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External debt and fixed capital investment nexus in middle-income countries in Sub-Saharan Africa: A quantile regression analysis

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ABSTRACT

Fixed capital investment promotes growth and economic transformation. In Sub-Saharan Africa (SSA) countries face limited domestic savings, fluctuating commodity prices, and vulnerability to global economic shocks. External debt remains as an alternative source of financing fixed capital. Excessive borrowing exposes countries to a debt overhang, which impedes future capital investment. Due to limited evidence on the external debt-investment nexus in SSA, this study investigates how external debt impacts fixed capital investment in middle-income countries for the period 1990 – 2020. Quantile regression analysis is used to account for the differential effects of exogenous variables on fixed capital investment. The findings reveal the existence of heterogeneous effects of all covariates. Diverging from previous studies, results confirm a non-linear relationship between external debt and fixed capital investment. Specifically, the study shows differential borrowing patterns at various levels of fixed capital distribution: countries at lower levels of distribution tend to borrow less, whereas those at higher levels borrow more. Trade balance has a negative impact, while other covariates, namely, general government consumption final expenditure, economic growth, and institutional quality, have positive impacts across the distribution of fixed capital investment. The findings emphasize the importance of considering the varying influence of these factors on different investment quantiles when designing policies, rather than relying solely on average effects. Furthermore, risk mitigation strategies can be developed by ensuring that countries at higher levels of distribution may leverage more external debt finance, while those at low levels adopt austerity.

Contribution/Originality: This study is among the few to use the quantile regression approach to analyse the external debt-fixed capital investment nexus. It shows heterogeneity and non-linearity across different economic conditions. Findings are more informative to middle-income countries compared to those based on ordinary least squares and autoregressive distributed lag approaches.

1. INTRODUCTION

In Sub-Saharan Africa (SSA), the economic landscape for middle-income countries is explained by external debt and investment dynamics, among other things. External borrowing has been a source of funding for budget deficits, development-oriented projects, and economic stabilization packages. Economists and policymakers have yet to settle the debate on the implications of employing debt financing for fixed capital projects like machinery, infrastructure, and buildings (Manasseh et al., 2022; Sumba, Ondiba, & Mugambi, 2023). Past studies by Ahmed (2021); Su, Sun, Ahmad, and Mirza (2021); Ngono (2022), and Adamu, Auwal, and Bala (2023) confirm that expenditure on fixed capital is a prerequisite for economic growth. Ainabor, Shuaib, and Kadiri (2014) argue that growth stagnates in

countries where there are low fixed investment expenditure outlays. More debt is necessary when it is used to finance investment projects that speed up growth. This is possible by working through industrialization and expansion of a country's productive capacity (Kararach et al., 2022). If not managed effectively, external debt can reach high levels beyond which a country is trapped in a debt overhang as repayments rise and discourage investment. Amoh, Abdul-Mumuni, Penney, Muda, and Ayarna-Gagakuma (2024) argue that suboptimal debt levels constrain both the country's potential to invest in strategic sectors and its fiscal space. The country may become unstable as resources are channeled to unproductive activities. Kocha, Iwedi, and Sarakiri (2021) demonstrate that the debt service burden has a positive effect on fixed capital investment in the short term while it has a negative impact in the long term, which is consistent with the debt overhang theory.

The SSA region has unique characteristics coupled with different economic structures, reliance on debt finance, and a mix of degrees of development. Economies in the West African region, like Ghana and Nigeria, have successfully utilized external debt for development, as has Kenya in East Africa. Debt effectiveness has been underpinned by good quality governance, strong macroeconomic policies and supportive economic conditions (Gallagher, Ramos, Were, & Marques, 2024; Omotor, 2021; Were, 2024). Understanding the external debt-fixed capital investment nexus is critical in SSA, as countries are confronted with developmental challenges being worsened by global shocks, limited national savings, and unstable commodity prices. Policymakers are still understanding how debt sustainability would contribute to growth. This study contributes to this discussion in three major ways: First, it analyses countries selected based on their level of development and different debt levels. Second, it employs quantile regression analysis to capture varying impacts of external debt across the different levels of fixed capital investment and hence provides a nuanced understanding of this relationship. More so, findings based on traditional regression techniques are limited in scope and application as they assume a homogeneous connection between the two variables. However, depending on the level of fixed capital investment, the contribution of debt and other covariates varies. Lastly, this study employs context-specific covariates like economic growth, institutional quality, government expenditure, and trade balance to provide reliable and robust results. Thus, results stratify the distributional effects of covariates on fixed capital investment in different quantiles.

Findings from this study reveal that the impact of all covariates on fixed capital investment is not uniform across different levels of the fixed investment distribution. This finding highlights the importance of considering the varying influence of these factors on different investment quantiles, rather than relying solely on average effects. Diverging from past studies, our results indicate a non-linear relationship between external debt and fixed capital investment. This discovery challenges traditional linear models and suggests that the interaction between these variables is more complex than previously thought. This study confirms the differential borrowing patterns observed at various levels of fixed capital distribution. Specifically, countries at lower levels of fixed capital distribution tend to borrow less, whereas those at higher levels borrow more. This pattern suggests that countries with higher fixed capital investments may have greater access to external debt or may be more willing to leverage debt to finance further investments.

The remainder of the paper focuses on empirical literature, which is reviewed in Section 2, and the methodology is discussed in Section 3. Findings, conclusions, and policy implications are discussed in Sections 4 and 5, respectively.

2. LITERATURE REVIEW

Literature highlights mixed evidence on the impact of external debt on fixed capital investment. Some past studies, Abdullahi, Hassan, and Abu Bakar (2016); Fumey, Bekoe, and Imoru (2022) and Amoh et al. (2024) find a negative effect, while Kassu, Mishra, and Asfaw (2014) report a positive long-run effect and a negative short-run effect. The negative effect is explained by the tax disincentive effect. Haughton (2020) confirms a unidirectional causality from external debt to fixed capital investment. On the contrary, Lucky and Uzah (2016) demonstrate that external debt, among other factors, has a negative but insignificant effect on fixed capital investment. On the contrary,

Adamu et al. (2023) argue that there is no causal effect of debt on fixed capital investment. This is consistent with findings by Ghali (2023), which show that external debt has an insignificant effect on fixed capital investment in both the long and short run for all sampled countries except for Egypt and Benin, which exhibited a positive effect. The positive effect of external debt on fixed capital investment as postulated by Kamau (2021) and Bal (2014) is consistent with the Keynesian views. Thus, evidence suggests feedback effects on these variables. The lack of consensus by past studies demonstrates that findings are sensitive to sample selection, method of analysis, and context (Kengdo, Ndeffo, & Avom, 2020). For example, some reviewed studies employed techniques at varying degrees of complexity, like ordinary least squares (OLS), vector autoregression (Kamau, 2021) and autoregressive distributed lag (ARDL) approaches (Bal, 2014; Fumey et al., 2022). Such techniques could explain different interpretations and conclusions reached on the external debt-fixed capital investment nexus. The relationships are also sensitive to whether fixed capital investment is classified as public or private (Fumey et al., 2022). Past studies (Turan & Yanıkkaya, 2021) and Kadiroğlu (2024) demonstrate that fixed capital investment is also explained by interest rates, savings and government effectiveness, which act as mediators.

The relationship between government expenditure and fixed capital investment is a complex and multifaceted one, as evidenced by the diverse findings from various studies. Evidence from past studies highlights conflicting findings across different contexts. While some past studies (Lucky & Uzah, 2016); Onyinye, Idenyi, and Ifeyinwa (2017); and Hein et al., (2020) find a positive relationship, Mahdi (2023) and Chen, Law, Wong, and Azman-Saini (2022) report negative and no effects, respectively. More so, Onyinye et al. (2017) confirm a bidirectional causal relationship between fixed capital investment and government expenditure, suggesting mutual influence and interdependence. Pasara and Garidzirai (2020) further argue that while expansionary fiscal policy stimulates investment expenditure and growth, aligning with Keynesian economic theory, its effectiveness depends on the specific economic context and the efficiency of government spending. At times, the effect of government expenditure on fixed capital investment differs depending on whether government expenditure is considered as developmental or recurrent (Gatawa & Bello, 2012). The former has a positive effect while the latter has a negative effect. Osinike (2014) highlights the importance of sectoral analysis of investment in agriculture and administrative sectors, which has a positive effect. More so, results are sensitive to methodological choices employed, like causality analysis (Onyinye et al., 2017) and measures of expenditure employed (Hein et al., 2020).

These varying conclusions require more work in different contexts to guide policymakers in coming up with tailored policies. In other contexts, expansionary policies may promote investment, while in others, they may have a crowding-out effect as explained by other institutional quality variables. Thus, contextual factors are critical as they demonstrate the complexity and differences in linkages between the key variables. Thus, the type and measures of expenditure matter in understanding the behaviour of fixed capital expenditure.

Evidence on the contribution of economic growth to fixed capital investment is not conclusive. Zhong (2019) concludes that there is bidirectional causality, while Onyinye et al. (2017) and Opadeji, Olaniyi, Adekanmbi, and Olubitan (2023) show that fixed capital investment has no effect on economic growth while past studies by Meyer and Sanusi (2019) and Dawood, Haidar, and Jasim (2024) show that it enhances growth. The effect varies according to income status, being positive in high-income countries, not significant in middle income countries, and negative in low-income countries (Topcu, Altinoz, & Aslan, 2020). On the contrary, other studies Ahmed (2021); Su et al. (2021) and Ngono (2022) argue that economic growth explains the level of fixed capital investment and the impact is significant in both the short and long run (Udude, Odo, Ituma, & Elom-Obed, 2017). Economic growth may have a negative effect (Adamu et al., 2023), a non-linear effect (Kononenko & Repin, 2016), or be insignificant (Chen et al., 2022). These diverse findings require careful consideration of the context, methodologies, and variable measurements when interpreting the linkages.

Findings on the effect of trade balance on fixed capital are not conclusive. There is unidirectional causality (Qayyum & Zaman, 2019), trade balance has no effect (Chen et al., 2022), and a negative effect (Orok, John, Okon, &

Udoka, 2022). Abdulsahib (2024) argues that there is no causal relationship between the variables, while Udude et al. (2017) find that trade balance has a positive effect. More so, Rajni (2013) confirms a bidirectional effect between trade balance and fixed capital investment. Clearly, there is no consensus on the link between these two variables, which leaves policymakers with no definite direction. Trade may be beneficial or harmful to investment expenditure. Findings suggest the need for context-specific studies that incorporate the different economic structures, levels of development, and trade policies.

In a study of this nature, understanding the effect of institutional quality cannot be ignored, as postulated by Lim (2014). Effective and strong institutions promote investment in fixed capital (Akobeng, 2017; Chen et al., 2022), and this is strengthened as remittances are converted to fixed capital (Su et al., 2021). However, the contribution of institutional quality to fixed capital investment differs according to the indicator. For example, investment is promoted by low corruption, a positive investment profile, and government stability, while factors like a lack of rule of law and internal conflict adversely affect investment in fixed investment capital (Ngono, 2022). The negative effect is supported by Grigoli and Mills (2014), who suggest that institutional quality has an adverse effect and is used by governments as a tool for rent seeking. Thus, the link between fixed capital investment and institutional quality is complex, and there is no consensus, as results differ according to contextual factors. This requires a nuanced approach to understanding how different institutional dimensions relate to fixed capital investment dynamics.

3. EMPIRICAL METHOD AND MODEL

This study employs quantile regression analysis as postulated by Koenker and Bassett (1978). It is adopted to mitigate against the limitations posed by using OLS, ARDL, and other dynamic models, which may overestimate parameters. These models do not consider unobserved heterogeneity (Harding, Lamarche, & Pesaran, 2020). Quantile regression provides more informative and reliable estimates. The method provides information on the behaviour of each parameter on the entire distribution of the dependent variable. Using this approach, it is possible to identify changes in levels of significance and signs of parameters. The change in signs is usually interpreted as indicating a non-linear relationship between the dependent and independent variables. Knowledge of these dynamics is important for policymakers when designing intervention techniques to improve the status quo. According to Koenker and Bassett (1978), the adopted technique helps to examine both the conditional distribution and expected value of fixed capital investment. We examine the effect of explanatory variables over nine quantiles ranging from 0.10 to 0.90. The general form is as follows:

$$Quant_{yit}(\tau|X_{it}) = X_{it}^{\tau}\beta_{\tau} \quad (1)$$

Where $Quant_{yit}(\tau|X_{it})$ is the τ^{th} conditional quantile of fixed capital investment and X_{it}^{τ} is a vector of covariates for each country (i) and year (t), while β_{τ}, is the slope of covariates within the τ^{th} quantile. The model can be stated, specifically, as:

$$Quant_{yit}(\tau|\alpha_i\xi_t, X_{it}) = \alpha_i + \xi_t + \beta_{1\tau}TD_{it} + \beta_{2\tau}CE_{it} + \beta_{3\tau}EG_{it} + \beta_{4\tau}TB_{it} + \beta_{5\tau}IQ_{it} \quad (2)$$

Where ξ_i is the error term; the slope of the intercept, or the unobserved country heterogeneity, is captured using α_i. Most quantile regression models include additive fixed effects (Lamarche, 2010). But this study incorporates an estimator that is linear and ignores additive fixed effects. Thus, the underlying model is as follows:

$$FC_{it} = K_{it}\beta(\xi_{it}^{*}) \quad (3)$$

Where, K_{it} represents a vector of explanatory variables for each country (i) and time (t). Parameters and the error terms are represented by β and ξ_{it}^{*} respectively.

In examining the impact of external debt on fixed capital investment, we employ the following model (Amoh et al., 2024), and the variables are as defined earlier:

$$FC_{it}(\beta|X_{it}) = \beta(\tau)'X_{it} + \varepsilon_{it} \quad \text{i=1, 2,……,N and t = 1, 2,……,N} \quad (4)$$

Where FC_{it} is the fixed capital investment or dependent variable, X_{it} represents a set of covariates, $\beta(\tau)$ is the unknown coefficient(s), ε_{it} is the error term, we have countries denoted by (i), and years are captured by (t).

The specific model is denoted by:

$$FC_{it} = \alpha_{it} + \beta_1 TD_{it} + \beta_2 CE_{it} + \beta_3 EG_{it} + \beta_4 TB_{it} + \beta_5 IQ_{it} + \varepsilon_{it} \qquad (5)$$

For a particular country (i) and year (t), where FC_{it}, as was defined; TD_{it} is the total external debt stock as % of GDP, CE_{it} is the general government consumption final expenditure; EG_{it} is the annual percentage growth in GDP; TB_{it} is the trade balance and IQ_{it} is a proxy for institutional quality.

To enhance the robustness and validity of findings, the study compares results based on quantile regression and those found using OLS. The Hausman tests are applied to select the best OLS model by testing the null hypothesis that the random effects model is appropriate.

3.1. Data and Data Sources

The current study employs data for 23 middle-income countries selected from Sub-Saharan Africa[1], covering the period from 1990 to 2020 based on data availability. The data, sourced from the World Bank, includes definitions and variables critical to the analysis. The definitions adopted for the variables are standard and widely accepted in economic research, ensuring consistency and reliability.

The dependent variable: Fixed Capital Investment (FC) is the gross fixed capital formation as a % of GDP as defined by the World Bank; FC represents the net increase in physical assets within an economy. The variable is critical to understand the level of investment in infrastructure, machinery, and buildings, which are essential for economic growth. The main explanatory variable, Total External Debt (TD), is defined as the sum of public, publicly guaranteed, and private non-guaranteed long-term debt, short-term debt, and use of IMF credit. The comprehensive definition captures the total liabilities owed by a country to foreign creditors, which can affect its financial stability and investment capacity. There are four control variables: General government final consumption expenditure (CE), expressed as a percentage of GDP, includes all government current expenditures for purchases of goods and services, including employee compensation. It captures the role of the government and its impact on the economy and overall demand; Economic Growth (EG) is defined as the annual percentage growth rate of GDP at market prices based on constant local currency. It measures the increase in the production of goods and services in an economy over time. It can also capture economic health and wellbeing; Trade Balance (TB), defined as the excess of exports over imports as a percentage of GDP, this variable indicates a country's trade performance and its ability to generate foreign exchange through exports; Institutional Quality (IQ), collected from the POLITY2 variable obtained from the Polity IV Project, this variable captures a country's political regime characteristics. It is essential to understand political and governance qualities that tend to influence policies and investment decisions.

3.2. Diagnostic Tests

In testing for stationarity, the study uses the method by Fisher; robust standard errors are applied to reduce the presence of heteroscedasticity, and we use correlation coefficients and variance inflation factors (VIF) to test for multicollinearity. The method by Johansen (1988) is employed to test for cointegration.

4. RESULTS AND DISCUSSION

4.1. Descriptive Analysis

Descriptive statistics for variables are presented in Table 1. The findings show that the highest average value is for Total external Debt (TD), which stands at 58.73% of GDP with a range of 485.402%. This indicates significant variation in debt levels among the sampled countries, with some being heavily indebted compared to others. The average value for Fixed Capital (FC) is 21.736% of GDP, with a range of 80.64%, when considering the minimum and

[1] Benin, Botswana, Burundi, Cameroun, Carbo Verde, Congo, Cote D'Ivoire, Djibouti, eSwatini, Ghana, Guinea, Kenya, Lesotho, Mauritius, Namibia, Nigeria, Rwanda, Senegal, Seychelles, South Africa, Tanzania, Togo, Zimbabwe.

maximum values. Government Final Consumption Expenditure (CE) has a mean value of 15.034% and ranges from 0.911% (minimum) to 43.484% (maximum).

The average growth rate of GDP is relatively low at 3.108%, with some countries experiencing a slowdown in growth, while others reached levels of up to 9% per annum. Institutional Quality (IQ) scores vary, with some countries showing negative measures, and the minimum value stands at -1.370. Most countries have trade deficits, with an average value of 10.399% of GDP. This is supported by evidence showing that deficits for some countries reach up to 120.717% of GDP, while surpluses are as high as 36.684%. Higher deficits lead to increased borrowing and are often inflationary.

Three variables, FC, CE, and TD, are positively skewed, with means higher than the median. In contrast, Economic Growth (EG), Trade Balance (TB), and IQ are negatively skewed, with means lower than the medians. Most variables exhibit kurtosis values higher than 3, indicating that much of the data is concentrated in the tails.

Table 1. Descriptive Statistics.

Statistics	FC	CE	EG	TB	TD	IQ
Mean	21.736	15.034	3.108	-10.399	58.730	1.370
Median	20.110	13.844	4.000	-8.570	46.797	1.410
Minimum	0.410	0.911	-9.000	-120.717	3.895	-8.000
Maximum	81.050	43.484	9.000	36.684	489.297	10.000
Standard deviation	9.907	6.858	3.473	9.294	5.493	5.711
Skewness	1.369	1.544	-1.009	-1.831	2.881	-0.001
Kurtosis	7.126	6.939	4.189	9.558	16.859	1.445
N	679	679	679	679	679	679

The correlation matrix is presented in Table 2. Both positive and negative correlations are visible among variables. Specifically, results show that CE, EG, and IQ have positive and significant associations with FC. Both TD and TB have negative associations with FC. There is no problem of multicollinearity among explanatory variables with coefficients less than 0.80.

Table 2. Correlation Matrix.

Variables	FC	CE	EG	TB	TD	IQ
FC	1.000					
CE	0.118***	1.000				
EG	0.121***	-0.181***	1.000			
TB	-0.240***	-0.420***	-0.023	1.000		
TD	-0.086**	-0.032	-0.193***	0.147***	1.000	
IQ	0.173***	0.210***	0.129***	-0.210***	-0.307***	1.000

Note: **significant at 5% and ***significant at 1%.

Furthermore, multicollinearity is checked using variance inflation factors (VIFs) and tolerance levels in Table 3. Multicollinearity exists where VIF values are greater than 10 and tolerance levels have values lower than 0.10 (Tattar, Ramaiah, & Manjunath, 2016). All variables pass the test and show no multicollinearity, and tolerance metrics are within the acceptable range.

Table 3. VIF and Tolerance Factors.

Variables	Variance inflation factors	Tolerance factors
CE	1.309	0.764
EG	1.103	0.910
TB	1.259	0.794
TD	1.146	0.873
IQ	1.182	0.846

Table 4 presents findings on tests for stationarity of each variable. They show that all variables are stationary at levels except for TD, which is stationary after first differencing. This shows that most of the data does not change over time and across different cross sections. Statistical properties (mean, variance, autocorrelation) are constant over time.

Table 4. Test for Unit Root.

Variables	Level		First difference		Order
	Statistic	p-value	Statistic	p-value	
FC	-2.650	0.000	-23.176	0.000	I(0)
CE	-3.583	0.000	-19.617	0.000	I(0)
EG	-12.737	0.000	-28.952	0.000	I(0)
TB	-4.191	0.000	-24.514	0.000	I(0)
TD	1.061	0.856	-21.469	0.000	I(1)
IQ	-8.314	0.000	-22.129	0.000	I(0)

4.1.1. Tests for Cointegration

Results for cointegration are based on methods by Kao (1999) and Pedroni (1999) to assess the presence of a long-run relationship among variables. The variables do not have a long-run relationship, as results fail to reject the null hypothesis of no cointegration.

4.1.2. Hausman Tests

The study performs Hausman tests to choose between the random and fixed effects models. The null hypothesis is that the random effects model is appropriate. Findings show that we fail to reject the null, and therefore we use the random effects model [p-value=0.0504, Chi-square=11.05]. The purpose is to compare parameters based on OLS with those found using quantile regression analysis in Table 5.

4.2. Findings based on Panel Quantile Regression

The results based on quantile regression analysis and random effects (RE) models are presented in Table 5. Empirical findings demonstrate heterogeneous effects of variables on fixed capital investment (FC). For total external debt (TD), it was observed that its effect on FC changes across different quantiles. At quantiles below the 40th, TD has a significant and negative effect on fixed capital investment. Consistent with past studies (Fumey et al., 2022) and Amoh et al. (2024), which show that as external debt rises, less is spent on FC. Such findings are possible where there is debt overhang, and countries expect a rise in future debt repayments, and they become less willing to spend on FC. More so, financiers may institute credit rationing, which limits funds available for investment. This finding is in line with what is found using OLS. On the other hand, findings show that the effect of external debt on FC is positive after the 40th quantile. This is possible as confirmed by some past studies, Kamau (2021) and Kocha et al. (2021), which support the notion that countries are borrowing to finance investment in infrastructure, technology, and other capital items. Thus, findings demonstrate a non-linear effect of debt on FC. Results demonstrate a U-shaped relationship between the two variables.

Similarly, this study indicates that general government final consumption expenditure (CE) has no effect on FC at both lower and higher quantiles, which is consistent with results based on the RE model. This corroborates well with findings by Chen et al. (2022), which show that CE makes no significant changes to the country's stock of fixed capital. CE has a positive and significant effect on FC between the 40th and the 70th quantile, all inclusive. The coefficient falls in magnitude as we move across the distribution of FC. This shows that higher CE avails more funds for FC as found in past studies (Hein et al., 2020; Pasara & Garidzirai, 2020). Moderate levels of CE are ideal for raising FC.

Findings, using quantile regression, on the contribution of economic growth (EG) show that the variable remains positive across the entire distribution of FC. Those based on RE models show that EG has an insignificant effect. Our results show that countries at different levels of development are investing in FC at different rates. Consistent with past studies, Su et al. (2021) and Ngono (2022) results show that countries are more likely to avail funds for FC where there are high growth expectations in the future. It is generally accepted that as countries grow, they can widen their ability to raise funds through a huge tax base, which avails funds for investment, and more so, the rate of technology adoption rises.

This study shows that there is heterogeneity in the impact of institutional quality (IQ) on FC. The contribution of IQ is positive throughout the distribution, and the parameter continues to increase in magnitude. Results based on the RE model are consistent with those in the 90^{th} quantile. Consistent with past studies by Chen et al. (2022) and Ngono (2022), this study shows that strong and better IQ improves FC. Investors are more confident and ready to commit funds for long-term investments where institutions are strong. A stable political environment lessens the risk and enhances policy consistency, which promotes FC.

Finally, the study shows that trade balance (TB) has a negative and significant effect on fixed capital investment (FC) based on the random effects (RE) model and quantile regression. Analysis using the latter shows the coefficient varies in magnitude across the investment distribution. Findings corroborate previous studies which show that continuous trade deficits limit fixed capital formation Udude et al. (2017) and Orok et al. (2022). This could be explained by the crowding out effect which results from channelling more funds toward deficit financing and less towards productive investments. Consequently, countries facing worsening trade balances may struggle to expand their fixed capital investment as most of their resources are directed towards meeting external debt obligations.

Table 5. Empirical findings.

Variables	RE	10th	20th	30th	40th	50th	60th	70th	80th	90th
CE	-0.098	0.086	0.061	0.061	0.143**	0.142***	0.120**	0.153*	0.138	-0.141
EG	0.106	0.596***	0.529***	0.499***	0.632***	0.551***	0.547***	0.441***	0.080*	0.258*
TB	-0.269***	-0.025	-0.064***	-0.082***	-0.088***	-0.098***	-0.087***	-0.084***	-0.062**	-0.162**
TD	-0.035***	-0.023***	-0.020***	-0.012*	-0.003	0.012*	0.017**	0.019***	0.027***	0.031***
IQ	0.108	0.320***	0.266***	0.191***	0.173***	0.179***	0.235***	0.286***	0.394***	-0.031
Constant	22.737***	10.084***	12.379***	13.668***	13.196***	14.307***	15.940***	18.245***	23.486***	36.206***
Chi-sq	153.32***									

Note: *Significant at 10%, **significant at 5% and ***significant at 1%.

5. CONCLUSION AND POLICY IMPLICATIONS

This study examined the heterogeneous impact of total external debt (TD) on fixed capital investment (FC) using a sample of middle-income countries from Sub-Saharan Africa (SSA). The study employed quantile regression analysis and a data set covering the period 1990 – 2020. It incorporated context-specific covariates like trade balance (TB), general government final consumption expenditure (CE), institutional quality (IQ), and economic growth (EG). The study tested stationarity, multicollinearity, and cointegration. Based on the Hausman test, the study estimated a Random Effects model to allow for comparison and robustness checks of parameters. The study confirmed that the effect of total external debt on fixed capital investment is heterogeneous for the sampled countries. There was a change in the sign of the parameter for external debt from negative to positive. This means countries seeking to finance fixed capital investment are expected to behave differently. Those at the lower level of the distribution of fixed capital borrow less compared to those at the higher level of the distribution. Using OLS estimates, findings show that all countries must borrow more, and it's not possible to separate the right policy options for countries. The results based on quantile regression are clear that total external debt and fixed capital investment have a non-linear relationship. This contradicts findings from literature showing the relationship is negative (Turan & Yanıkkaya, 2021), positive (Haughton, 2020), and insignificant (Adamu et al., 2023). More so, the study showed that countries in the middle of the distribution are free to increase government final consumption expenditure to improve their capital outlays. It is crucial that policymakers give priority to channeling funding into sectors that drive economic growth, like health, technology, and education. Countries must avoid deficit financing, as this may have a crowding-out effect on fixed capital investment. When supported by effective policy frameworks and quality institutions, an improvement in economic growth outcomes will boost investment in fixed capital, ceteris paribus. The mean value of institutional quality (IQ) stands at 1.470, which indicates a moderate level of democracy, highlighting the need to strengthen IQ to promote growth and high FC. Furthermore, the negative mean trade balance (TB) value of -10.399 signifies the existence of trade deficits across the sampled countries, which negatively affect FC by raising interest rates and potentially crowding out investment. To understand the challenges faced by middle-income countries in achieving high GDP growth rates, a thorough appreciation of the total external debt and FC nexus was necessary. This study has provided valuable insights into this relationship within the SSA context, aiding stakeholders and policymakers in developing strategies to effectively manage debt and enhance FC, ultimately boosting economic growth. Policies addressing the total external debt-fixed capital investment linkage must be dynamic, continuous, and adaptable as countries progress along the FC distribution.

Based on the findings, countries at the lower end of the distribution should be prioritized:

- Avoiding unjustifiable debt accumulation, restructuring debt to extend the maturity period and reduce interest payments, and enhancing revenue collections.
- being cautious about accumulating external debt, especially if it negatively impacts FC. Considerations on improving government effectiveness and managing interest rates to mitigate the adverse effects of external debt are critical.
- Public-private partnerships that offer tax incentives to enhance private sector investment projects, while eliminating unnecessary government expenditures.
- Institutional reforms to strengthen governance and provide a sense of security to investors.

For countries at the higher end of the FC distribution, leveraging debt effectively to maximize investment benefits is crucial. This entails:

- Borrowing funds for high-impact projects to enhance productivity and growth.
- Optimizing the debt maturity structure in line with the investment lifecycle and reducing the interest repayment burden.
- Implementing regulatory reforms to improve the investment climate and ease of doing business. This can enhance the positive impact of external debt on FC.

- Ensuring fiscal discipline to avoid excessive deficits.
- Building trust and ensuring accountability by transparently reporting debt levels and fund utilization to stakeholders.

Our study contributes to the body of knowledge by demonstrating that findings based on OLS techniques can be misleading, as they are not consistent with those based on quantile regression at different distribution points. This methodological departure provides insights that aid in policymaking. Understanding the heterogeneity of nations allows policymakers to tailor their external debt management strategies based on their varying levels of fixed capital investment. However, future studies could benefit from a more detailed examination of potential endogeneity between explanatory and dependent variables. For instance, high levels of external debt could also be a consequence of low fixed capital investment, necessitating the use of appropriate econometric techniques to address this bidirectional relationship. Exploring other contextual factors influencing the effect of external debt on fixed capital investment and employing mixed methods is more plausible.

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