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Analysing the Role of External Debt and Corruption on Economic Growth in the Sub-Saharan African Region

Minor Dissertation submitted to the University of Cape Town in partial fulfilment of the requirements for the degree of Master of Commerce in Applied Economics.

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Abstract

This paper examines the relationship between corruption, external debt and economic growth in the Sub-Saharan African region as the roles of external debt and corruption as growth drivers or deterrents remains inconclusive. The paper employs a two-step system generalized method of moments (sysGMM) model to estimate the relationship between external debt, corruption and economic growth. An interaction term between external debt and corruption is included to determine whether the impact of external debt on growth is influenced by the level of perceived corruption in an economy. Corruption is found to have a negative and often significant relationship with economic growth whilst external debt has significant, varying associations with economic growth. The interaction between debt and corruption is also found to significantly influence economic growth.

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Keywords: external debt, corruption, economic growth, two-step system GMM

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CHAPTER 1: INTRODUCTION

In recent years, it seems substantial and sustainable economic growth has eluded developing countries such as those within the Sub-Saharan African (SSA) region. In the same instance, corruption perceptions have all but stagnated or worsened with only a handful of countries showing improvement. Debt levels in SSA, particularly external debt levels, continue to rise in efforts to meet public finance shortfalls. Debt has long been used to supplement government fiscal deficits or to finance national capital intensive projects in support of the development and growth agenda (Soludo, 2003). Whilst external debt is ideally used to support growth, corruption is generally believed to erode growth efforts in the form of investments, foreign direct inflows and a stable macro environment in which business is conducted (Tanzi and Davoodi, 2002; Mauro, 1996; Wei, 2000).

According to Transparency International (2021), the SSA region had the worst perceived corruption with an average index of 33/100[1], 10 points below the world average of 43/100, and only 5 out of 49 countries scored above 50/100. This would suggest that SSA has the worst public sector corruption compared to its global counterparts. In the literature , such high perceptions of corruption coupled with poor governance are often considered growth deterrents (Sobrinho and Thakoor, 2019).

The World bank (2022) released their latest International Debt Statistics report which found that Sub-Saharan African countries recorded an average increase of 10.7% on their external debt stock which was the highest increase of any other region to achieve their sustainable development goals. Chinese debt was particularly popular within the region with Angola leading the pack of borrowers that together hold 45% of Chinese debt stocks. West African giants Ghana and Nigeria were singled out for having some of the larger increases in external debt stock of up to 17% whereas the likes of Zambia faced such a huge debt burden that it was the first country to default on its debt obligations in the pandemic era (Pandey, 2021). The region had the poorest performance across the IDS debt indicators where the debt to GNI ratio increased by 20.3% in a period of 9 years to reach 43.7% in 2020.

140 billion dollars (US) (approximately 6% of GDP) is the estimated amount of money the African continent loses annually to corrupt activities (Adekoya, 2020). Corruption eradication and reduced debt burdens are some of the many promises African leaders have run their

[1] The corruption perception index is the perceived level of public sector corruption on a scale of 0-100, where 0 indicates highly corrupt countries and 100 signifies corruption free countries.

campaigns on. Leading up to the 2021 Zambia elections, Nyambe (2021) reported on a 17 million (USD) medical supply scandal that came to light in 2020. It was found that a Zambian company was awarded a contract to supply health kits despite not being a registered company at the time and that the health kits being supplied were sub-standard and unsafe for use. It is alleged that despite sounding the alarms on the potential health risks, the kits were still distributed for use by health professionals thus putting ordinary Zambians at risk.

Most recently Kenya Medical Supplies Authority (KEMSA) found itself in the middle of a procurement scandal in which over 1 million condoms went missing alongside 908 000 mosquito nets and tuberculosis medication amounting to 10 million (Ksh). In addition to the above, prices of the procured goods are estimated to have been inflated by an additional 640 million (Ksh) which is believed to be pocketed by officials involved (Wairimu, 2022). In spite of being a regional leader in corruption perception, Transparency International (2021) considers Botswana a significant decliner having fallen 10 points since 2012. Rising perceptions of corruption both domestically and internationally are as a result of scandals such as the National Petroleum Fund case in which top government officials such as the chief executive of the Botswana Energy Regulatory Authority and the former managing director of Basis Points Capital were implicated in a 250 million (Pula) embezzlement allegation (Saba, 2018).

In 2021, the International Monetary Fund (IMF) approved a 700 million (USD) (approximately 2% of GDP) loan to Cameroon to aid in their recovery from the effects of the pandemic despite the country being under investigation for the mismanagement of another recent loan amounting to 326 million (USD) (Ndi, 2021). Granting more external debt in the presence of corruption may reinforce a cycle of mismanagement and financial irresponsibility. The country may become trapped in a pattern of borrowing to cover debts, with limited improvement in governance and accountability. South Africa and Kenya similarly had 750 million (USD) loans approved from the World Bank that both countries plan to use for fiscal strengthening as they continue to rebuild their economies (Business Tech, 2022; Guguyu, 2022). The African Development Fund authorised funding worth 116 million (USD) that would primarily support Tanzania's southern highway upgrade alongside smaller (in scale) socio-economic projects should benefit roughly 1 million people in rural Tanzania (African Development Bank, 2021). Improperly implemented debt-funded projects can be vulnerable to corruption and embezzlement. Lack of transparency and accountability can lead to the diversion of funds for personal gain, undermining the intended developmental impact of the

borrowed resources. It is therefore important for both lenders and borrowing countries to prioritize transparency, accountability, and effective governance mechanisms in the planning and execution of debt-funded projects if the debt is to have the intended growth enhancing effect.

Uptake of such financing agreements has driven the debt to gross domestic product (GDP) ratios up within the region. The debt to GDP ratio ideally signals a country's ability to pay back its debts based on its output. Africanews (2022) reported on the top 20 African countries with the highest debt to GDP ratios and the entire list is composed of SSA countries. Seychelles, considered the least corrupt country in the region, placed tenth on the list with a ratio of 81.9% whilst South Sudan, the most corrupt country in the region and the world, closed off the list at 64,4%.

Goldman (2019) argues that liquid, capital rich countries exploit the capital needs of developing countries and determine the terms of sovereign borrowing with their interests in mind. When the interest of lenders coincides with corrupt state officials, it can give rise to what is known as odious debt which Boyce and Ndikumana (2011) define as debt that is neither authorised by the people nor does it benefit them, and the lender is aware of said circumstances. A recent example is that of Mozambique's 2013 "hidden loan" of 2 billion (USD) that had not been approved by the country's parliament. Instead, the debt agreement was between three state owned companies and private lenders from Europe and the Middle East. It is believed that the people of Mozambique (excluding the conspirators within government) did not benefit from the debt in any way, rather, ripple effects are estimated to have cost the country an estimated 11 billion (USD) all while forcing an extra 2 million Mozambicans into poverty (Cortez et al, 2021) (Jubilee Debt Campaign, 2021). Such hidden debt falls under a legal grey area in as it is difficult to determine if the state actually owes the debt. Nonetheless, government will often be required to service the loan despite not benefitting from it thus worsening their debt burden and growth outlook.

As of 2020, countries in the Sub-Saharan African region are facing an external debt burden of over USD 700 billion (approximately 29% of GDP) which is the highest it's been in a decade (Pandey, 2021). However, SSA's rising debt levels must be contextualized within the broader global landscape. For instance, while SSA's debt-to-GDP ratio is indeed growing, it is still lower than that of many other developing regions. According to the IMF (2021), Latin America and the Caribbean have higher average debt-to-GDP ratios—around 57%—with countries like Brazil and Argentina experiencing ratios above 80%. Similarly, debt in Asian economies such

as India and Sri Lanka have also grown significantly, reaching debt-to-GDP ratios of 70-75% in some cases (Kharas & Dooley, 2021). These comparisons suggest that SSA's debt levels, though concerning, are not the highest globally but still present significant challenges for debt sustainability and long-term economic growth.

While SSA faces unique challenges, it is not alone in grappling with the dual issues of corruption and debt. Latin American countries, for example, also struggles with high levels of public sector corruption, which has undermined the effectiveness of debt-financed development projects. Countries such as Venezuela and Argentina have faced both economic crises and corruption scandals, with rising debt levels failing to translate into meaningful economic progress. Similarly, in Asia, the rise of external debt has often been accompanied by governance challenges, particularly in countries like Sri Lanka, which faced a sovereign debt crisis exacerbated by mismanagement of public funds.

Kaufmann (2010) sought to establish ways in which corruption could affect public finance and he argued that corruption can influence the debt mix, debt allocations and the cost of debt servicing. Despite many countries being affected by corruption, there is limited literature that empirically investigates its interaction with other economic variables. Corruption in SSA remains highly perceived and a debt crisis looms over the region all whilst economic growth remains a common goal. This paper seeks to investigate the relationship between growth and external debt, corruption and growth as well as to establish whether there is a significant interactive effect between corruption and external debt on economic growth.

The paper will address the following questions:

- Do external debt levels impact growth outcomes?
- Is corruption a growth driver or deterrent?
- How does the interaction between external debt and corruption affect economic growth?

In our analysis, we use annual panel data from 37 Sub-Saharan African countries for the period 2012 to 2021. The relationships between external debt, corruption and growth are estimated using the System Generalized Method of Moments (System GMM) econometric technique whose primary objective is to provide efficient and consistent estimates in the presence of endogeneity, unobserved heterogeneity, and serial correlation in dynamic panel data models. The key variables of interest are the lagged dependent variable, external debt, the corruption perception index and the interaction term. The paper finds that the lagged dependent variable has a persistent, positive and significant relationship with growth thus emphasising

the importance of the initial economic condition when estimating the future growth outcomes in the SSA region. Both corruption and external debt are shown to impact growth negatively and significantly whilst the interaction between the two variables is positively and significantly influences output levels, suggesting that the coordination between external debt and corruption may enhance economic growth, but the negative impact of individual variables remains greater.

The rest of the paper will be organised as follows: chapter 2 will provide a theoretical review of growth models, debt-growth theories, and corruption-growth theories as well as prior empirical work regarding the debt-growth nexus and the relationship between corruption and growth. Chapter 3 will focus on data and research methodology whilst chapter 4 will present and discuss the findings from chapter 3. Chapter 5 will conclude and provide policy recommendations for the sample countries.

CHAPTER 2: LITERATURE REVIEW

Growth theory today can broadly be classified as either exogenous or endogenous depending on whether growth is driven by factors from outside or from within the model respectively. This section will begin with a look into exogenous theory, primarily neoclassical models, before delving into endogenous theory as well as corruption and debt theories. It will then conclude with a discussion on recent empirical findings involving our variables of interest namely, economic growth, external debt and corruption.

The first insights into exogenous growth theory can be traced back to the works of Adam Smith who like other classical economists of that day were interested in long run development following the onset of the industrial revolution (Hagemann, 2009). Smith (1776) proposed a laissez-faire economy that was self-sustaining in the long run with little to no interference from the government. However, Smith's theory was found to have empirical weaknesses by economists such as David Ricardo (De Vroey, 1975:424) and was replaced by the neoclassical paradigm which remained the dominant framework up until the Great Depression (1929-1939) where it failed to explain how and why the global economy collapsed and why it would not correct itself thus leaving a theoretical gap for a framework that could adequately inform policy to jumpstart the economy. Up until this point, growth economics had received little attention from scholars. Nonetheless, the re-emergence of growth theories as we know them today gained traction post WWII (1939-1945) as economists in industrialised countries sought to take full advantage of the gains made from capitalism (Ruttan, 1998).

Keynes (1936) unlike those before him argued that growth was demand driven through the four components of aggregate demand (AD) namely, consumption, government expenditure, investments and net exports. He believed that an increase in one or more of the above components would in turn increase overall output via the multiplier effect whilst insufficient aggregate demand would result in an equilibrium below full employment. Deviation from full employment owed to fluctuations in aggregate demand would then result in either recessionary or inflationary gaps that Keynes recommended would require government intervention to return the short run economy to its long-term potential. Despite the fact Keynes theory did not implicitly state specific policy recommendations, policy makers used his work to inform their response to booms and busts in the business cycle (Jahan *et al*, 2014). Governments could use counter-cyclical fiscal policy to either increase (in the case of a boom) or decrease (in the case of a bust) one of the components of AD to shift it back towards full employment equilibrium. Keynes emphasised the need to only regulate short run fluctuations in the business cycle because "in the long run we are all dead".

Informed by Keynesian economics, governments in the West embraced deficit spending as a growth stimulant from the end of the Great Depression up until the 1970s when it became unsustainable and their economies suffered from stagflation, which occurs when an economy records persistent slow growth accompanied by rising inflation and high unemployment (Palley, 2005). Naturally, it followed that Keynesianism lay blame to the state of the economy in the seventies and was thus abandoned as a primary growth framework as it failed to provide viable remedies for stagflation.

Despite Keynesianism's dominance until the seventies, there still wasn't a definitive growth model that explained why growth occurred and how it could be replicated. Economists Harrod (1939) and Domar (1946) sought to extend Keynes short run theory by extending his savings-investment analysis into a dynamic, long run model whose main objective is to achieve steady-state growth. Domar's model is founded on the duality of investment on both the supply side and the demand side. He contends that net investment, which amounts to an increase in real capital stock, increases an economy's productive capacity such that it raises aggregate supply in a way that aggregate demand needs to simultaneously increase to achieve full employment at a higher level from the initial point of equilibrium (van Rijckeghem, 1966). He explains this using a sequence of equations which essentially explain that output supply is an outcome of the product between capital productivity and the stock of real capital. Therefore, if either one

of these two factors increases or decreases through net investment channels, supply of output will respond in the same direction.

On the demand side, Domar borrows from Keynes' aggregate demand theory where a variation in net investment is directly proportional to the change in aggregate demand via the multiplier effect. The marginal propensity to save however, exhibits an inverse relationship with effective demand such that an increase in the savings-income ratio will decrease effective demand. In order to achieve full employment equilibrium, supply and demand should be equal. He then deduced that as a pre-condition to achieve steady state growth, net investment should equal the product of the marginal propensity to save, real capital stock and the productivity of capital. Nevertheless, to properly understand the growth rate required to sustain steady growth, Domar further considered fully employed supply and demand in their incremental form. Given that net investment is assumed to equal the change in the amount of real capital and that steady growth is achieved when the change in supply is equal to the change in demand (at full employment), it then follows that the growth rate required to sustain full employment in the long term occurs when the supply side (investment) and the demand side (national income) increase to an amount equal to the product of the savings-income ratio and the average productivity of increased real capital stock.

Harrod (1939) attempted to address three growth related issues within a dynamic model. The first being how to achieve steady growth in an economy where both the marginal propensity to save and the capital-output ratio are fixed. Next, he considered the conditions in which steady state growth could be maintained in the long run and lastly, the constraint of natural factors on the growth rate. To address the following issues, Harrod conceptualises three different growth rates namely: the actual growth rate, the warranted growth rate and the natural growth rate . The actual growth rate is dependent on the actual savings rate and investments within an economy and is expressed as the ratio between change in income and total income at a given time. The warranted growth rate which can be referred to as the "entrepreneurial equilibrium" is the rate of growth at full employment when all the savings are absorbed by investment and capital stock is fully utilised such that actual growth equals warranted growth and the expectations of investors are satisfied.

Harrod proposes that steady state growth is achieved when actual growth equals warranted growth and that the capital coefficient needed to realise actual growth is also equal to the required capital coefficient necessary to maintain warranted growth given a savings rate *s*. Therefore, given a savings rate *s*, actual investment should equal expected investment. In

reality, those on the supply side cannot predict the warranted growth rate making it impossible to equate it to the actual growth rate. As such, even if achieved, this is called a *knife-edge* equilibrium because any slight changes in actual growth relative to warranted growth will deviate the economy away from the desired steady equilibrium (Sato, 1964:380). The economy also faces an additional constraint from natural factors such as population growth, technological advances, and natural resources. These factors can put a cap on growth resulting in a natural growth rate. The first best solution would therefore be when all growth rates are equal.

The combined Harrod-Domar model views the growth rate as a function of the ratio between the national savings rate and the productivity of capital measured by the capital-output ratio (Van den Berg, 2013). Consequently, output can be increased in one of two ways that is either by increasing national savings which is dependent on income levels or by decreasing the capital-output ratio given it is inversely proportional to the growth rate (Hagemann, 2009). An economy's savings are equal to loanable funds available to purchase capital stock and increase productive capacity. Hence, an increase in savings is believed to lead towards greater economic growth. A large capital-output ratio, however, implies that current investments are inefficient and adding to that capital stock via new investment will not increase productive capacity beyond what it already is. The opposite holds true when the capital-output ratio is low.

Another theory that emerged was that of Robert Solow who agreed with all but one of the assumptions made by the Harrod-Domar model which was "that of fixed proportions" (Solow, 1956:66). He asserts that the assumption of fixed proportions was to blame for the instability problem (deviations between actual growth and warranted growth that results in prolonged inflation or high levels of unemployment) of the Harrod-Domar model. His goal was to show that continuously increasing the level of savings and capital stock is not enough to perpetually sustain per capita income growth in the long run. Solow (1956) made use of a two-factor aggregate production function in which there are constant returns to scale, diminishing marginal returns to each factor and long run growth is driven by labour supply, capital accumulation and technological change.

The model progresses through a series of equations beginning with a Cobb-Douglas type of production function used to determine technological possibilities given labour and capital as inputs. Whilst prior models were focused on aggregate output and capital stock, Solow's model implied that output in the economy is dependent upon capital per worker. Therefore, what exactly determines capital per worker? Given that aggregate capital stock depends on the level

of investment, similarly, capital per worker is dependent on investment per worker which is influenced by the same savings rate as in the aggregate sense. Investment per worker which signifies the rate at which capital stock is added to the economy, can thus be expressed as the product of the savings rate and output per worker.

The second determinant of capital per worker is the depreciation rate. It signifies how quickly an economy loses capital stock given wear and tear. Using investment per worker and depreciation per worker, one can then work out the required level of capital per unit of labour in the steady state growth path. When investment per worker exceeds depreciation per worker, capital is being added faster than it is wearing out such that the capital-labour ratio rises until a point where the two determinants equal each other again and the economy would have returned to its steady state level. If the opposite is true, capital per unit of labour will fall until it reaches the steady state level. Romer (2006) contends that regardless of where capital per unit of labour begins , it will eventually converge to its steady state level.

The same production function in its intensive form simplifies to a point where the only predictor of output per unit of labour is the capital-labour ratio regardless of the size of the economy. This, coupled with the assured conditional convergence of capital per worker through the assumption of diminishing marginal returns, means that countries that exhibit a similar savings rate, capital depreciation rate, population growth rate and technical progression rate should ideally achieve nearly the same amount of output per worker once in the steady state. It also implies that poorer countries will grow faster than their wealthy counterparts and that their growth rate will slow down as they converge to their respective steady state (Agenor and Montiel, 1999: 673).

By the late 1970s, economists and policy makers had grown dissatisfied with exogenous models owing to their various shortcomings some of which include their inability to account for changes in growth rates between time periods and the lack of income convergence between developed and developing countries (Ugur, 2016). Differences in technological capabilities could explain the disparities in per capita incomes but not when technology is exogenous to the models being used to inform economic decisions. Consequently, these deviations between theory and reality created a theoretical gap from which endogenous growth theory emerged. For some, the omission of human capital, which accounted for over half of capital stock in the United States in the late 1960s (Kendrick, 1976) and was believed to have increasing returns unlike that of physical capital (Lucas, 1988), from exogenous models such as Solow's seemed empirically inadequate. The augmented Solow model was then generated to account for human

capital in a way that rids the original model from omitted variable bias and is sometimes considered as a precursor to endogenous growth theory (Mankiw *et al*, 1992).

Building upon the works of Harrod and Domar, some of the earliest endogenous models are founded on the equation $Y= AK$ where output (Y) is a product of A, a positive constant that reflects factors affecting technology , and K which represents a combination of both physical and human capital (Arrow, 1962; Frankel, 1962). In this instance however, capital does not exhibit diminishing returns as in the exogenous models because the diminishing returns are offset by knowledge externalities and substitutable factors which propel technological progression in the case of Frankel or increased productivity from "learning by doing" in the case of Arrow. In the absence of diminishing returns to capital, the long run growth rate becomes an increasing function of the investment rate which can be influenced by fiscal and monetary policy (Pack, 1994).

Current endogenous growth theory was pioneered by Romer (1986) and Lucas (1988) who like Solow before them, acknowledged technical progression as a key driver of long term economic growth. However, whilst Solow proposed that the determinants of technical change were external to the model, Romer and Lucas argued that the endogenous component of technological progression is integral to achieving sustained growth (Whelan, 2014:1). Romer's assertions were informed by innovation based theory which is dependent on intellectual capital. Intellectual capital is born out of research and development for which the firm producing new varieties of knowledge and products experiences diminishing returns whilst all other firms enjoy positive externalities from the innovations. As a result, technology progresses and output increases. The government has the role of incentivizing research and development by means of its growth policy. Lucas, on the other hand, found investment in human capital to be the most important factor in a race to achieve high levels of output. He suggests that governments should subsidise education as well as research and development in efforts to grow an economy's human capital capacity.

According to Gandhi (2020), the African region is the second largest spender on education relative to other regions (on average 5% of GDP). Unfortunately, their efficiency rates fall below 60% and 50% for primary school and secondary school respectively thus affecting their completion rates and the way in which education can positively affect their growth outlook. This implies that monetary investments alone are not enough to increase human capital and that there is greater value in ensuring efficient use of resources. Solow (1994) criticised the robustness of Lucas's endogenous model based on the assumption of exactly constant returns

to capital noting how unlikely that would be in the real world. Another criticism comes from the inability to test endogenous theory itself. Instead, research tends to be focused on disproving exogenous theory as a way of affirming their growth perspectives (Fine, 2000). Though flawed, the augmented Solow model will be used as the primary framework for this paper as it has been found to provide useful insight into understanding how capital deepening and technological progress (both of which can be financed by external debt) can be used to increase output.

The relationship between debt (public, external or domestic) and economic growth is one that has interested scholars from Keynesian times. However, there seems to be a lack of consensus regarding the particular nature of said nexus. Current literature postulates four possible outcomes from the interaction between the debt and growth (Saungweme and Odhiambo, 2019:57-58). Following from Keynes deficit spending proposition, the first viewpoint argues that debt positively influences economic growth. For example, Rebelo (1995) postulates that, under the right conditions, debt can be used to finance investments in both physical capital (e.g., infrastructure, factories) and human capital (e.g., education, health, skills development) in a way that these investments improve productivity and create a cycle of increasing returns to scale, which supports higher growth rates. Further, in cases where debt is used to finance investments that increase the productivity of the economy it can help stimulate endogenous growth as discussed above. According to Rebelo's model, endogenous growth driven by investments in innovation and capital is sustainable in the long term as it creates a continuous cycle of development.

Others such as Myers (1977) and Krugman (1988) have argued a negative correlation between the two variables. The last two schools of thought hypothesize either a non-linear relationship or neutral association. This paper will focus on the debt overhang hypothesis to theorise the inverse relationship and the dual gap theory to explain the positive correlation.

The debt overhang hypothesis stemmed from Myers (1977) who considered a firm's decision to borrow. He found that when a firm's debt burden is too large, they may be forced to forgo potentially profitable new projects resulting in underinvestment. This happens because profits from the new investments will essentially be "taxed away" by payment obligations to current creditors such that the firm does not realise an increase in their equity value and cannot meet their liabilities to the financiers of the new investment. Krugman (1988) and Sachs (1989) extended Myers micro concept to a macro scenario in which a country faces an overwhelming debt stock such that a substantial portion of their output is directed towards debt servicing on

external debt thus disincentivizing potential investment which in turn negatively affects economic growth. If there is an expectation that a country will not be able to pay back its debt and there are little to no fiscal incentives to invest, increased government borrowing will drive up the interest rate thus 'crowding out' private investment, particularly domestic investment as it then becomes too costly for investors (Gamber and Seliski, 2019). Krugman also highlighted that when debt-servicing takes up a large portion of GDP, it leaves decision makers with less revenue for other social and capital projects that can improve the people's livelihood outside of investment.

Alternatively, the investment-savings gap is a concept in development economics that highlights the difference between the amount of domestic savings available for investment in an economy and the amount of investment required to sustain long-term economic growth. The gap becomes particularly important for developing countries, which often struggle with low domestic savings rates due to factors like low income, economic instability, and lack of access to financial markets (Lewis, 1955).

The idea behind the investment-savings gap is that in developing economies, domestic savings are insufficient to meet the needs for investment in infrastructure, capital goods, and technological advancement. In such cases, external financing—either in the form of foreign aid, foreign direct investment (FDI), or external debt—is required to fill this gap and facilitate the necessary investments for economic development (Basu and Maertens, 2007).

Chenery and Strout (1966) identified two gaps in the economy that can hinder growth in less developed countries. National savings are used to finance investment however, underdeveloped countries face inadequate savings which results in "investment limited growth". The gap between savings and investment is called the savings gap. The second gap arises from a lack of foreign exchange inflows which limit's a developing country's ability to import fixed capital needed to improve productivity and increase their output.

The dual-gap theory above suggests that the problem of insufficient domestic savings is compounded by the need to import capital goods for development. The central argument is that developing countries face not just a savings gap, but also a foreign exchange gap such that developing countries need both foreign capital (to address the savings gap) and foreign exchange (to finance the imports of capital goods). The theory proposes that these developing countries would need external financing to bridge both the savings and trade gaps, with foreign aid or external borrowing serving as the bridge to increase domestic capital formation.

Whilst Chenery and Strout (1966) originally focused on foreign aid as a solution to the dual gap problem, others such as Bender and Löwenstein (2005) have extended the original hypothesis to include external debt as an alternative to foreign aid to close both the savings gap and the trade gap in hopes of stimulating growth. Accumulation of foreign debt is assumed to finance new investments and the purchase of fixed capital using foreign currency. This model can thus be criticised for focusing on availability and accessibility of external debt without giving a clear prescription of how these funds should be allocated by recipient countries in order to fully benefit from them.

One of the barriers to effectively utilizing external resources to bridge the investment-savings gap is corruption. In many developing countries, corrupt practices divert public funds, misallocate investments, and distort the efficient functioning of markets. Corruption has been described as "the abuse of public or corporate office for private gain" (Bhargava, 2005). Whilst the unethical nature of corruption remains largely undisputed, the economic impact of corruption remains ambiguous amongst researchers. Proposers of corruption rely on the "grease the wheels" hypothesis which implies that corruption can influence changes in growth in a positive direction. Pioneered by Leff (1964), Leys (1965) and Huntington (1968), the above theory suggests that corruption can increase output in one of two ways. First, it can be used to speed up processes that would otherwise be delayed by red tape. Second, bribes can be used to incentivise hard work amongst government employees particularly when bribes are offered per piece of work done. Consequently, on a macro scale for example, 'grease" money works to alleviate the inefficiencies faced by those looking to invest caused by ill-functioning bureaucracies therefore speeding up the investment timeline which then feeds into the growth process.

Opposingly, "sand the wheels" enthusiasts argue that corruption is detrimental to growth more so in the presence of bad governance and weak institutions (Méon and Sekkat, 2005:71). This hypothesis posits that corruption creates institutional inefficiencies that would otherwise not exist because government employees are expectant of a bribe to do the same work they would normally do otherwise. If stakeholders expect to be pay exorbitant bribes to pursue their investments, especially when many independent centres are responsible for the approval of a project, it will likely erode their confidence in the host country as well as raise their costs such that they may eventually forego their projects altogether to the detriment of growth (Mauro, 1995). Essentially, corruption proposers contend that corruption can smooth over bureaucratic

weaknesses whilst opposers argue that it creates further weaknesses and worsens the condition of state institutions.

The role of institutional quality in the use of external debt and foreign investment to close the savings gap has gained increasing attention. Studies have shown that countries with weak institutions are less likely to effectively channel external funds into productive investments. According to Alesina and Weder (2002), countries with high levels of corruption tend to receive less foreign aid and are less effective at utilizing this aid for development purposes. Similarly, countries with weak legal frameworks and lack of transparency are less likely to attract foreign direct investment, which is often needed to boost productivity and technological advancement.

The effectiveness of external debt and foreign investment is further compromised by the mismanagement of funds. Lambsdorff (2003) argues that in corrupt environments, funds from international loans or foreign direct investments are often misallocated to inefficient projects or pockets of the political elite, rather than being used for productive investments that could foster long-term growth. In extreme cases, debt may be used to finance consumption rather than investment in capital goods or infrastructure, undermining the potential of external debt to foster sustainable development.

To ensure that the investment-savings gap is addressed effectively, it is crucial for developing countries to address issues of corruption and institutional weaknesses. Modern growth literature stresses the importance of aligning foreign investment and debt with national development priorities. Bender and Löwenstein (2005) argue that it is not merely the availability of external resources that matters but the way in which they are allocated. Countries must focus on building sound institutional frameworks that ensure external funds are used for capital projects that promote long-term growth, rather than being diverted by corrupt practices.

2.1 Empirical Review

Many countries have faced and continue to suffer from a low savings rate that is compounded by weak tax revenues therefore limiting funds available to the government which results in external borrowing to meet financial shortfalls. Consequently, the external debt and economic growth nexus is of particular interest to researchers and interested stakeholders and has thus been extensively researched for both developed and developing countries. To date, there is no consensus on the actual nature of this relationship with evidence being found for both a positive and negative relationship between the two variables.

Examining 43 African countries over an 18-year period, Ehikioya *et al* (2020) employed system Generalised Method of Moments (sysGMM) to determine the dynamic relationship between external debt and economic growth. They found evidence of a long run equilibrium relationship that exhibits Laffer curve type characteristics where beyond a certain point in the short run, increasing amounts of external debt will have adverse effects of the level of output. Their study did not however establish an optimal debt level to recommend to policy makers which could be a topic for further research. Senadza *et al* (2017) also used the sysGMM model to estimate the external debt and economic growth nexus in 39 Sub-Sahara African (SSA) countries between 1990 and 2013. Unlike Ehikioya *et al* above, their findings did not provide evidence to support the presence of a non-linear relationship and instead suggested that external debt has significant, negative effect on growth.

Adedoyi *et al* (2016) and Al Kharusi and Ada (2018) both used the Auto-regressive Distributed Lag (ARDL) model to test the significance of the relationship between external debt and economic growth in Nigeria and Oman respectively. Both sets of researchers established the existence of a significant long run relationship between the two variables in each respective country. However, only Al Kharusi and Ada were able to ascertain the nature of said relationship (negative) in Oman whilst Adedoyi *et al* observed that there exists no causality between external debt and growth in Nigeria.

In all the papers discussed above, the authors recognised the importance of external debt as a finance tool given the savings gap in many countries. Their recommendation was that governments need to put in place mechanisms and institutions that keep records of debt servicing obligations and ensure the efficient use of external debt in investments that produce adequate returns to the economy. In the presence of such interventions, Mensah *et al* (2018) found that external debt positively impacted growth in 36 SSA countries between 1996 and 2013. They explained that countries that have weak institutions and poor governance fail to appropriately allocate and fully utilise external debt in a way that would boost their output levels. These findings agreed with those of Korkmaz (2015) who found that external debt in Turkey positively influenced economic growth on a quarterly basis over an eleven-year period. The positive impact of external debt on economic growth seems to be greatly influenced by governance factors and macroeconomic policies that allow developed countries relative to developing countries to better utilise their debt and record more positive growth outcomes (Zhang *et al*, 2020).

The empirical literature exploring the relationship between corruption and growth has mostly supported the view that corruption has a negative impact on growth outcomes unlike that of the external debt-growth dynamic which remains largely ambiguous. However, whilst conducting a meta-analysis of 41 quantitative studies that explored the corruption-growth nexus, Campos *et al* (2016) discovered that non-academic authors had a bias towards reporting results in support of the 'sand the wheels' hypothesis relative to their academic counterparts. Sharma and Mitra (2019) assessed the impact of corruption control on growth for a panel of countries between 1996 and 2005. Using dynamic panel data models that controlled for endogeneity, they found that corruption control positively influences economic growth therefore supporting the theory that widespread corruption is detrimental to growth. Interestingly, Bitterhout and Simo-Kengne (2020) established a positive relationship between corruption and growth for BRICS countries from 1996 through to 2014 when they controlled for heterogeneity and endogeneity and the opposite when they only accounted for fixed effects (heterogeneity). This suggests that there may be a level of corruption that can 'grease the wheels' and propel the economy towards high output levels.

The varieties of democracy (V-Dem) are an international data-collection project that covers various aspects of democratic quality and have a political corruption index that serves as a corruption indicator (Coppedge *et al*, 2021). Uberti (2022) used the political corruption index to examine the effects of corruption on growth over a 220-year period starting in 1790. The study found robust evidence of a negative association between the two variables with democratic governments performing relatively worse than autocracies because of their decentralised nature that allows for more channels through which corruption can occur. This could explain why Southern hemisphere countries record high perceptions of corruption as their governments tend to be 'democratic' and larger in size. In a similar study focused on the East and Southeast Asian countries, Saha and Sen (2021) also established the influence of a political regime on the corruption-growth nexus. However, their results suggested that autocratic regimes actually experience growth-enhancing effects in the presence of high levels of corruption whilst democracies with similar levels of perceived corruption suffer detrimental growth outcomes.

Obamuyi and Olayiwola (2019) investigated the transmission channels through which corruption affects economic growth in India and Nigeria. As per their findings, corruption hindered the level of investments and human capital development causing them to adversely affect economic growth in both countries. Corruption, however, was not found to have any

effect on political stability and it turn growth. Other transmission channels in literature included decreased foreign direct inflows and increased inflation which both have negative externalities on economic progression (Gründler and Potrafke, 2019). To wholly understand corruption's impact on growth, research should expand beyond their direct relationship and should consider the indirect effects of corruption as it interacts with other key macroeconomic variables such as debt, investments, human capital and government expenditures (d'Agostino *et al*, 2016).

Studies specifically examining the relationship between external debt and corruption remain quite scarce. As such, the subsequent paragraphs will consider the association between public debt (external and domestic) and corruption. In considering the Nigeria case, Fagbemi and Olatunde (2019) established significant short run adverse effects of corruption on public debt as well as bi-directional causality between the two. Long run results were insignificant suggesting that current anti-corruption efforts may be of less importance in helping long term debt accumulation and fiscal irresponsibility. There seems to be a layman disposition that highly corrupt countries tend to amass large amounts of debt. However, Benfratello *et al* (2018) established that corruption had a greater impact on increasing sovereign debt in high income countries compared to their less developed peers who are generally presumed to be relatively more corrupt (Gray and Kaufman, 1998). Regrettably, Benfratello *et al* failed to quantify the precise impact of corruption on public finances.

As of December 2020, approximately 80% of employed persons in Africa had jobs in the urban informal sector. This shadow economy accounts for the majority of economic activity on the continent (Guven and Karlen, 2020). González-Fernández and González-Velasco (2014) considered the influence of the informal economy and corruption on public debt in autonomous Spanish states between 2000 and 2012. Whilst both exhibited a significant and positive association with public debt, the shadow economy had a marginally greater economic significance as its impact diluted that of informal economic activity in the states. Countries with substantial informal sectors often suffer from inadequate revenues because they cannot collect taxes from the unregulated part of the economy. As such, they turn to public debt as a way to meet their fiscal deficits thus increasing their debt burden. It should be noted that debt in of itself is not bad for the economy, rather, how it is utilised is of greater importance. In addition to anti-corruption schemes, SSA countries should enact policy that will formalise a larger portion of their overall economies so as to increase their tax base.

Corruption sometimes affects public debt through public expenditure. Rent seeking government employees may opt for capital-intensive investments as opposed to labour-

intensive ones as there are more avenues through which they can seek bribes and amass wealth from illicit financial flows (Kaufmann, 2010). As more money is lost to corrupt practices, more debt is undertaken to meet the shortfall thus continuously increasing the countries debt stock. Cooray and Schneider (2013) corroborated Kaufmann's argument with results that suggest that the positive effect of corruption on debt is further compounded by high government spending as well as the presence of a shadow economy.

Shittu *et al* (2018) is one of the few studies that considers all the three variables of interest in this paper (economic growth, external debt and corruption) within the same region (SSA). Like other researchers, they found evidence of a significant negative relationship between external debt and economic growth in the selected five SSA countries but surprisingly found growth-enhancing effects of corruption which goes against the findings of most empirical findings. They however did not consider the interaction between corruption and external debt which this paper will include because it has been shown that corruption and debt do not operate in isolation of each other and understanding how they influence each other is of great importance to future policy and initiatives within the region.

CHAPTER 3: MODEL SPECIFICATION, DATA & METHODOLOGY

3.1 Model Specification and Econometric Approach

The framework used to investigate the nexus between external debt, corruption and economic growth follows the work by Shittu *et al* (2018) who employed an augmented Solow model that incorporates the impact of corruption on the level of productivity to capture its final effects on economic growth. Beginning with an economy that produces a single commodity and has the following neoclassical production function:

$$Y_t = K_t^{\alpha} H_t^{\beta} [A_t(\rho) L_t]^{1-\alpha-\beta}, \quad (1)$$

where Y_t is the aggregate level of real income proxied by natural log of gross domestic product per capita (lngdppc), K_t is the level of physical capital represented by gross fixed capital formation as a percentage of GDP (gfcf) whilst H_t is the level of human capital proxied by the human development index (hdi) and A_t is the multifactor level of productivity. L_t is labour supply proxied by population growth (popgrowth) and ρ represents the level of corruption given by the natural log of the corruption perception index (lncpi).

Corruption, assumed to be exogenous, has been incorporated into this growth model through its deterioration of input productivity. This kind of deterioration can take many forms. For

example, allocation of physical capital may be transferred away from socially benefitting, growth-enhancing projects and towards projects that promise large side payments with low detection risks (Lambsdorff, 2003). Also, public officials that are appointed based on bribes and nepotism may not have the capacity to do their jobs effectively thus affecting the efficiency and quality of public service which trickles down to overall output.

Consequently, in line with the above augmented Solow model and the debt overhang hypothesis, equation 1 is log-linearised to form the following base model which will be estimated for a panel of 37 countries over the 2012 to 2021 period to test the empirical relationships between economic growth, external debt, corruption and the interaction between external debt and corruption. It is specified as follows:

$$lngdppc_{it} = \alpha_i + \beta\ exdebt_{it} + \lambda\ lnpci_{it} + \propto X_{it} + \eta_t + \mu_{it} \quad , \qquad (2)$$

$$i = 1, \dots, N\ (country); t = 1, \dots, T\ (time),$$

where $lngdppc_{it}$ is the dependent variable log of real per capita GDP in country i at time t, $exdebt_{it}$ and $lncpi_{it}$ are the external debt and corruption variables respectively and X_{it} is a vector of all independent variables including debt servicing, gross fixed capital formation as a percentage of GDP, inflation, population growth, the human development index and the interaction term between external debt and corruption. α_i captures country specific effects, η_t absorbs period-specific shocks by accounting for time specific effects and μ_{it} is the error term that captures the effects of all omitted variables. β, λ and $\propto$ are the parameters to be estimated.

Bitterhout and Simo-Kengne (2020) highlight a few challenges that arise from growth related studies. First, the explanatory variables may be correlated to the disturbances in the model which is referred to as endogeneity. There are many sources of endogeneity, one of which is simultaneity bias that occurs when randoms shocks that affect economic growth also affect independent variables such as corruption and external debt in the context of this study. Second, they highlighted omitted variable bias as a possible source of endogeneity. Omitted variable bias occurs when variables that help explain growth outcomes are excluded from the model usually due to a lack of consistent, reliable data. This can be particularly true for African focused studies as quality data on African countries is not always readily available or accessible.

To overcome the above challenges, previous panel data studies (Mallik and Saha, 2016; Fatima *et al*, 2020; Saha and Sen, 2021) have made use of either the difference-GMM (diffGMM) pioneered by Arellano and Bond (1991) or the system-GMM (sysGMM) produced

by the works of Blundell and Bond (1998). Both versions of the Generalized Method of Moments (GMM) use internal instruments to overcome the problem associated with endogeneity and incorporate fixed effects. GMM estimation is also appropriate in studies that have a short time period and larger sample. As per Sohag *et al* (2018), in the presence of endogeneity, GMM is applicable in situations where T<25 and N>25 as is the case in this study where T=10 and N=37.

We note that preceding literature acknowledges that economic growth is a long-term phenomenon, and short panels may limit the ability of System GMM to capture the full dynamic effects of key growth drivers. Short time spans do not allow for an accurate estimation of how changes in policy variables (such as corruption or trade liberalization) impact growth over the long run and they may fail to capture the lagged impact of explanatory variables because the method primarily focuses on the short-run dynamics and the relationship between variables within a few periods (Iglesias *et al*, 2011; Arellano and Bover, 1995).

The above notwithstanding, whilst both estimators use lagged values of the endogenous variables as instruments and are based on first differencing, the sysGMM is preferred over the diffGMM because it is better suited to deal with the persistence stemming from the lagged dependent variables and regressors (Bitterhout and Simo-Kengne, 2020). More specifically, Roodman (2009) suggests use of the two-step sysGMM as opposed to the one-step as it is considered to be more robust in its findings. As such, this study shall proceed with the two-step sysGMM to estimate the following equation:

$$lngdppc_{it} = \beta_0 + \beta_1' exdebt_{it} + \beta_2' lncpi_{it} + \beta_3' dbtser_{it} + \beta_4' gfcf_{it} + \beta_5' inf_{it} + \beta_6' popgrowth_{it} + \beta_7' hdi_{it} + \beta_8' debtcorr_{it} + \mu_{it} \quad (3)$$

As per the literature review, the coefficients of external debt (β_1'), gross fixed capital formation (β_4'), population growth (β_6') and the human development index (β_7') are expected to be positive whilst the coefficients of debt servicing (β_3') and corruption (β_2') are expected to be negative in line with the sand the wheels hypothesis. The sign and significance of β_8' are of particular importance as it captures the interaction effect of corruption and external debt on the log of per capita GDP. Additionally, the marginal effects of corruption and external debt on GDP are computed as follows:

$$\frac{\delta lngdppc_{it}}{\delta exdebt_{it}} = \beta_2 + \beta_8\ lncpi_{it} \quad (4a)$$

$$\frac{\delta lngdppc_{it}}{\delta reversecpi_{it}} = \beta_3\ + \beta_8\ exdebt_{it} \quad (4b)$$

Equation (4a) demonstrates the marginal impact of debt accumulation on growth in the presence of corruption. If $\beta_8 < 0$, then equation (4a) implies that a one unit increase in external debt stocks yields a larger reduction in output as the extent of corruption increases. In other words, an increase in external debt levels enhances growth when countries are highly corrupt. Conversely , if $\beta_8 > 0$, a higher level of external debt increases growth with less corruption. In other words, the marginal effect of external debt and corruption reveals that an increase in the level of external debt on growth per capita growth depends on the level of corruption in the economy. Likewise, equation (4b) is the marginal effect of corruption in the presence of a large external debt.

As part of the preliminary analysis the pooled OLS and fixed effects approaches will also be used to estimate equation 3. However, it should be noted that with dynamic panel data and a short time period, neither the OLS nor the fixed effects techniques perform particularly well for different reasons. The pooled OLS technique does not account for panel data structuring as it ignores the uniqueness of each cross-sectional unit (heterogeneity) thus producing upward biased and inconsistent estimates (Mehrhoff, 2009). In the case of fixed effects, downward bias can occur in a model containing a lagged dependent variable and can be worsened by a short time period (Farkas, 2005). As part of the robustness checks, in addition to estimating equation 3 using the two-step diffGMM, an alternative measure of corruption (cic) will be used to generate comparative results for the two-step sysGMM technique. To consider any cross-sectional dependence, we also have included year dummies as instruments in some regressions as there may be an endogeneity problem for some of our explanatory variables. To check the validity of the instruments used, the study employs the test of overidentifying restrictions as prescribed by Sargan (1958) in which the null hypothesis states that the instruments are not correlated with the residuals. In addition, a diagnostic check will be carried out to test that the differenced error term is not second order auto correlated.

3.2 Data Sources and Variable Definitions

To investigate how the interaction between external debt and corruption affects economic growth, this paper employs panel data from 37 countries in the Sub-Saharan African region whose data was available for all the variables used in the study. Annual data from 2012 to 2021 was collected from the World Development Indicators, International Debt Statistics, World Governance Indicators, Transparency International and the Human Development Report Data Centre.

The period of study was determined by the availability of comparable data for the Corruption Perception Index (CPI) which is the primary measure of corruption used in this study. From 2012 onwards, Transparency International revised their methods of measurement to make the CPI comparable from year to year (Gründler and Potrafke, 2019). Drawing from Mauro and Zohar (2021) as well as Rachadi and Boudelaa (2020), the paper will focus on the short-term effects of external debt, corruption and their interaction on economic growth because of the limited time period in which the CPI is consistent and comparable.

The dependent variable is the natural log (ln) of real gross domestic product per capita (gdppc). Gdppc is preferred over cumulative GDP because it accounts for country specific differences. External debt measured as a percentage of gross national income (GNI) captures the portion of total debt that is owed to lenders outside of the country. Creditors may include but are not limited to other governments, international financial institutions or commercial banks. The human development index is a composite statistic that falls between 0 (poor development) and 1 (highly developed) and captures the progression of long term human development.

Transparency Internationals Corruption Perception Index (CPI) is a composite index that considers the extent to which corruption is perceived amongst public officials operating within the government of a country. Prior to 2012, the index ran between 0 and 10 with 0 signalling extreme corruption. It was however incomparable between years and has since been revised to account for year on year comparability and now falls between 0 (completely corrupt) and 100 (completely clean).

For the rest of this paper, the CPI is preferred over control of growth (CIC) as a primary proxy of corruption because the former measures perceived corruption in the public sector by experts whereas the latter includes perceived corruption in both the private and public sectors from opinion polls and experts (Rohwer, 2009). Previous studies suggest that for studies focused on the relationship between corruption and economic growth, the CPI is more relevant because it focuses on perceived corruption, which is often seen as having a direct impact on investor confidence, foreign direct investment (FDI), and the business climate. Perceptions of corruption, particularly in African countries such as those sampled in this study, can influence decision-making more immediately than the more technical and aggregate measure of governance provided by the CIC (Fosu, 2017; Asongu and Odhiambo, 2018; Zhou and Wang, 2019).

Informed by previous corruption studies (Saha and Sen, 2021; Bitterhout and Simo-Kengne, 2020; Benfratello *et al*, 2018), the CPI has been rescaled as *100 – CPI* to create a direct indicator where 0 represents corruption free countries and 100 signifies totally corrupt countries as this makes for easier inferences. Making reference to Mauro (1995), Treisman (2000) and Charron *et al* (2014), the CIC which normally lies between -2.5 (low control of corruption) and 2.5 (high control of corruption), has also been rescaled to fall between 0 and 10. This approach makes the interpretation of results more intuitive where 0 represents the lowest control of corruption and 10 represents the highest. As such, for the rest of the paper, the CIC will lie between 0 and 10.

It is important to note that where the rescaled CPI is 0 indicating a corruption free country, the rescaled CIC will equal 10 which signals strong control of corruption and vice-versa. This will be a key consideration in chapter 4 of this study.

Debt servicing expressed as a ratio to exports represents a countries ability to gain foreign exchange to meet its debt obligations. A 'large' ratio implies an unsustainable debt burden; however, it is rather difficult to assess what constitutes sustainable debt levels as this varies from country to country. Gross fixed capital formation as a percentage of GDP consists of additions to the economy in the form of fixed assets such as land improvements, plant, machinery, the construction of roads, schools, hospitals, commercial and industrial buildings relative to the country output. It is used as a proxy for physical capital where it has been implied in previous research that increases in physical capital often led to increases in economic output (Akram, 2017; Asteriou *et al*, 2020). Inflation expressed as a percentage is important in as far as the uncertainty of debt service payments that comes from the variation in price levels. Lastly, debtcorr and debtcorr2 are measurements of the interaction between external debt, the corruption perception index and the control of corruption respectively whilst the year dummies are included to account for shocks whose effects are limited to a specific time period.

Table 1 below shows the basic descriptive statistics for each individual variable included in the study. Gross domestic product per capita (*gdppc*) values range from 263.36 to 10,956.95 with a deviation of 2,073.06 from the mean. Given that the mean of 1,836.73 is closer to the minimum than the maximum, it implies that gdppc values have a long right-tail and are positively skewed. There is evidence of great variation in the trend of the variables between 2012 and 2021 as shown by the fairly large standard deviation figures. Perceived corruption is quite high in the selected Sub-Saharan African countries with an average of 67.93, a variation of 10.55 and a minimum and maximum of 35 and 89 respectively. The values of control of

corruption seem to agree with those of the CPI as a mean of 3.64 signals relatively weak control of corruption. Despite a high maximum of 429.74%, external debt as a percentage of GNI is within a reasonable range with an average of 46.70% and a minimum of 4.95%.

Table 1. Summary Statistics

Variable	Denoted As	Obs	Mean	Std Dev	Min	Max
Gross domestic product per capita	*gdppc*[2]	370	1836.725	2073.057	263.361	10956.95
External debt as a percentage of GNI	*exdebt*	370	46.70438	51.2144	4.950816	429.7383
Debt servicing expressed as a ratio to exports	*dbtser*	370	3.579534	5.685859	0.0527959	47.45129
Corruption perception index	*cpi*	368	67.92935	10.55002	35	89
Natural logarithm of CPI	*lncpi*	368	4.2048	0.1716	3.5553	4.4886
Control of corruption	*cic*	370	3.636067	1.140444	1.83773	6.813031
Gross fixed capital formation (% of GDP)	*gfcf*	365	22.85761	8.986956	3.465809	81.02102
Inflation	*inf*	370	6.740954	15.72994	-17.59471	235.5154
Population growth rate	*popgrowth*	370	2.508573	0.7936178	-0.076949	3.867091
Human development index	*hdi*	370	0.5255135	0.0926748	0.354	0.817
Interaction term	*debtcorr*	368	197.0323	219.4701	21.24128	1855.39
Proxy interaction term	*debtcorr2*	370	173.4691	189.7668	12.89364	1490.066

Note: obs=observations, std dev=standard deviation, min=minimum value, max=maximum value

As part of the preliminary analysis, a Pearson correlation test is conducted, and the results are displayed in table 2. Debt servicing, corruption, control of corruption, population growth, the human development index and the secondary interaction term (*debtcorr2*) all appear to have significant relationships with gross domestic product per capita. The sign on the coefficient of external debt is in line with debt overhang hypothesis whilst that of debt servicing contradicts it. However, it must be noted that this may be because the values of debt servicing are not 'large enough' to exhibit a negative association with economic growth as evidenced from table 1.

Table 2. Pearson correlation results

	gdppc	exdebt	dbtser	cpi	cic	gfcf	inf	popgrowth	hdi	debtcorr	debtcorr2
gdppc	1.0000										
exdebt	−0.0027	1.0000									
dbtser	0.4722*	0.5369*	1.0000								
cpi	−0.4761*	−0.0117	−0.2484*	1.0000							
cic	0.4226*	0.0626	0.2391*	−0.9680*	1.0000						
gfcf	−0.0572	0.1279*	−0.0085	−0.1542*	0.1427*	1.0000					
inf	−0.0348	0.0538	0.0166	0.1563*	−0.1354*	−0.1934*	1.0000				
popgrowth	−0.5419*	0.0378	−0.2748*	0.4211*	−0.4377*	0.2377*	0.0447	1.0000			
hdi	0.8780*	−0.0131	0.4012*	−0.5020*	0.4625*	0.0183	−0.0107	−0.5116*	1.0000		
debtcorr	−0.0198	0.9991*	0.5187*	0.0222	0.0333	0.1210*	0.0607	−0.0507*	−0.0303	1.000	
debtcorr2	0.1136*	0.9545*	0.6089*	−0.2569*	0.3078*	0.1464*	−0.0084	−0.0985	0.1024*	0.9417*	1.000

NB: (*) refers to statistical significance at the 5% level.

Corruption perception is shown to be significantly and negatively correlated to gdppc thus agreeing with the theoretical expectation that corruption sands the wheels of growth in the

[2] The summary statistics and the Pearson correlation results contain descriptive statistics for the raw data. For the empirical sections i.e., unit roots to regressions, we will use the natural logs of gdppc and cpi.

sample countries. The sign on the coefficient of control of corruption also follows the *a priori* expectation that strong control of corruption positively and significantly impacts a country's growth outlook. However, the coefficient of gross capital formation does not agree with theoretical expectations as it signifies a negative, insignificant relationship with growth whilst population growth which proxies labour supply appears to have a negative, significant association with growth. Debt servicing, the proxy interaction term (*debtcorr2*) and the human development index exhibit positive, significant relationships with growth.

Most of the variables seem to have optimum linearity as their coefficients are below the 0.8 threshold used to indicate the absence of collinearity problems. Nonetheless, it should be noted that corruption (*cpi*) and control of corruption (*cic*), are highly correlated presumably because they are both measures of corruption. This should not matter as they will not be used in the same model thus it should not affect the validity of the results. External debt and hdi are also highly correlated with the interaction terms and gdppc respectively, which is to be expected as elements of the former variables are from components of the latter variables.

Panel data consists of time series and cross-sectional data; therefore, the time series component warrants the application of unit root tests to avoid the problems associated with spurious regression (Bitterhout and Simo-Kengne, 2020). For both the Fisher Augmented Dickey Fuller ("ADF") and the Phillips Perron ("PP") unit root tests, the null hypothesis states that the variable has a unit root whilst the alternative hypothesis is the absence of a unit root for the variables in question.

Table 3. Unit root Tests

Variable	Fisher ADF Inverse normal	Order of Integration	Phillips-Perron Inverse normal	Phillips-Perron First difference	Order of Integration
lngdppc	-7.060^{***}	I(0)	-0.4671	-9.3368^{***}	I(1)
exdebt	-3.3732^{*}	I(0)	3.8417	-12.6956^{***}	I(1)
exdebtsq	-1.8316^{**}	I(0)	4.8852	-10.8244^{***}	I(1)
dbtser	-5.9358^{***}	I(0)	-1.0090	-17.0302^{***}	I(1)
lncpi	-5.6683^{***}	I(0)	-0.3880	-11.9453^{***}	I(1)
cic	-7.4346^{***}	I(0)	1.5730	-8.9551^{***}	I(1)
gfcf	-6.4026^{***}	I(0)	-0.5081	-10.6712^{***}	I(1)
inf	-9.3775^{***}	I(0)	-9.4741^{***}		I(0)
popgrowth	-6.2476^{**}	I(0)	-0.4597	-3.2934^{***}	I(1)

hdi	-9.3263^{***}	I(0)	-6.4621^{***}		I(0)
debtcorr	-3.2484^{**}	I(0)	3.9732	-12.2114^{***}	I(1)
debtcorr2	-3.8510^{*}	I(0)	3.4891	-11.7426^{***}	I(1)

NB: (*), (**) and (***) refer to statistical significance at the 10%, 5% and 1% levels respectively.

The results of the unit roots tests are reported in Table 3 above and support the existence of a unit root at either level terms or first difference. In the case of the ADF, the unit root test is conducted with a drift and 1 lag whilst the PP test only includes 1 lag. The ADF indicates that for all variables we reject the null hypothesis and conclude that the series are stationery in level terms. In the case of the PP results, *inf* and *hdi* are stationery in level terms and the remaining variables are stationery at first differences. Where there are inconsistencies between the ADF and PP results, the PP results will be used as first preference as the PP test is considered to be consistent even in the presence of certain types of structural breaks and to be more robust in the presence of heteroscedasticity (Phillips and Perron, 1988).

It is important to note that in samples with a short time period (T) such as the one used in this study (T=10), the power of the unit root tests may be comprised as the power of the test is dependent on the span (T) of the data relative to the size of the sample (N) (Gujarati and Porter, 2009).

CHAPTER 4: FINDINGS AND DISCUSSION

The main objective of this study is to explore how the relationship between external debt and corruption influences the growth trajectory of select SSA countries. The analysis begins with the use of the pooled OLS method as a preliminary estimation. Next, the paper will discuss the regression results from the fixed and random effects models before finally considering the results from the two-step difference and system GMM estimations.

4.1 Pooled ordinary least squares regression results

Using the pooled OLS method, column 2 of Table 4 reports the results where the corruption perception index (*lncpi*) is used as the measure of corruption whereas column 3 reports the results where the alternative proxy of control of corruption (*cic*) is used as a measure of corruption. In model 1, the coefficient of external debt is negative and statistically significant at the 1% whilst in model 2, the coefficient of external debt is significant and positive also at the 1%. The above findings seem to support both the debt overhang hypothesis and the dual gap problem which argue that debt can hinder or promote growth respectively.

The coefficient of corruption is negative and statistically significant at 5% level in model 1. This result indicates that corruption has a negative direct impact on GDP per capita which is consistent with the previous studies (Erum and Hussain, 2019; Cieślik and Goczek, 2018) This finding also agrees with the results displayed in model 2 in which the coefficient of control of corruption is significant and positive at the 5% level. This means that where corruption levels are low or control of corruption is high, output per capita will also increase.

Table 4. Pooled OLS Results

lnGDPPC	Model 1	Model 2
exdebt	-0.0626^{***} (0.0178)	0.0069^{***} (0.0024)
lncpi	-0.3896^{**} (0.2095)	
debtcorr	0.0144^{***} (0.0041)	
cic		0.0710^{**} (0.0347)
debtcorr2		-0.0023^{***} (0.0007)
hdi	7.8594^{***} (0.2968)	7.8185^{***} (0.2943)
gfcf	0.0030 (0.0024)	0.0023 (0.0024)
dbtser	0.0166^{***} (0.0058)	0.0127^{**} (0.0055)
inf	0.0018 (0.0013)	0.0016 (0.0013)
popgrowth	−0.0292 (0.0321)	−0.0351 (0.0323)
_cons	4.650^{***} (0.9680)	2.7941^{***} (0.1963)
F (8, 354)	192.47	190.55
p-value	0.0000	0.0000
Adj R-squared	0.8088	0.8064
time periods	10	10
obs	363	365

NB: (*), (**) and (***) refer to statistical significance at the 10%, 5% and 1% levels respectively.

Interestingly, both interaction terms are significant however, under model 1, the interaction between external debt and corruption positively affects growth contrary to the finding under model 2 in which the interaction between control of corruption and external debt has a negative impact on growth. It would be the expectation that the interaction terms would follow the direction of the individual variables in their respective models i.e. a negative impact in model 1 and a positive impact in model 2. Debt servicing and the human development index are both found to have positive and significant relationships with GDP per capita whilst all other variables have insignificant relationships with the dependant variable.

However, as previously mentioned, the results from pooled OLS under a short time period should be considered cautiously as the estimates can be inconsistent and suffer from upward bias. As such, this study will not be relying on the results reported in table 4. Instead, they provide a basic glimpse of what relationships may be exhibited by the variables under consideration.

4.2 Fixed effects and Random effects regression results

Table 5 below reports the findings of the fixed effects ("FE") and random effects ("RE") models. Columns 2 and 3 display the FE and RE estimates when the primary measure (*lncpi*) of corruption is used and columns 4 and 5 are the estimates when the alternative proxy (*cic*) is used. In model 1, none of the variables of interest (external debt, corruption and interaction term) are significant though the coefficient signs of corruption and the interaction term are per theoretical expectation particularly for developing countries such as those in SSA. Of our variables of interest in model 2, only corruption has a significant and negative impact on growth outcomes. The insignificance of the interaction term in models 1 and 2 implies the interaction between external debt and corruption does not have a substantial impact on the performance of the economy in the selected SSA countries.

Table 5. Fixed Effects and Random Effects

lnGDPPC	Model 1 (Fixed Effects)	Model 2 (Random Effects)	Model 3 (Fixed Effects)	Model 4 (Random Effects)
exdebt	0.0055 (0.0050)	0.0038 (0.0053)	−0.0021*** (0.0007)	−0.0021*** (0.0007)
lncpi	−0.1799 (0.1096)	−0.2462** (0.1135)		
debtcorr	−0.0014 (0.0012)	−0.0010 (0.0012)		
cic			−0.0046 (0.0157)	−0.0022 (0.0165)
debtcorr2			0.0005*** (0.0002)	0.0005** (0.0002)
hdi	3.1529*** (0.2557)	3.7391*** (0.2558)	3.0969*** (0.2580)	3.6962*** (0.2596)
gfcf	0.0023*** (0.0006)	0.0021*** (0.0007)	0.0023*** (0.0006)	0.0022*** (0.0007)
dbtser	−0.0042*** (0.0016)	−0.0042** (0.0017)	−0.0041** (0.0016)	−0.0040** (0.0017)
inf	−0.0012*** (0.0003)	−0.0012*** (0.0003)	−0.0010*** (0.0003)	−0.0010*** (0.0003)
popgrowth	0.0121 (0.0134)	0.0046 (0.0141)	0.0153 (0.0134)	0.0080 (0.0141)
_cons	6.1476*** (0.4843)	6.1491*** (0.5093)	5.4309*** (0.1410)	5.1311*** (0.1581)
F statistic	28.62		29.19	
Wald chi2		288.32		285.69
p-value	0.0000	0.0000	0.0000	0.0000
groups	37	37	37	37
obs	363	363	365	365
Hausman chi2 (7)	44.04		48.03	
p-value	0.0000		0.0000	

NB: (*), (**) and (***) refer to statistical significance at the 10%, 5% and 1% levels respectively.

In models 1 and 2, all the other explanatory and control variables excluding population growth are shown to have significant relationships with GDP per capita at either the 1% or 5% level. The negative coefficient on debt servicing suggests that countries with higher debt burdens experience slower economic growth. This may be because larger amounts of money go towards paying back external debt as opposed to growth enhancing activities within the country (Adamu, 2016; Guei, 2019). However, as the coefficient in itself is rather small, it is not expected to have a particularly large effect on GDP per capita.

From columns 4 and 5, the interactive term between external debt and the second proxy of corruption (control of corruption) is positive and significant at the 1% and 5% level respectively despite the individual variables of external debt and control of corruption are shown to have negative impacts on growth. That means under these models, the two variables need to work alongside each other to have an overall positive impact on growth otherwise in isolation they contribute towards negative growth outcomes. For the remainder of the variables, their coefficients signs and significance levels agree with those found under models 1 and 2.

The study then employed the Hausman test to determine whether the FE model or RE model is more appropriate given the null hypothesis that the preferred model is the random effects and the alternative being the fixed effects (Wooldridge, 2010). For both measures of corruption, the Hausman test with h-statistics of 44.04 and 48.03 and p-values of 0.0000, implies that the unique errors are correlated with the regressors, and that the FE model (models 1 and 3) is the preferred estimation model.

4.3 Difference and System generalised method of moments regression results

Our benchmark results are based on the system generalised method of moments estimator ("sysGMM") whilst the difference generalised method of moments estimator ("diffGMM") is used for comparison purposes keeping in mind that the sysGMM generally performs better than the diffGMM in the presence of persistent lagged variables.

This analysis examines the determinants of economic growth as measured by the natural logarithm of gross domestic product per capita (l*ngdppc*). The study employs two different econometric techniques (diffGMM and sysGMM) and incorporates various control variables. Key variables of interest include the lagged dependent variable (*l.lngdppc*), external debt (*exdebt),* the measures of corruption (*lncpi* and *cic*) and the interaction terms (*debtcorr* and *debtcorr2*). To begin our analysis, we consider the models without the interaction terms.

Table 6. Difference and System GMM Results without Interaction Terms

lnGDPPC	Model 1 (diffGMM)	Model 2 (sysGMM)	Model 3 (diffGMM)	Model 4 (sysGMM)
l.lngdppc	0.5785*** (0.1908)	0.9533*** (0.0321)	0.5439*** (0.1712)	0.4342** (0.1962)
exdebt	−0.0006 (0.0004)	−0.0009* (0.0005)	−0.0014* (0.0006)	−0.0037*** (0.0011)
lncpi	−0.0423 (0.1046)	−0.2167** (0.1101)		
cic			−0.0146 (0.0133)	−0.0340 (0.0903)
hdi	1.3511* (0.7273)	0.1925 (0.2865)	1.7037*** (0.7536)	2.5143** (1.0264)
gfcf	0.0022** (0.0011)	0.0009 (0.0012)	0.0020* (0.0011)	−0.0014 (0.0028)
dbtser	−0.0009 (0.0015)	0.0029 (0.0022)	0.0020 (0.0025)	0.0124* (0.0067)
inf	−0.0004* (0.0002)	0.0001 (0.0001)	−0.0004** (0.0002)	0.0017* (0.0009)
popgrowth	0.0224*** (0.0089)	0.0166* (0.0093)	0.0198** (0.0010)	−0.1084 (0.1082)
_cons		1.1145** (0.4970)		3.2372** (1.2362)
obs	289	326	291	328
groups	37	37	37	37
instruments	30	32	30	21
F statistic	46.92	255663.17	62.81	7979.00
p-value	0.000	0.000	0.000	0.000
Hansen test	28.90	26.19	25.67	13.65
p-value	0.148	0.292	0.266	0.324
AR (1)	−2.02	−2.62	−1.81	−0.09
p-value	0.043	0.009	0.071	0.932
AR (2)	1.30	−1.85	−0.99	−1.24
p-value	0.193	0.064	0.322	0.214

The diagnostic AR(2) test in all four models has a p=value greater than 5%, implying that all the models are free from the problem of second order serial correlation. In addition, the Hansen tests yield insignificant probability values in all four models, which implies that the instruments employed in the models are adequate and not over-identified

The coefficients of the lagged dependent variables are positive and statistically significant at 1% and 5% across the four models, indicating the persistence and path-dependency of the dependent variable in SSA countries (Dawood *et al*, 2024).

In line with the 'sand the wheels' theory, corruption perception (*lncpi*) in models 1 and 2 has a negative impact on output levels, however, this relationship is only significant in model 2 at the 5% level. The coefficients of control of corruption (*cic*) are both negative and insignificant thus disagreeing with the findings of models 1 and 2 as theory proposes that greater control of corruption (low corruption) should yield higher growth outcomes. Instead, the negative coefficients support the 'grease the wheels' hypothesis. This means that under

models 3 and 4, poor governance would propel growth, and strong governance will hinder growth.

External debt has a persistently negative effect on economic growth. In models 2, 3 and 4, this relationship is not only negative but also significant suggesting evidence of the debt overhang theory as proposed by Krugman (1988) where high debt accumulation in the sample countries results in lower levels of output as resources are diverted towards debt servicing and away from productive investment.

In model 1, all the control variables are significant with the exception of debt servicing whilst in model 2, all the control variables are insignificant excluding population growth. Barring debt servicing and inflation, the signage on the control variables is consistent across the two models and in line with theoretical expectations as discussed in prior chapters.

In models 1, 3 and 4, the human development index is positively related to GDP per capita and is significant at the 10%, 1% and 5% levels. The human development index is typically considered an important determinant of long-term growth, particularly in endogenous growth models that emphasize the role of human capital (Barro, 1991).

Population growth and physical capital (proxied by gross fixed capital formation) are similar in their findings in that they are both have positive effect of growth in models 1 through 3 but exhibit a negative association in model 4. For both variables, the negative coefficients are found to be insignificant whilst the positive coefficients are mostly significant. This would imply that both variables can be considered to be key growth drivers (Bloom *et al*, 2003). The mixed findings on inflation align with broader literature which finds mixed results regarding inflation's impact on growth, with some studies suggesting that moderate inflation may not significantly harm growth (Fischer, 1993).

Debt servicing is only significant in model 4 where it displays a positive association with economic growth potentially due to the fact that servicing debt might lead to improved investor confidence or facilitate continued borrowing for growth (Calvo, 1998). We will now consider how the interactions between the independent variables and economic growth look when the interaction term is introduced into the model

Table 7. Difference and System GMM Results with Interaction Terms

lnGDPPC	Model 1 (diffGMM)	Model 2 (sysGMM)	Model 3 (diffGMM)	Model 4 (sysGMM)
l.lngdppc	0.5552** (0.2278)	0.8442*** (0.0672)	0.4944*** (0.1755)	0.5629* (0.3044)
exdebt	−0.0492** (0.0246)	−0.0381** (0.0166)	−0.0060* (0.0033)	0.0092* (0.0049)
lncpi	−0.3802 (0.2422)	−0.4010** (0.1795)		
debtcorr	0.0112**	0.0086**		

	(0.0057)	(0.0038)		
cic			−0.0688*** (0.0258)	0.2200** (0.1038)
debtcorr2			0.0012 (0.0008)	−0.0031* (0.0015)
hdi	1.6420** (0.7919)	1.0967** (0.5352)	2.4133*** (0.7854)	1.1576 (1.3638)
gfcf	0.0024 (0.0020)	0.0013 (0.0012)	0.0014* (0.0007)	0.0007 (0.0015)
dbtser	0.0025 (0.0047)	0.0042 (0.0031)	−0.0009 (0.0045)	0.0173* (0.0100)
inf	0.0020 (0.0021)	0.0001 (0.0003)	0.0001 (0.0004)	0.0012 (0.0010)
popgrowth	0.0297*** (0.0106)	−0.0069 (0.0128)	0.0115 (0.0114)	−0.0449 (0.0776)
_cons		2.2752** (0.8475)		1.8317 (1.5998)
obs	289	326	291	328
groups	37	37	37	37
instruments	28	31	29	22
F statistic	.	59249.99	.	8881.57
p-value	.	0.0000	.	0.0000
Hansen test	25.19	25.77	22.96	18.50
p-value	0.154	0.216	0.291	0.101
AR (1)	−0.59	−2.10	−1.59	−0.70
p-value	0.552	0.036	0.113	0.484
AR (2)	0.12	−1.19	−0.80	−0.67
p-value	0.904	0.232	0.423	0.504

NB: (*), (**) and (***) refer to statistical significance at the 10%, 5% and 1% levels respectively.

External debt is negative and significant in both models 1 and 2, indicating that an increase in external debt is associated with a decrease in gross domestic product per capita. A percentage change in external debt is associated with a 0.0492% (model 1) and 0.0381% (model 2) decrease in economic growth in the short run at the 5% significance level, on average *ceterus paribus*. Exdebt debt has a minimally larger impact on growth in model 1 relative to model 2 as shown by the size of the coefficients. The negative association between external debt and the dependent variable may reflect potential crowding-out effects or heightened financial risk that impede growth efforts (Wang *et al*, 2021).

In line with previous studies (Ghalwash, 2014; Hamdia and Hakimib, 2020) corruption perception has a negative effect on growth per capita. However, this impact is insignificant in model 1 and significant in model 2 at the 5% level. Despite the difference in significance, the persistent negative impact on growth supports the sand the wheels hypothesis which postulates that ongoing corrupt practices within the SSA region will continue to hinder growth and development efforts unless otherwise addressed by the governing authorities.

Similar to the pooled OLS results, the interaction term *debtcorr* is positive and significant at the 5% level, suggesting that the interaction between external debt and perceived corruption has a positively moderating effect on economic growth in models 1 and 2. The interaction term

coefficients indicate that the effect of external debt on economic growth depends on the level of corruption, and vice versa. Specifically, for each additional unit of corruption, the negative effect of external debt on economic growth is reduced by 0.0112 in model 1 and 0.0086 units. Conversely, for each additional unit of external debt, the negative effect of corruption on economic growth is also reduced by 0.0112 and 0.0086 units respectively.

The positive coefficient of the interaction term suggests that the combined effect of high external debt and high corruption is less detrimental to economic growth than the sum of their individual effects. This could imply that in countries with high corruption, the negative impact of external debt on economic growth is relatively mitigated whilst in countries with large debt burdens, the eroding effects of corruption on growth are also minimised.

Given the heavy debt burden experienced by countries across the region coupled with high levels of corruption on average, this result may prove useful as it provides insight into how the two variables when interacted may eventually 'grease the wheels' of growth. Nonetheless, the coefficients of these variables suggests that the negative impact on output of the individual variables particularly perceived corruption is significantly greater than the positive effects derived from their interaction. Therefore, it is unlikely that these positive effects may be realised in reality.

The human development index and population growth are the only other significant variables in model 1 with both having a positive impact on the dependent variable. The human development index is also positive and significant in model 2 however, population growth is negative and insignificant in model 2 which may underscore the complexity of population growth dynamics and its impact on growth. Evidence that the human development index being a proxy for the level of human capital enhances growth as it increases supports the augmented Solow model which holds the position that human capital is a growth driver (Cohen and Soto, 2007). In this regard, policy makers within this model would benefit from focusing on formulating and implementing policy that is geared towards deepening their human capital capabilities as argued in literature by Ali *et al* (2018). The positive and significant labour supply proxied by population growth is in line with prior findings that contend that a large supply of labour increases productivity and in turn output particularly in labour intensive countries such as those found in the SSA region (Fukao and Makino, 2021).

The Hansen statistics test shows that the additional instruments associated with the system and difference GMM estimators in models 1 and 2 are valid and do not reject the specification

of the null hypothesis. Moreover, although the test of AR(1) is rejected in model 2, the corresponding AR(2) test in models 1 and 2 is not rejected, confirming the hypothesis that the residuals are not serially correlated in second order.

It is important to note that despite the similar findings between model 1 and 2, the findings of model 2 are preferred owing to the weaknesses of the difference GMM estimator. Arellano and Bond (1991) highlights that the difference GMM may face challenges in adequately controlling for endogeneity, especially in the presence of omitted variable bias whilst Roodman (2009) asserts that difference GMM estimates can be sensitive to the choice of instruments, potentially leading to biased results.

4.3.1 Assessing the marginal effects of corruption and external debt on growth

The marginal impact of external debt on growth in the presence of corruption is given by $\beta_2 + \beta_8\ lncpi_{it}$. In the short run, β_2 which is the external debt coefficient is equal to -0.0492 in model 1 and -0.0381 in model 2 whereas β_8 which is the coefficient of the interaction term is given by 0.0112 and 0.0086 in models 1 and 2 respectively and $lncpi_{it}$ which is the mean of corruption is 4.2048. Replacing the above values into the formula gives the marginal impact of external debt on growth to be -0.0021 and -0.0019 as shown in table 7.

Table 8. Marginal effects

	Model 1	Model 2
Marginal effect of external debt	**-0.0021**	**-0.0019**
Marginal effect of corruption	**0.1429**	**-0.0007**

This means that when corruption is considered, the impact of external debt on growth decreases by 0.0021 and 0.0019 in models 1 and 2 respectively. Given the negative and significant coefficients of external debt in models 1 and 2, the moderating effect of corruption, though minimal, reduces the overall dampening effects of external debt on gross domestic product per capita which improves growth outcomes.

On the other hand, the marginal change in economic growth as corruption levels increase, taking into account external debt, is given by $\beta_3 + \beta_8\ exdebt_{it}$. Table 7 shows that the marginal effect of corruption on growth is positive in model 1 and negative in model 2. This means in model 1, the moderating effect of external debt increases the negative impact of corruption on economic output by 0.1429 whilst in model 2, external debt has practically no moderating impact (0.0007) on the negative influence of corruption on growth. Given the marginal effect in model 1 is larger and positive, it would be prudent to identify in which

instances the impact of corruption on growth can be increased in the face external debt given both tend to exist simultaneously in most economies. By doing so, governments can put in place measures to mitigates these effects.

4.3.2 Alternative proxy control of corruption

In models 3 and 4, we analyse the same relationships we did in models 1 and 2 with the only change being the measure of corruption and consequently the interaction term. For models 3 and 4 we use the control of corruption which has been rescaled to run between 0 and 10 with 10 signifying corrupt free countries. Similar to models 1 and 2, the lagged dependent variable, exhibits a positive and significant relationship at the 1% and 10% level in models 3 and 4 respectively. In line with (Huffman and Huffman, 2021), the persistent positive and significant relationship of the lag of lngdppc across all four models suggests that the initial economic condition of these countries is important in determining their growth potential.

Like the previous 2 models, external debt has a negative and significant influence on GDP per capita growth in model 3. However, the finding in model 4 provides insight into another school of thought (Olusegun *et al*, 2021) that asserts that external debt propels growth. External debt as a driver of growth is used to finance growth stimulating activities such as infrastructure and human capital development. It is used to support the country's public expenditure in a way that trickles down over time and positively changes the growth trajectory of the economy. Given the debt levels within the sample, this result implies that the debt level in itself may not be of much consequence, rather, the manner in which the borrowed funds are used is of much greater importance in growth dynamics as outlined by the results of (Chukwu, 2023).

Control of corruption is expected to have a positive effect on growth outcomes as it speaks to the quality of the institutions within an economy. In model 3, the coefficient of control of corruption is negative and significant contrary to theoretical expectation whereas in model 4, control of corruption displays a positive and significant relationship with the dependent variable. This means, for model 4, a 1 unit increase in control of corruption in the short run leads to 0.2200 percentage increase in economic output, holding all things constant. This agrees with the findings of (Leite *et al*, 2019) who propose that when a country has a good control of corrupt practices particularly in the public sector through anti-corruption initiatives and hefty fines and sentences for corruption, public finances are less likely to be lost through streams of corrupt practices and directed towards the growth stimulating initiatives discussed above. Whilst the findings in model 3 may disagree with the expected outcomes, they do however

agree with the findings of Useche and Reyes (2020) who in their study also found evidence that weak corruption control, alternatively increased corruption, encourages growth.

Comparable to the primary measure of corruption, the interaction term (*debtcorr2*) in model 3 is positive and insignificant, suggesting that at higher levels of control of corruption, the negative effects of external debt are dampened by 0.0012 units. However, in the presence of high levels of external debt, the positive effect of control of corruption on economic growth becomes less negative thus moving the relationship between control of corruption and growth in a more positive direction. The interaction term in model 3 is the only one that is not significant across the four models.

Contrarily, the coefficient of *debtcorr2* is negative and significant in model 4 indicating that in the countries with poor governance and high corruption levels, external debt tends to boost economic growth but as control of corruption improves and corruption declines, external debt becomes a less effective growth driver. Further, the interaction term implies that good governance fosters growth in countries with low debt whilst economies with large debt burdens will likely require governance reforms to achieve positive growth outcomes. The positive and significant coefficients of external debt and control of corruption are greater than that of the interaction term ,therefore, it may be argued that the individual effects of these variables have a greater influence in boosting economic growth than their interaction has in weakening it.

The human development index and gross fixed capital formation are the only other significant variables in model 3 with both having a positive impact on economic growth. Human development index is also positive but insignificant in model 4. Like the lagged dependant variable, human capital proxied by the human development index, and physical capital proxied by gross fixed capital formation both have positive associations across all four models signifying their importance as growth drivers, despite not always being significant, as outlined by the previously discussed augmented Solow model. Debt servicing in model 4 is significant and positively associated with growth at the 10% level. This may be because it shows a country's commitment to pay off their debt which boosts investor confidence and reduces the risk associated with lending more money or investing in the economy (Yousaf and Mukhtar, 2020).

The instruments used in both models 3 and 4 are shown to be significant as evidenced by Hansen p-values of 0.291 and 0.101 respectively. Further, the AR(1) and AR(2) tests in models 3 and 4 are not rejected, confirming the hypothesis that the residuals are not serially correlated

in both first order and second order thus confirming the validity of the results. Lastly, the number of instruments across all for models is less than the number of groups which is key requirement for the GMM estimator.

4.3.3 Positive threshold of external debt and corruption

Across the four models, we calculated the threshold above which the effect of the external debt and corruption starts to be positive. In model 1, the results show that the impact of corruption (measured as the natural logarithm of CPI) on GDP growth is positive when external debt is higher than the threshold of 33.95 (-0.3802 + 0.0112 *exdebt*) and the impact of external debt on output is positive when perceived corruption is higher than the threshold of 4.39 (-0.0492 + 0.0112 *lncpi*). As shown in Table 8, the threshold for external debt is lower than the average value of external debt (46.70438) over the whole sample whilst that of corruption (4.2048) is higher, suggesting that external debt, though having a negative association is likely to boost GDP growth for most of the countries in the sample and corruption is likely to decrease growth as per *a priori* expectations.

This means countries whose corruption perception (*lncpi*) threshold falls below the threshold need to improve their controls of corruption to benefit from the economic growth externalities of external debt. This finding is in line with the study by Alfada (2019) in which a certain degree of corruption may promote economic growth.

In model 2, the results of the threshold effects align with those of model 1. However, it should be noted that the external debt threshold (46.63) is not much lower than the average level of external debt therefore, in this model, external debt is likely to boost growth in relatively fewer countries than in model 1.

Table 9. Threshold for positive impact on growth

	External debt threshold	Corruption threshold
Model 1	**33.95** $(-0.3802 + 0.0112\ exdebt)$	**4.39** $(-0.0492 + 0.0112\ lncpi)$
Model 2	**46.63** $(-0.4010 + 0.0086\ exdebt)$	**4.43** $(-0.0381 + 0.0086\ lncpi)$
Model 3	**57.33** $(-0.0688 + 0.0012\ exdebt)$	**5.00** $(-0.0060 + 0.0012\ cic)$
Model 4	**70.97** $(0.2200 - 0.0031\ exdebt)$	**2.97** $(0.0092 - 0.0031\ cic)$

In models 3 and 4, the results show that the impact of control of corruption (*cic*) on GDP growth is positive when the level of external debt is higher than the thresholds of 57.33 and 70.97 respectively and the impact of external debt on output is positive when control of corruption is higher than the threshold of 5.00 and 2.97 respectively.

We note that in both models 3 and 4, the external debt thresholds are much higher than the average value of external debt (46.70438) whilst those of corruption (4.2048) are higher in model 3 and lower in model 4. In the instances where the thresholds are higher than the average values, it is unlikely that many countries in the sample are unlikely to experience the positive effects of external debt and control of corruption on growth.

4.3.4 Crowding out or Crowding in?

We note from tables 5 to 7 that investment proxied by gross fixed capital formation has a persistently positive relationship with economic growth with the exception of model 4 in table 6. From the discussion in chapter 2, literature suggests that external debt can either reduce investment in the country (crowd out) or encourage investment (crowd in) which will in turn affect the growth outcomes of the country.

Using the fixed effects estimation technique, this section investigates how external debt and debt service affect economic growth through investment. The theoretic premise suggests that as debt stock increases, investment subsequently decrease, leading to a contraction in economic growth and vice-versa.

The results in table 10 reveal a robust positive relationship between GDP per capita and investment, with the coefficient for GDP per capita being highly significant at the 1% level. This indicates that higher income levels are associated with greater investment. In wealthier economies, higher income levels provide the financial resources necessary for increased investment in physical capital, such as infrastructure and machinery. This is consistent with the neoclassical growth theory, which emphasizes that richer economies are better able to finance investment in capital, either through higher domestic savings or by attracting more foreign investment (Solow, 1956).

External debt also plays a significant role in influencing investment, with the coefficient for external debt being positive and statistically significant at the 5% level. This suggests that external borrowing can, at least up to a point, help encourage investment by providing financing for capital formation. In line with the views of Easterly (2001) and Panizza (2008), this finding supports the notion that external debt can be a useful tool for funding investment, particularly in developing countries where domestic savings might be insufficient. Borrowing allows countries to finance long-term development projects that can potentially boost economic growth.

However, the relationship between external debt and investment is not linear. The coefficient on external debt squared is negative and significant at the 10% level, indicating that while external debt may initially promote investment, its effect diminishes and eventually reverses as debt levels rise. This non-linear relationship highlights the potential dangers of excessive debt accumulation. Once debt levels become unsustainable, they may crowd out productive investment due to the increased burden of debt servicing, leading to a "debt overhang" that deters new investments (Krugman, 1988). As Sachs (1989) notes, while moderate levels of debt can help stimulate growth, excessive debt can lead to financial instability and discourage future investment.

Perceived corruption has a negative and statistically significant coefficient which implies that at higher levels of perceived corruption are strongly associated with lower levels of investment. This finding is consistent with Mauro (1995) and Tanzi and Davoodi (1997), who argue that corruption creates an uncertain and inefficient macro which is detrimental to investment and economic growth.

Interestingly, the coefficient for FDI inflows is negative and highly significant, which may contrary to theoretical expectations that foreign direct investment fosters growth. This negative relationship could indicate that FDI inflows are crowding out domestic investment in some instances. In particular, foreign investors may dominate certain sectors, leaving little room for local businesses to invest. This result is supported by Alfaro *et al* (2004), who suggest that the impact of FDI on domestic investment depends on the “absorptive capacity of the economy and the extent to which FDI contributes to broader economic linkages”. In some cases, FDI may fail to generate significant benefits for local industries and could even crowd out domestic investment.

Trade openness, on the other hand, is positively correlated with investment, with a statistically significant coefficient. Open economies, which have access to broader markets, technologies, and capital, tend to have higher levels of investment. This agrees with the findings of Barro (1991) and Sachs and Warner (1995) who propose that open economies tend to grow faster because they can attract more investment and adopt more advanced technologies, which enhances their capital formation.

In contrast, the results for debt service and inflation are not significant, suggesting that these factors may not have a direct impact on investment in this particular sample. Debt service, despite having a negative coefficient, is not statistically significant, possibly because the

burden of servicing debt may not be a significant constraint on investment in countries with low levels of debt or longer-term debt structures. Similarly, inflation, although often associated with uncertainty and higher costs of investment, does not appear to significantly affect investment in this context, which may reflect relatively stable inflation rates in the sample period.

Table 10. Effect of External Debt on Investment

gfcf	Fixed Effects
lngdppc	20.1840^{***}
	(4.5960)
exdebt	0.0951^{**}
	(0.0468)
exdebtsq	-0.0002^{*}
	(0.0001)
lncpi	-18.1363^{**}
	(8.8527)
fdiinflows	-0.2401^{***}
	(0.0723)
tradeopen	0.1469^{***}
	(0.0384)
dbtser	−0.0690
	(0.1321)
inf	−0.0420
	(0264)
_cons	4.650
	(53.3783)
F (8, 281)	9.60
p-value	0.0000
obs	326
groups	37

Taken together, the findings suggest that investment is primarily driven by factors such as income levels, external debt (up to a point), trade openness, and the business environment i.e. corruption levels. However, excessive external debt and the presence of corruption can significantly undermine investment, pointing to the importance of managing these variables carefully to promote sustainable capital formation. The non-linear effect of external debt underscores the importance of maintaining debt at sustainable levels to avoid the negative consequences associated with high debt burdens.

Further, the coefficients of the external debt and its square variable mirror the relationship proposed by the Laffer curve in which increases to debt are marginally beneficial to growth up to the optimal debt level after which increases in debt levels result in diminishing returns to growth.

To calculate the optimal debt level, consider the following:

If, $gfcf_t = \propto_0 + \propto_1 exdebt_t + \propto_2 exdebt_t^2 + \propto_3 \text{lncpi} + \ldots\ldots +$

Then, $\frac{\delta gfcf_t}{\delta exdetb_t} = \propto_1 + 2 \propto_2 exdebt_t = 0$

$\therefore exdebt_t^* = \frac{-\propto_1}{2\propto_2}$

since $\propto_2 < 0$, then $exdebt_t^* > 0$ where $exdebt_t^*$ is the optimal debt level.

It then follows that the optimal debt level can be calculated using the coefficients of external debt and its respective square as given in table 10. The result of said calculation indicates that the optimal debt level is 237.75% as given by [-0.0952/(2(-0.0002)]. From table 1, the average level of external debt across the sample countries is 46.70% whilst the maximum level is 429.74%.

This would suggest that there is room for policy makers to further exploit external debt as a finance tool as the average debt level is nearly 200% less than optimal. Nevertheless, the hesitation to uptake any further debt can be owed to the fear of losing sovereignty over economic decision-making (Moyo, 2009) or the increasing risk of debt distress (World bank, 2020) which can be detrimental to growth objectives and subsequent outcomes.

CHAPTER 5: CONCLUSIONS

This chapter deliberates the research findings of the study as applied to the Sub-Saharan Africancontext and presents an overview of the study as a conclusion to the research. The study was arranged in five chapters, starting with the introduction, followed by the literature review, then a discussion of the methodology and date before proceeding to a discussion of the research findings and an undertaking of the data analysis and the subsequent conclusion in chapter 5.

As the SSA region has been contracting more external debt, particularly Chinese debt, and has struggled with sprawling corruption, this study aimed to investigate the relationship between external debt stock, corruption, and economic growth. The research objective was to determine the direct impact of corruption and external debt on growth between 2012 and 2021 as well as investigate whether the interaction between the two variables worsened or improved the growth outlook as they often exist concurrently within the economies of the sample countries.

The research reviewed various exogenous and endogenous growth theories to understand what drives growth in different contexts. Theoretical and empirical literature on the debt growth nexus focussing on the debt overhang hypothesis and the dual gap theory were

considered in addition to the sand the wheels and grease the wheels hypothesis in respect of the corruption and growth relationship. In chapter 3, the research methodology was specified, the data was explained and preliminary tests in the way of summary statistics, correlation tests and the units root tests were carried out. It was determined that the system GMM would be preferred given the short time frame of 10 years and possible endogeneity problems that may arise. The pooled OLS, fixed effects, random effects and difference GMM were selected as comparison estimation techniques for robustness purposes. The results were then presented and analysed in chapter four based on regressions performed by the author. For section 5.1, the paper will focus only on the benchmark results of the system and difference GMM estimators.

5.1 Summary of Findings and Policy Recommendations

This study provides insights into the complex relationship between external debt, corruption, the interaction between external debt and corruption and economic growth across thirty-seven (37) member states of the Sub-Saharan African region. Besides the three variables of interest, the other explanatory and control variables considered include the lagged dependent variable, debt servicing, human development index, gross fixed capital formation, population growth and inflation. In addition to the explanatory variables, year dummies were also used as instruments when implementing the GMM estimator. The study used yearly data for all the countries involved in the period 2012 to 2021 and employed the system and difference GMM techniques to estimate the short run relationships.

The Pearson correlation test was conducted, and the results found evidence of significant relationships between gross domestic product per capita and debt servicing, corruption, control of corruption, population growth, the human development index and the secondary interaction term (*debtcorr2*). The findings of the Fisher Augmented Dickey Fuller unit roots tests indicate that all the variables are stationery at level terms whilst those of the Phillips Perron unit root tests determined that inflation and human development index are stationery in level terms and the remaining variables are stationery at first differences.

Across all four models, l.lngdppc is found to have a positive and significant relationship with growth suggesting evidence of conditional convergence in which each country is converging toward its own steady-state level (Bonnefond, 2014). The persistence of the lagged dependant variable underscores the importance of historical economic conditions in shaping the ongoing trajectory of economic development. It suggests that the past level of economic

development in these SSA countries continues to positively influence and contribute to the current economic growth.

With the exception of model 4, external debt is found to agree with the relationship proposed by the debt overhang where increases in debt are damaging to growth. These findings reveal the importance of SSA countries to have proper debt management strategies in place to ensure their debt burdens do not grow beyond an unsustainable level where it continues to negatively affect growth. Model 4 renders support to the dual gap theory in which debt is beneficial to growth in that it provides supplementary financing where there is a savings deficit as often seen in developing countries found in the SSA region. This points to the need to ensure that debt is used for the purposes it is contracted for and that it is not misused for corrupt practices and personal gain. Further, for models 1 and 2, an external debt threshold of 33.95 and 46.63 respectively was discovered to fall below the average external debt of 46.70 signalling that most countries within the sample would experience growth effects from their external debt stocks. However, given how close the threshold is to the mean in model 2, it highlights the need for debt contraction in the sample countries as the majority are at risk of falling above the mean and facing negative consequences to their growth outlook.

Section 1.1 highlighted a few examples of corruption that have robbed the economies of some countries within the region. In the short run, corruption is seen to have a negative effect but not always significant impact on economic output thus supporting the sand the wheels hypothesis with the exception of model 3 where control of corruption has a negative association with the dependent variable therefore confirming the grease the wheels hypothesis. Given the persistent negative association and the minimum of 35 and maximum of 89, it may be prudent to address the causes of corruption to enable them to be rooted out lest they continue disrupting growth effects within the region. Anti-corruption efforts need to be at the forefront of these countries' agenda and the consequences for those found practicing corruption need to be stringent in order to deter others would from delving into these practices.

Human capital proxied by human development has been revealed to be a strong predictor of future growth in the sample SSA countries. As such, these countries must ensure that they deliberately increase their human capital capabilities through increased accessed to quality education, better health care systems and improved living conditions. This will increase their human development index which in turns boosts economic growth. Though insignificant in all

but one model, they would benefit from developing their gross fixed capital formation to provide a larger base for further gross domestic product per capita growth.

5.2 Recommendations for further study

This paper is subject to limitations related to the quality and accessibility of data. Some variables rely on information gathered from diverse sources, introducing the possibility of inconsistencies in data collection and recording methods. Future studies may include the real interest rate as a control variable given its influence over external debt. For this study, the real interest rate had many missing observations across the cross sectional units and was therefore dropped to improve the quality of the results.

Additionally, future studies may look at the results in segmented ways to draw out more from them such as across the South, East, West and Central regions within SSA or divide the countries into resource rich and non-resource rich countries. An investigation into the nonlinear effects of external debt, corruption and their interaction on growth could be carried out with more system GMM iterations to make for better and broader comparisons.

Further, as highlighted in section 3.1, growth dynamics are better observed over a long time period. As the system GMM works best with shorter time periods, it might fail to adequately capture the dynamic relationships between variables that lead to growth future periods this understating these relationships in short panels. Subsequent research can be carried out using a combination of the System GMM and other methods such as the distributed lag models or longer panel data to better capture these long-term, lagged effects on growth.

Lastly, using interaction terms between continuous variables such as external debt and perceived corruption in multiple regression can lead to new insights into how variables jointly affect the dependent variable. However, this approach also presents challenges, including issues with multicollinearity, interpretation complexity, statistical power, and model overfitting. Jaccard, Wan, and Turrisi (1990) provided essential recommendations, such as centering the variables and interpreting marginal effects, to address some of these challenges. Other research, such as Aiken and West (1991) offer standardization of variables as a useful strategy for handling these complications. By carefully addressing these issues, future studies can make more insightful and interpretable conclusions from models that include interaction terms between continuous variables.

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