.8	116.2
EXDEBT	40	46.02	23.94	11.18	106.5
GNS	40	16.46	6.717	3.103	25.73

Source: Author's computation

Additionally, the results reveal that the variables exhibit a high degree of reliability, as their mean values consistently fall within the minimum and maximum values. For example, private investment ranges between 7.856 and 31.47 with a mean of 19.07, Real interest rate ranges between -53.444 to 23.00 with a mean value of 1.528, real GDP Growth rate ranges from -3.306 to 11.523 with a mean value of 5.644, Government Expenditure ranges from 6.585 to 16.79 with a mean value of10.78, Broad money supply ranges from 7.288 to 23.62 with a mean value of 16.01, Trade Openness ranges from 22.30 to 56.26 with a mean value of 35.05, Gross National expenditure ranges between 101.8 to 116.2 with a mean value of 109.1, external debt stock ranges from 11.18 to 106.5 with a mean value of 46.02 while Gross National Saving ranges from 3.103 to 25.73 with a mean value of 16.46. The results further provide no evidence of outliers since the values of the standard deviation are realistically small.

To determine whether there is a likelihood of a multicollinearity problem among the variables in the model and to establish the level of linear relationship among the explanatory variables, a pairwise correlation analysis was performed. The analysis of pairwise correlation results are presented in Table 3 below.

Table 2: Pairwise Correlation Results

	R_INT	RGDP	GE	MS	TO	GNE	EXDEBT	GNS
R_INT	1.0000							
RGDP	0.305	1.0000						
GE	0.316	0.180	1.0000					
MS	0.513**	0.0462	0.261	1.0000				
TO	0.491**	0.325	0.118	0.732***	1.0000			
GNE	0.164	0.456**	0.192	-0.0870	0.264	1.0000		
EXDEBT	0.0850	0.0396	0.268	-0.475**	-0.469**	0.193	1.0000	
GNS	0.760***	0.289	0.136	0.655***	0.639***	-0.0663	-0.0738	1.0000

*****p<0.01, **p<0.05, *p<0.1**

Source: Author's computation

The correlation results show no evidence of a multicollinearity problem among the explanatory variables, as the correlation coefficient values for all variables are below the 0.8 threshold level in absolute terms (Studenmund, 2001). Therefore, the regression model is free from the multicollinearity problem.

4.2.Checking for Stationary Properties of Data

Table 3: ADF and Phillips Perron (PP) Unit Root Test Results

	ADF Test		Order of Integration	Phillips Perron Test		Order of Integration
Variables	**Levels**	**First Difference**		**Levels**	**First Difference**	
Pr_Inv	-2.089	-3.315***	**I(1)**	-1.549	-8.466***	**I(1)**
	(0.2489)	(0.0142)		(0.8116)	(0.0000)	
R_INT	-2.013	-4.231***	**I(1)**	-3.195*		**I(0)**
	(0.2808)	(0.0006)		(0.0854)		
RGDP	-3.797***		**I(0)**	-3.591**		**I(0)**
	(0.0029)			(0.0306)		
GE	-1.560	-4.336***	**I(1)**	-2.537	-7.794***	**I(1)**
	(0.5035)	(0.0004)		(0.3097)	(0.0000)	
MS	-1.074	-4.249***	**I(1)**	-3.259*		**I(0)**
	(0.7253)	(0.0005)		(0.0733)		
TO	-1.745	-5.113***	**I(0)**	-2.578	-6.916***	**I(1)**
	(0.4080)	(0.0000)		(0.2903)	(0.0000)	
GNE	-2.683*		**I(0)**	-2.747	-8.502***	**I(1)**
	(0.0771)			(0.2172)	(0.0000)	
EXDEBT	-2.258	-3.494***	**I(1)**	-1.951	-4.189***	**I(1)**
	(0.1857)	(0.0081)		(0.6276)	(0.0046)	
GNS	-1.637	-3.892***	**I(1)**	-2.755	-7.902***	**I(1)**
	(0.4639)	(0.0021)		(0.2138)	(0.0000)	

$^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$; Probability values in parenthesis

Source: Author's computation

The Augmented Dickey-Fuller (ADF) and Phillips-Perron unit root tests are used to determine the order of integration of the variables under consideration. Table 3 shows the results of these tests from the ADF and Phillips-Perron methods. The results in Table 4 indicate that the GDP growth rate and gross national expenditure are stationary at their levels, according to the ADF test, while the other variables are non-stationary but become stationary after the first difference. Conversely, the results show that real interest rates, real GDP growth, and money supply are stationary at levels under the Phillips-Perron test, while other variables are non-stationary at levels but become stationary after the first difference. Overall, the findings suggest that the variables are integrated of order zero and order one, with none being integrated of order two. This means that neither the ordinary least squares (OLS) technique nor the Vector Error Correction (VEC) method can be used to estimate the regression model. Therefore, the Autoregressive Distributed Lag (ARDL) bounds testing approach to cointegration is employed to examine the presence of both short-run and long-run relationships between domestic private investment and independent variables.

The following the Pesaran and Shin (1995) and later by Pesaran et al. (2001), the ARDL model was adopted for analysis due to its statistical significance since it is more reliable for small sample dataset, allows the estimation of both short run and long run jointly, accounts for the effects of shocks in regression

equation, generates unbiased estimates even in cases of endogenous covariates and allows different variables to have different optimal number of lags. The F-test Bounds results are presented in Table 5 below.

Table 4: F-Test Bounds Cointegration Results

F-Statistic	4.850
10% (Lower bound, Upper bound)	(2.280, 3.713)
5% (Lower bound, Upper bound)	(2.764, 4.419)
1% (Lower bound, Upper bound)	(3.983, 6.181)

Source: Author's computation

The F-test bounds the test to cointegration results, indicating that the computed F-statistic is 4.850. The bounds testing results suggest that there is a level relationship amongst the variables simply because the F-statistic is evidently above the upper bound at all the conventional levels of significance except for 1% level, implying that we reject the null hypothesis of no level relationship and conclude that there is a level relationship among the variables.

4.3.Analysis of Empirical Results

The ARDL general-to-specific approach is employed to examine the short-run and long-run effects of real interest rates on domestic private investment in Uganda. Table 5 presents the short-run and long-run ARDL estimation results. The results in Table 5 reveal that the coefficient of the error correction term is presented with the correct sign, which is negative, with a magnitude between -1 and 0, and statistically significant at 1% level. The error correction term coefficient value of -0.750 implies that approximately 75.0% of the adjustment to the long-run equilibrium occurs within a year.

Table 5: Short-run and long-run coefficients of the ARDL Model

VARIABLES	D.Domestic Private Investment
Error Correction Term	-0.750***
	(0.125)
LONG RUN COEFFICIENT RESULTS	
Real Interest Rates	0.0800***
	(0.0281)
Real GDP Growth Rate	-0.510***
	(0.158)
General Government Final Consumption Expenditure	-0.383***
	(0.122)
Money Supply	0.139
	(0.155)
Trade Openness	0.0612
	(0.0680)
Gross National Expenditure	0.560***
	(0.121)
External Debt Stock	-0.0470**

	(0.0183)
Gross National Saving	0.335***
	(0.112)
SHORT RUN COEFFICIENT RESULTS	
D.Real GDP Growth Rate	0.280**
	(0.123)
D.General Government FinalConsumptionExpenditure	0.267**
	(0.124)
D.Money Supply	-0.437**
	(0.183)
D.Gross National Expenditure	-0.199*
	(0.0970)
Constant	-47.52***
	(11.45)
Observations	35
R-squared	0.702
Adj. R-squared	0.517
F(13, 21)	3.80
Prob > F	0.0033

Standard errors in parentheses
***** p<0.01, ** p<0.05, * p<0.1**
Source: Author's computation

Additionally, the R-squared, commonly known as the coefficient of determination, shows the goodness of fit of the model and is presented well. The R-squared for the model is 0.702, which implies that the regressors considered in the model explain 70.2% of the variations in the domestic private investment in Uganda. Besides, the overall F-statistic for the model is 3.80 with the probability value of 0.0033, which suggests rejection of the null hypothesis "that all coefficients are statistically equal to zero". This signifies that real interest rates, real GDP growth rates, general government final consumption expenditure, money supply, trade openness, gross national expenditure, external debt, and gross national saving jointly determine domestic private investment in Uganda.

According to the results in Table 5, the real interest rate is reported to have a positive and statistically significant long-term effect on domestic private investment in Uganda, significant at the 1% level. The positive coefficient of 0.0800 indicates that, all else being equal, a one-unit increase in the real interest rate raises domestic private investment in Uganda by 8.0%. The positive impact of the real interest rate on domestic private investment is attributed to favorable policies implemented by the Ugandan government to support investment by ensuring that both foreign and local investors receive better treatment through low interest rates. This finding contradicts the results of Malawi and Bader (2010), Li and Khurshid (2015), George-Anokwuru (2017), and Ofori and Asumadu (2018), who found a negative effect of the real interest rate on domestic private investment.

The results also show that the real GDP growth rate has a negative and statistically significant long-term effect on domestic private investment in Uganda, significant at the 1% level. The negative coefficient of

0.510 indicates that, all else being equal, an increase in real GDP growth rate reduces domestic private investment by 51.0%. This negative impact of real GDP on private investment can be linked to shocks such as the COVID-19 pandemic and the Russian-Ukrainian war, which have minimally impacted the Ugandan economy and thus negatively affected domestic private investment. This aligns with the study by Almsafir and Morzuki (2015), which also reported an adverse effect of real GDP growth on private investment. In the short term, however, real GDP shows a positive and significant effect on domestic private investment, significant at the 5% level. The positive coefficient of 0.280 suggests that a rise in real GDP growth increases private investment by 28.0%, ceteris paribus. This short-term positive impact of real GDP on private investment could be due to government initiatives like providing credit facilities to nationals to bolster their businesses and recover from shocks like the COVID-19 pandemic, which catalyzed economic recovery, increased economic activities, and boosted domestic private investment. This finding is consistent with the work of Kalu and Onyinye (2015), who also found a positive relationship between real GDP and domestic private investment.

General government final consumption expenditure has a negative and significant long-term effect on domestic private investment in Uganda, significant at the 1% level. Specifically, the coefficient of 0.383 indicates that, ceteris paribus, a one-unit increase in government final consumption expenditure decreases domestic private investment by 38.3%. The adverse long-term impact of government expenditure could be due to increased corruption among government agencies, where resources intended to promote private investment are diverted for personal benefits, ultimately hindering the growth of domestic private investment over time. This aligns with findings by Laopodis (2001) and Sineviciene (2015), who observed that government expenditure can crowd out domestic private investment. Conversely, in the short run, general government final consumption expenditure has a positive and significant effect on domestic private investment at the 5% level. The coefficient of 0.267 suggests that, holding other variables constant, a percentage increase in government expenditure results in a 26.7% boost in domestic private investment. The short-term positive effect may be attributed to government efforts to combat corruption, such as the Investors Protection Unit under the State House and the State House Anticorruption Unit in Uganda, which aim to reduce corruption within government agencies and promote private investment. This finding is consistent with the results of Mamatzakis (2001), Ombuki et al. (2014), and Rahman et al. (2015), who reported a crowding-in effect of government expenditure on domestic private investment.

Broad money supply showed a positive but insignificant long-term effect on domestic private investment in Uganda. However, in the short run, broad money supply had a negative but significant effect on domestic private investment, with significance at the 5% level. Specifically, the coefficient of 0.437 indicates that an increase in broad money supply diminishes domestic private investment by 43.7%, ceteris paribus. The negative impact of the broad money supply on domestic private investment could be attributed to rising commodity prices resulting from the severe impact of the COVID-19 pandemic, which led to higher inflation rates and hindered the growth of domestic private investment. This finding aligns with those of Sulaiman (2020), who found that money supply driven by higher inflation rates negatively affected domestic private investment in Nigeria.

Gross national expenditure as a percentage of GDP has a positive and significant long-term effect on domestic private investment in Uganda, significant at the 1% level. The positive coefficient of 0.560 indicates that, holding other variables constant, an increase in gross national expenditure raises domestic private investment by 56.0%. This long-term positive impact may be due to improved infrastructure investments in the country, which have reduced the cost of doing business in Uganda, attracting more

private investment opportunities and thereby boosting domestic private investment. This aligns with the findings of Akinlo and Oyeleke (2018) and Omitogun (2018), who reported a crowding-in effect of gross national expenditure on domestic private investment. However, in the short term, gross national expenditure has a negative and significant effect on domestic private investment at the 5% level. Specifically, a coefficient of 0.199 suggests that a rise in gross national expenditure reduces domestic private investment by 19.9% (ceteris paribus). The short-term negative effect might be due to rampant corruption in many national projects, particularly infrastructure projects designed to enhance domestic investment, which ultimately hampers growth. This finding concurs with the results of Fouladi (2010), Gatawa and Bello (2012), Foye (2014), and Yovo (2017), who identified a crowding-out effect of gross national expenditure on domestic private investment.

External debt stock has a negative but significant long-term effect on domestic private investment, with significance at the 5% level. The negative coefficient of 0.0470 indicates that an increase in the stock of external debt reduces domestic private investment by 4.7%, ceteris paribus. The adverse impact of external debt on domestic private investment could stem from the misallocation of borrowed resources to unproductive sectors, such as the purchase of military hardware to suppress opposition protests, which do not contribute to economic growth and ultimately hinder the growth of domestic private investment over time. This result aligns with the findings of Turan and Yanıkkaya (2021), who observed that external debt stock tends to crowd out domestic private investment.

Finally, gross national saving has a positive and significant impact on domestic private investment in the long run, which is significant at the 1% level. The positive coefficient of 0.335 indicates that, ceteris paribus, a rise in gross national saving increases domestic private investment by 33.5%. The positive effect of gross national savings on domestic private investment could be attributed to the accommodative monetary policy stance taken by the Central Bank of Uganda, which kept the Central Bank Rate at 10.25% in previous periods. This policy attracted more savings to local commercial banks and promoted private investment, thereby supporting the long-term growth of domestic private investment.

4.4.Diagnostic Tests

To determine whether the regression model meets the classical linear regression assumptions (BLUE properties), diagnostic tests are conducted. These include tests for serial correlation, heteroscedasticity, normality, multicollinearity, model specification, and stability.

Following the results in Table 6 below, the ARDL regression model is free from serial correlation, ARCH disturbance, heteroscedasticity, and omitted variables. The residuals are normally distributed, and there is no evidence of perfect collinearity.

Table 6: Diagnostic Tests

Test	Test statistic	P-values
Ramsey Reset	F(3, 17) = 4.41	0.6137
Serial-correlation	Chi (2) = 0.653	0.4191
ARCH effect	Chi (2) = 0.047	0.8292
Heteroscedasticity	Chi (1) = 0.02	0.8967
Multicollinearity (VIF)	5.69	
Normality	Chi (2) = 0.2116	0.8996

Stability Test	Stable	Stable

Source: Author's compilation

Finally, the model shows parameter stability. This is indicated by the CUSUM and CUSUMQ lines remaining within the 5% significance critical bounds, suggesting that we fail to reject the null hypothesis and that the parameters are stable, as shown in figures 1 and 2 below.

Figure 2: Recursive Estimates of CUSUM Curve

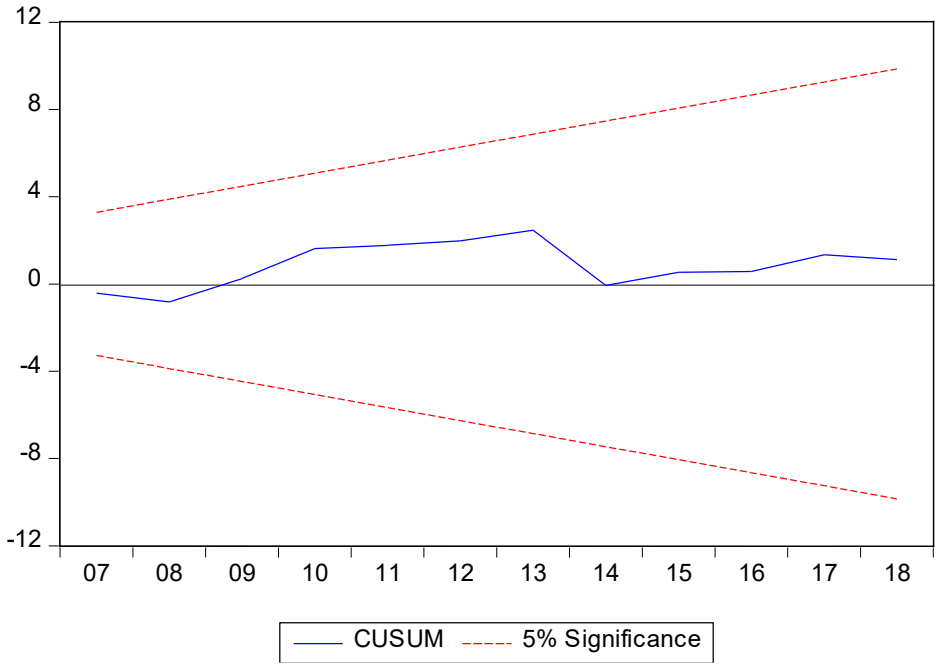
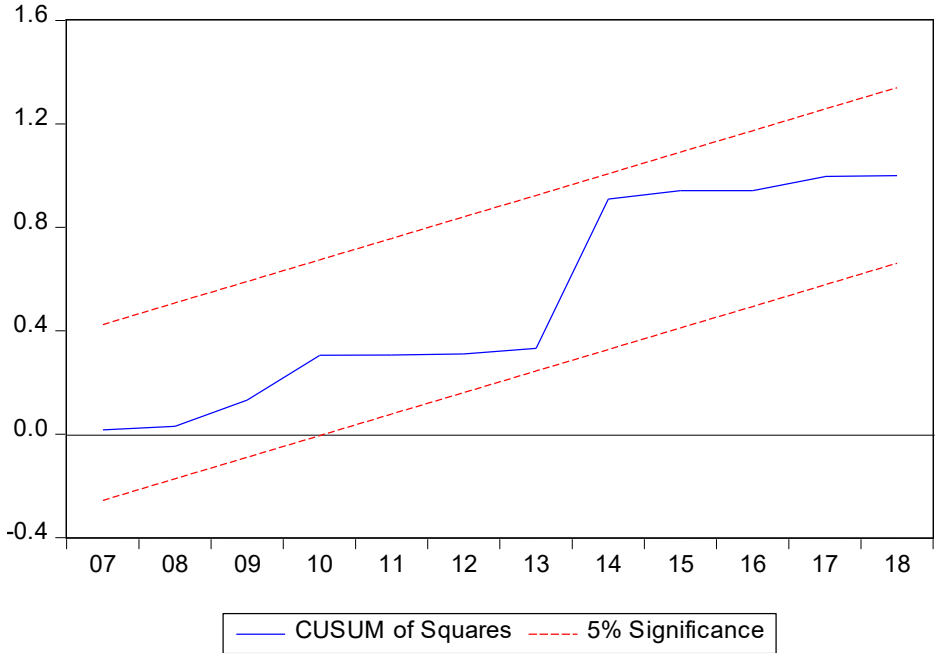


Figure 3: Recursive Estimates of CUSUM Squared Curve



Source: Author's computation

5. Conclusions and Policy Recommendations

In summary, this paper examined the impact of real interest rates on domestic private investment in Uganda from 1983 to 2022. The study aimed to determine whether real interest rates promote or hinder the growth of domestic private investment in Uganda. To address this, the ARDL bounds testing approach to cointegration was applied to data from 1983 to 2022. The findings indicated that real interest rates have a positive and significant long-term effect on domestic private investment. Furthermore, the research showed that domestic private investment is collectively influenced by real interest rates, real GDP, government expenditure, money supply, trade openness, gross national expenditure, external debt stock, and gross national savings, as demonstrated by the F-test and R-squared.

Therefore, the study recommends policies that support domestic private investment in the country. These policies include, but are not limited to, stabilizing real interest rates by implementing favorable policies aimed at promoting economic activities and encouraging private investment. Such policies involve creating a friendly business environment through improved economic infrastructure, such as lower power tariffs, better road networks, and increased business confidence, as well as ensuring the rule of law and maintaining solid macroeconomic management through low inflation and a stable exchange rate. Furthermore, the government should consider promoting innovations in the financial services sector, as it has been confirmed that financial innovations reduce costs for investors and make doing business easier. The government should also work to reduce external debt by boosting local economic activities and ensuring formal registration of informal businesses, so domestic investors are not heavily taxed to meet debt obligations. Finally, the government should focus on increasing domestic revenue mobilization to encourage savings and enhance domestic private investment.

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