External debt's impact on capital formation in lower-middle-income countries in Africa: ARDL approach

تأثير الدين الخارجي على تكوين رأس المال في البلدان ذات الشريحة الدنيا من الدخل المتوسط في إفريقيا: باستخدام تقنيات نموذج الانحدار الذاتي للإبطاء

Sherine Boshra Ghaly
Lecturer of Economics - Sadat Academy for Management Sciences
Sherine.toma@sadatacademy.edu.eg

Abstract:

In most African nations, capital is among the most significant impediments to long-term growth, necessitating a constant level of capital formation, the preponderance of which is financed by government debt. Emerging economies have utilized external debt to encourage domestic investment, however, several of the world's most indebted emerging economies failed to direct these debts to capital formation.

As a result, while excessive debt is criticized for stifling economic growth, the majority of emerging nations cannot thrive without borrowing. As a consequence, this study intends to explore the external debt's impact in the short and long-term on capital formation in Africa's lower-middle-income countries from 2000 to 2020 as no studies have been identified to quantify this impact on such nations.

The "dynamic fixed effect DFE and pooled mean group PMG ARDL" techniques are used. The presence of a statistically significant and negative error correction term indicates the presence of a long-run connection. In this study, the PMG estimator is shown to be more effective and consistent. The results show in general that external debts

have an insignificant negative impact on capital formation both in the short and long-term except for Egypt and Benin, which have a short-term positive impact on capital formation.

Keywords: External debt, Capital formation, Lower-middle-income, Pooled mean group ARDL.

المستخلص:

يعد رأس المال في معظم الدول الأفريقية أحد أهم العوائق أمام النمو طويل الأجل، مما يستلزم مستوى ثابتًا من تكوين رأس المال والذي يتم تمويل الجزء الاكبر منه من خلال الديون الحكومية. استخدمت الاقتصادات الناشئة الدين الخارجي لتشجيع الاستثمار المحلي، ومع ذلك، فشلت العديد من الاقتصادات الناشئة الأكثر مديونية في العالم في توجيه هذه الديون إلى تكوين رأس المال. نتيجة لذلك، في حين يتم انتقاد الديون المفرطة لخنق النمو الاقتصادي، فإن غالبية الدول الناشئة لا يمكنها الازدهار دون الاقتراض. لذلك تحاول هذه الدراسة استكشاف الآثار القصيرة والطويلة المدى للديون الخارجية على تكوين رأس المال في "البلدان ذات الشريحة الدنيا من الدخل المتوسط" في إفريقيا من عام 2000 حتى عام 2020 حيث لم يتم تحديد أي دراسات لتحديد هذا التأثير على هذه الدول. تم استخدام تقنيات نموذج الانحدار الذاتي للإبطاء الموزع للتأثير الثابت الديناميكي (DFE) والمجموعة المتوسطة المجمعة (PMG). تم إثبات وجود اتصال طويل المدى من خلال وجود مصطلح تصحيح خطأ سالب وذو دلالة إحصائية. في هذه الدراسة تبين أن مقدر PMG أكثر فعالية واتساقًا. تظهر النتائج بشكل عام أن الديون الخارجية لها تأثير غير معنوي سلبي على تكوين رأس المال على المدى القصير والطويل باستثناء مصر وبنين ، والتي لها تأثير إيجابي معنوي قصير الأجل على تكوين رأس المال.

الكلمات المفتاحية: الدين الخارجي، تكوين رأس المال، الشريحة الدنيا من الدخل المتوسط، المجموعة المتوسطة المجمعة، نموذج الانحدار الذاتي للإبطاء الموزع.

Introduction:

Building sustainable economic growth in Africa is one of the most pressing development concerns (Anyanwu, 2014). In most African countries, capital is one of the most significant hurdles to economic progression. The long-term growth of any country requires a sustained level of capital formation which is "the sum of expenditures on additions to the economy's fixed assets plus net changes in the stock of inventories" (World Bank Metadata Glossary). Despite the apparent benefits of public investment, most of the funding comes from government debts (Fonchamnyo, Dinga & Ngum, 2021). For that reason, external debt, which refers to "financial obligation owing to foreign lenders and is frequently issued in a currency other than the debtor nation" (World Bank Metadata Glossary), has long been seen as a necessary precondition for a successful debt-growth process. With external debt, emerging economies financed successful initiatives and enhanced domestic investment. As a result, the borrowing country's total growth rate accelerated. Several deeply indebted developing nations were unable to satisfy debt repayment by 1982 (Erbe,1984). Therefore, the majority of emerging economies cannot thrive without borrowing, although, if a country is not employed its external debt for productive purposes, its capacity to meet its obligations is severely hampered and lead to excessive debt that is commonly cited as a hindrance to long-term economic growth and poverty elimination (Imbs & Rancière, 2005; Siddique, Selvanathan & Selvanathan, 2016). The rapidly increasing number of nations experiencing payment problems has frequently led to the conclusion that increases in foreign debt have not been matched by increases in a suitably productive capital stock (Erbe,1984). The burden of low- and middle-income nations' external debt increased by 5.6% on average to $8.7 trillion in 2020. Foreign debt

increase in most nations has not been matched by growth in GDP and exports (World Bank, 2022).

The proportion of debt-financed government expenditure available varies significantly and is largely influenced by the investment strategy employed. Even when all potential productivity-boosting spending is considered, consumption remains to represent a significant percentage of external debt. Furthermore, there are reasons to be concerned about the long-term economic consequences of capital inflows into nations that have depended substantially on net borrowed capital to increase capital output (Erbe,1984). This considerable shift in developing-country perceptions of the relevance of external debt poses an essential inquiry: what is the impact of foreign borrowing on emerging economies' capital formation? (Fonchamnyo et al., 2021). Predominantly in the "lower-middle-income countries", as no studies have been identified to quantify this impact on such nations although middle-income nations are a place of residence for 75% of the worldwide's population and 62% of the destitute, and their GDP per capita is ranging from $1000 to $4000 (World Bank, 2021). As a corollary, the middle-income country is quite prominent.

Consequently, this study uses "the dynamic fixed effect and pooled mean group panel autoregressive distributive lags (ARDL) technique" to inspect the influence of external borrowing on capital formation in lower-middle-income in Africa. The remainder of the study is arranged in the following manner: section 2 focuses on the theoretical review, whereas section 3 focuses on the literature review. Section 4 focuses on external debts and capital formation in middle-income countries in Africa. Section 5 is divided into three sections: data and techniques, empirical results discussion, and conclusion.

Theoretical background:

Economic development may be achieved through increasing investment (Ukessays, 2018). As a result, theories scrutinized, such as the Harrod-Domar post-Keynesian growth model, which was the first to analyze the level of investment needed to ensure perpetual full employment and continuous income growth. Two complaints levelled at the early model were a lack of workforce difficulties and the premise of constant productivity. Despite its shortcomings, this was the first model to stress the need of investing in both demand and supply (Hochstein, 2020). According to the Solow model, increasing capital investment continuously raises the growth rate only temporarily as the capital-labor ratio rises. The economy returns to a long-term growth path when the marginal product of additional units of capital decreases. When production, capital, and labor expand at the same rate but output per worker and capital per worker remains constant, the economy is on a steady-state growth path. According to neoclassical economists, raising the trend rate of growth entails expanding labor supply as well as boosting labor and capital productivity (Erickson & Dalgaard, 2007). On the other hand, a popular accelerator concept evolved succeeding Keynes. Accelerator theories state that acquiring fixed assets is a process of reacting to certain capital stock. Investment decisions will alter as manufacturing demand predictions evolve. Therefore, accelerator models presuppose that increased production will result in more investment. Early, overly straightforward accelerator models assumed that enterprises could quickly modify their capital positions, that expectations would not change, and that there would be no delays. Lag structures were added to subsequent rounds of adaptable accelerating theory to account for lags in investment appraisal. because these assumptions are problematic in practice (Baddeley, 2003). In their analysis, they prioritize internal sources of investment over external

sources of investment (Fonchamnyo, Dinga & Ngum, 2021). Post-Keynesians believe that fiscal policy should be governed by the concept of effective demand, with governments running deficits or surpluses to achieve full employment. Because persistent deficits under the Kaleckian model imply constantly rising investment spending levels, private expenditure is overburdened rather than driven out by government spending. Hyman Minsky added a capital element to this reasoning, arguing that government debt accumulated as a result of previous deficits improves private sector balance sheets (King, 2008). As per the dual gap hypothesis, external debt is preferred over domestic borrowing in allowing long-term growth. Investment, according to the notion, is a consequence of insufficient domestic savings in underdeveloped countries to sustain crucial economic growth investment. As a result, requiring the use of additional outside goods and services makes sense. In contrast, the acquisition of external capital is based on the interaction between local savings and foreign capital, investment, and economic progress. The first criterion for borrowing is whether or not the return on investment exceeds the borrowing cost (Adegbite, Ayadi, & Ayadi, 2008).

From another perspective, due to a lack of domestic capital, emerging economies frequently go to foreign sources to cover the shortfall when local sources of investable capital are insufficient (Panizza, 2008). The debts theories explored the economic consequences of government debt such as Classical economists. However, these theories have received slight courtesy. Classical economists such as Smith, Ricardo, and Mill have similar views. According to Smith, governments should avoid running budget deficits, even if domestic investors own the whole debt. Since debt repayment would eventually lead to higher taxes, capital flight, and currency depreciation, all of which would affect the remaining domestic production. Debt stifles economic progress by

diverting funds to ineffective projects. Budget deficits are only tolerable during times of crisis; therefore, a system for financing government expenditure is necessary for capital accumulation. Household spending and, to a smaller extent, household savings are reduced by taxation. Consequently, taxes have different effects than public borrowing, which greatly impacts savings. As a result, public borrowing creates an equal amount of private investment. Hence, classical economists agree that saving and investment equilibration occurs spontaneously and without interference, unlike interest rates in neoclassical economics or income via the multiplier in Keynesian economics. As a result, taxes discourage new investment and therefore capital accumulation while maintaining current productive capacity; yet, public borrowing hurts existing productive capacity by shifting resources from productive to unproductive and inefficient purposes (Tsoulfidis, 2007). Ricardo's aversion to government borrowing and the detrimental influence of debt service on the allocation of resources efficacy was demonstrated. Ricardo was concerned that servicing debt would endanger potential capital formation. Furthermore, there is an aversion to borrowing, as well as concerns about the detrimental effect of taxes on investment. (Churchman, 2001). Mill contends that public debt may not have deleterious implications if it is sustained by foreign savings or produces savings that would otherwise not have been taken. Therefore, according to this approach, borrowing to pay government expenditure is harmful to the economy and its potential to generate development, Government borrowing hinders the economy's ability to accumulate since government expenditure is frequently unproductive. When these expenditures cannot be avoided, the preferred means of supporting them is through taxes (Tsoulfidis, 2007). According to the Keynesian school of thinking, such as Abba Lerner and Alvin Hansen, deficit spending and government debt accumulation may enhance or sustain

economic activity and attain full employment without saddling current or future generations. When governmental obligations become exorbitant or unpayable, they entail implicit default, which is carried out by the official and purposeful depreciation of the national currency. According to the Classical school of political-economic thought, which includes James Stewart and Alexander Hamilton, public debt should only be used to finance services and initiatives that help a market economy reach its full potential, and that examination should be done on a particular circumstance basis. They contend that, contrary to what classical economists think, public leverage is neither inherently destructive nor boundless, as Keynesians believe (Salsman, 2012). According to some theoretical models, proper current debt inflows will improve GDP. In typical neoclassical models, consenting for the country's borrowing capacity enhances provisional growth. Countries, where capital is scarce, have an inducement to borrow and spend because the capital's marginal benefit surpasses the rate of interest. Some endogenous growth models provide equivalent results (Pattillo, Poirson, & Ricci, 2002).

Empirical Evidence:

The inquiry of whether foreign debt enhances capital formation is not novel. It was a challenging topic in the 1960s, with a concentration on the common capital requirement models (Erbe,1984). Many academicians felt that external debts had little impact on economic development since the vast bulk of foreign resource inflows were consumed rather than invested (Erbe,1984). Krugman (1988) refers to "the negative relationship between external debt and investment as a debt overhang". Debt distorts the government's incentives since the

gains of effective performance accrue disproportionately to lenders rather than the country.

On the country's level, using the Vector Error Correction Model (VECM), Kassu, et al., (2014) investigated the relationships between capital formation and Ethiopia's public external debt. Explanatory variables used in the study were the consumer price index, export-import, the percentage of investment to GDP, the percentage of saving to GDP, and gross domestic product. According to the study, external debt has a favorable and significant long-run influence on capital development but has a negative short-term effect. Abdullahi et al. (2016) investigated the external debt on the Nigerian economy and capital formation between 1980 and 2013 using the "Autoregressive Distributed Lag (ARDL)" technique. "Capital formation, external debt service, external debt stock, national savings, and interest rate" were the variables utilized. Even though saving was the sole one, among the variables studied, exhibiting a bidirectional causality relationship, external debt was shown to have a negative and statistically significant impact on capital formation. The transmission channel of savings and capital formation was used by Ndemange (2018) to study the impact of foreign debt service on Kenyan GDP from 1980 to 2014 and conclude that debt servicing lowers GDP by limiting capital investment. Yousaf & Mukhtar (2020) examined the relationship between external debt and capital accumulation in Pakistan between 1972 to 2016 using the "ARDL bound testing approach". Explanatory variables were GDP growth rate, external debt to total government income ratio, consumer price index, and human capital measured by "gross secondary school enrolment". The findings support the debt overhang concept by demonstrating a negative association between Pakistan's external debt and capital stock.

Using panel approaches, Clements, Bhattacharya & Nguyen, (2003) conclude that in "low-income countries" external debt stock does not affect public investment contrary to debt payment, with the crowding-out effect growing as the debt service-to-GDP ratio rises. Explanatory factors included foreign aid as a percentage of GDP, urbanization, total debt service as a percentage of GDP, real per capita income, exports plus imports as a percentage of GDP, and external debt stock. Government expenditure decreases by 0.2 percentage points for every 1 percentage points increase in debt service as a proportion of GDP. This suggests that reducing debt service by 6% would raise investment by 0.75 percentage points of GDP, enhancing growth by around 0.2 percentage points Pattillo, Poirson & Ricci (2004) conducted a study in 61 developing countries between 1969 and 1998 and concluded that high levels of debt have a deleterious effect on both capital accumulation and investment. In high-debt nations, doubling debt slows output growth by around 1% while only minimally lowering per-capita physical capital and total factor productivity growth. Kocha, Iwedi, and Sarakiri (2021) used the pooled mean group technique to investigate the impact of debt on capital creation in Sub-Saharan Africa starting in 2000 to 2008. "External debt stock, external debt service, and external debt interest payment" are among the debt variables underlined. They reveal that increasing the stock of foreign debt has a limited effect on capital formation in the short term but has a significant negative impact in the long run. From 1990 to 2017, Fonchamnyo et al., (2021) used the "PMG ARDL approach" to inspect the influence of foreign debt on domestic investment in Sub-Saharan Africa. according to the study, foreign debt has an insignificant detrimental impact in short term, and in the long term, foreign debt appears to be infolding out local investment.

As abovementioned, the impacts of external debt on capital formation have received considerable attention in general in the literature, with several contradictory findings (Fonchamnyo et al., 2021). Nonetheless, no study has been uncovered so far to examine this effect in lower-middle-income countries in Africa. Previous studies focused on specific regions or low-income countries but this study focuses on lower-middle-income level nations. To address this challenge and fill a gap in the literature, the current study examines an extended yearly series of 18 African lower-middle-income countries from 2000 to 2020 using the panel ARDL technique.

External debts and capital formation in middle-income countries in Africa:

Africa's public debt has expanded, and the issue of debt in emerging countries has become increasingly more pressing (Kocha, et al., 2021). As levels of debt in middle-income nations have reached unprecedented levels in contemporary history (Estevao, 2022). Global debt soared by 28% of GDP in 2020, owing mostly to increased government spending in response to the COVID-19 outbreak and revenue loss due to the recession. Government borrowing contributed to considerably more than half of the worldwide public debt ratio growth, which currently stands at 99% of GDP (IMF, 2022). Increasing debt obligations may stifle investment and undermine growth. As the quantity of government debt grows, the cost of capital rises, affecting investment, reducing medium and long-term productivity and income development, and constraining productivity and output growth (IMF, 2022).

As demonstrated by Figure (1), total foreign debt stocks grew in most African middle-income countries beginning in 2017 and climbed further in 2020 as a consequence of the Covid-19 epidemic. In 2020, Egypt has the highest total foreign debt stocks, followed by Angola and

Nigeria, with Mauritania having the lowest. Algeria is the only county that decreased its external debt stock from 2000 to 2020 by 80%, contrary, Angola has the highest increasing percentage in the same period by 589% followed by Kenya with 521% and the lowest percentage was Congo with 12%.

Figure (1): Total external debt stocks in Africa's middle-income countries from 2000 to 2020
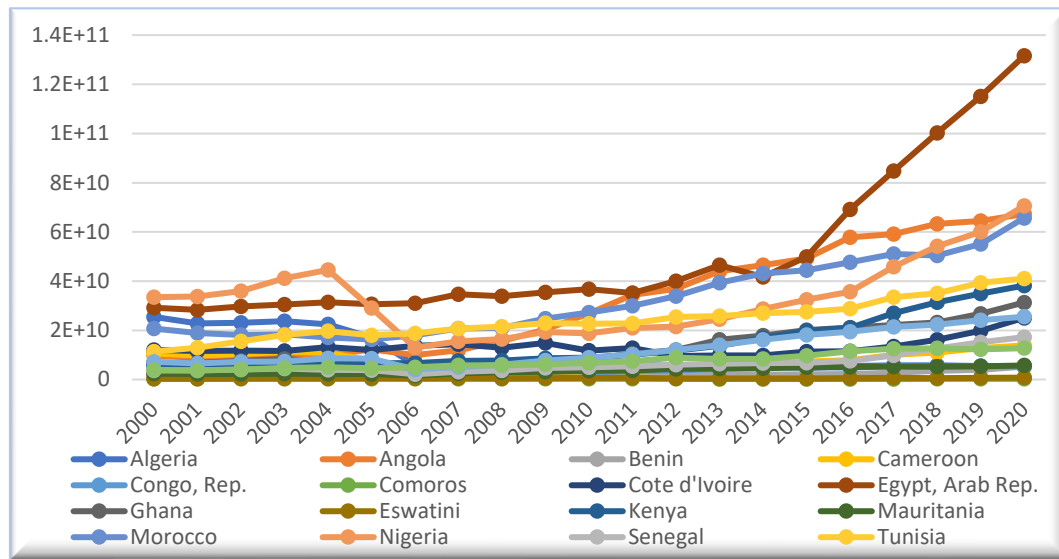
Source of Data: World Bank Database

On the other hand, as shown in figure (2) "gross capital formation as a percentage of GDP" has changed slightly in the middle lower-income countries in the graph from 2000 to 2020 except for the Congo, whose gross capital formation surged from 22% in 2000 to 61% in 2007 and 79% in 2015 before falling to 26% in 2020. Algeria has nearly doubled this percentage from 23% in 2000 to 48% in 2020. The percentage in Angola has declined from 30% in 2000 to 16% in 2022. From just under 16% in 2000 to 25% in 2022, the rate increased in Benin. Comoros's status has somewhat worsened. Cote d'Ivoire's increased from 14% in

2000 to 22% in 2022. In Egypt, the proportion was 19% in 2000, rose to 22% in 2008, and then began to decrease once again until it reached 13% in 2020.

Figure (2): Gross capital formation percentage of GDP in Africa's middle-income countries from 2000 to 2020
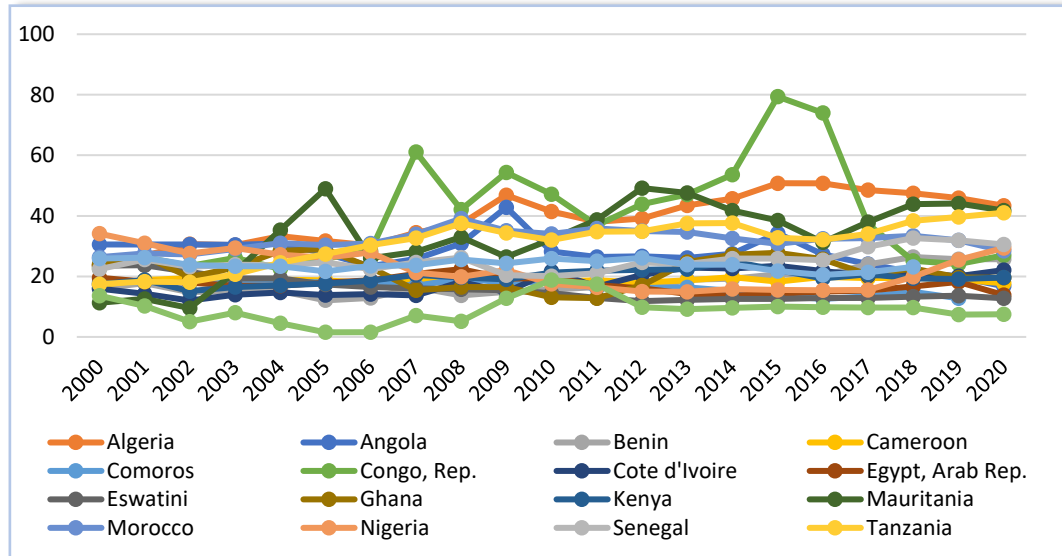
Source of Data: World Bank Database

Eswatini had a decrease in the proportion from 23% in 2000 to 12% in 2022. The percentage of Mauritania rose from 11% in 2000 to 4 % in 2020. Morocco saw a rise from 26% in 2000 to 39% in 2008 before falling to 28% in 2020. In Tanzania, the percentage increased from 17% in 2000 to 41% in 2020. The percentage has barely changed in Zimbabwe, Ghana, Kenya, Senegal, and Tunisia.

Data and methodology:

This empirical study intends to scrutinize the short- and long-run effects of external debt on capital formation in 18 African developing nations, including "Algeria, Angola, Benin, Cameroon, Comoros, Congo, Cote d'Ivoire, Egypt, Eswatini, Ghana, Kenya, Mauritania, Morocco, Nigeria, Senegal, Tanzania, Tunisia, and Zimbabwe". The selection of nations is mostly influenced by Africa's lower-middle-income countries. This categorization paints an inclusive view of the direct impact of foreign debt on capital formation in each country. Furthermore, it provides governments with more specific information on the influence of each flow on capital formation, to execute appropriate economic policies. The study runs from 2000 to 2020. The period of the study and countries were elected due to data obtainability of the World Bank categorization of African lower-middle-income countries. "The World Bank's World Development Indicators" were used to collect all of the data. The variables utilized shown in table (1) include "capital formation as the dependent variable, foreign direct investment, External debt, gross domestic product, gross domestic savings, and trade openness as explanatory variables".

Table (1): Variables description

Variable name	Description	Abbreviation
Capital formation	"Gross capital formation (% of GDP)"	GCF
Foreign direct investment	"Foreign direct investment, net inflows (% of GDP)"	FDI
External debt	"External debt stocks (% of GNI)"	EXD
Gross domestic product	"GDP per capita growth (annual %)"	GDPPC
Gross domestic savings	"Gross domestic savings (% of GDP)"	GDS
Trade openness	"Trade (% of GDP)"	TRA

In this study we will concentrate on the debt overhang effect on capital formation therefore we used the external debt stocks to measure this effect in the subsequent model:

$$GCF = \beta_0 + \beta_1 \, FDI + \beta_2 \, EXD + \beta_3 \, GDPPC + \beta_4 \, GDS + \beta_5 \, TRA$$

The Model:

Using a panel dataset with times t = 1, 2, 3,..., T, and country groups I = 1, 2, 3,..., N, the subsequent panel ARDL model is estimated:

$$GCF_{it} = \sum_{J=1}^{P} \lambda_{ij} \, GCF_{it-j} + \sum_{J=0}^{q} \delta_{ij} \, X_{it-j} + \mu_i + \varepsilon_{it}$$

The error corrections equation is as follows:

$$\Delta GCF_{it} = \varphi_i \, (GCF_{it-1} - \theta_i X_{it-1}) + \Delta \sum_{J=1}^{p-1} \lambda'_{ij} \Delta \, GCF_{it-1}$$

$$+ \sum_{J=0}^{q-1} \delta'_{ij} \, \Delta X_{it-j} + \mu_i + \varepsilon_{it}$$

Where X_{it} represents the regressor group vectors I; μ_i represents the fixed effect, φ_i is the long-run dynamics adjustment coefficient, δ_{ij} represents the coefficient vector and λ_{ij} represents the coefficient of the dependent variable lag. This equation will be estimated using two methods: the PMG developed and the DFE estimator.

The long-run connection can be isolated from the short-run dynamics because the ARDL model is simple in error-correction form. When the variables are nonstationary of order 1, the long-run link in an error-correcting model corresponds to a cointegrating connection (Kripfganz

& Schneider, 2022). "The error correction term" is applied to all groups of nations if the explanatory factors and the dependent variable cointegrate. Cointegrations of the dependent variable and explanatory variables are based on responses to long-term equilibrium deviations. This feature of the dependent and explanatory variables implies that the deviation from equilibrium affects the error correction model, which portrays the short-term dynamics of the system's dependent and explanatory variables (Teng, Khan, Khan, Chishti, & Khan, 2021).

Pesaran, et al., (1999) developed the "pooled mean group estimator", a novel adaptive estimating approach that effectively connects average and pool features with long-term panel data. Although the PMG approach permits short-run coefficients to be altered and estimated individually; which enables country regression results to be assessed; their distributions across groups are summarized using group averages, while long-run regressor coefficients stay constant across nations and are derived using data from many groups. (Cho, Greenwood-Nimmo & Shin, 2021). The DFE estimator, like the PMG, places a limit on the slope coefficient and error variances to ensure that they are similar in the long run across all nations (Zardoub, 2021).

Before performing the cointegration analysis, unit root tests should be conducted on the relevant time series. the "Im-Pesaran-Shin unit-root test" was utilized. Following the identification of the panel unit root, the concern about whether a relationship of long-run equilibrium between these variables is attainable arises. Traditional panel cointegration experiments like Kao, Pedroni, and Westerlund might be applied. the "Hausman test" was used to distinguish between the "PMG and DFE". The Pesaran CD test was then used to analyze cross-sectional dependence.

Empirical results:

Descriptive Analysis:

Considering gross capital formation in 18 countries, Zimbabwe had the lowest value in 2005 and the highest was in Congo in 2015. The Gross capital formation average value is 23.81034 with a minimum and maximum of -1.525177 and 79.40108, respectively. Algeria had the lowest external debt in 2013, while Congo had the highest in 2001. Foreign direct investment average value is 43.96331 with a minimum and maximum of -11.19897 and 39.82762, respectively.

Table (2): Descriptive Analysis

Variable	Obs	Mean	Std. Dev.	Min	Max
GCF	375	23.81034	10.41058	1.525177	79.40108
FDI	378	2.997236	5.376593	-11.19897	39.82762
EXD	378	43.96331	35.05862	2.551358	244.7754
GDPPC	378	1.430347	3.955075	-18.49118	18.06588
GDS	376	19.46736	15.75712	-21.46003	64.92741
TRA	376	67.41093	28.84948	20.72252	175.798

Correlation analysis:

The correlation matrix shown in table (2) illustrates a positive association between gross capital formation and foreign domestic investment, as well as gross domestic product per capita, gross domestic saving, and Trade openness. External debt and capital formation have a slight negative association.

Table (3): Correlation Matrix

	GCF	FDI	EXD	GDPPC	GDS	TRA
GCF	1.0000					
FDI	0.3682	1.0000				
EXD	-0.0569	0.1255	1.0000			

GDPPC	0.0458	-0.0711	-0.2185	1.0000	
GDS	0.6742	0.2239	0.0648	0.0936	1.0000	
TRA	0.3024	0.3805	0.3668	-0.0217	0.3654	1.0000

Unit root tests:

It is vital to assess the unit root before employing the ARDL model of each variable to ensure that none of the variables are stationary at I(2); otherwise, the analyzed findings will provide suspicious findings. The "Im-Pesaran-Shin unit root test" results reveal that capital formation, gross domestic product per capita, gross domestic savings, and trade openness have unit roots at the level, in addition, these variables have no unit roots at the first difference. Foreign direct investment and External debt have no unit root at I(0) and I(I).

Table (4): Im-Pesaran-Shin unit-root test

Variable	Level	P-value	First difference
GCF	1	0.1098	0.000
FDI	0	0.0198	0.000
EXD	0	0.0401	0.000
GDPPC	1	0.1059	0.000
GDS	1	0.9593	0.000
TRA	1	0.2143	0.000

Cross-sectional dependence:

To inspect the dependency in this study, the "Pesaran (2004) CD tests" was employed, which is appropriate for a balanced panel.

Table (5) Cross-sectional dependence tests

Tests	Statistics	p-value
Pesaran cross-sectional independence test	0.455	Pr = 0.649

In Table (5) The first differences were estimated and the Pesaran test was conducted, yielding a p-value of 0.649 and a statistic of 0.455 which demonstrates that the null hypothesis of no cross-sectional dependency is accepted and cross-sectional dependence no exists.

Table (6) Cointegration tests

	Kao		Pedroni		Westerlund	
	Statistic	p-value	Statistic	p-value	Statistic	p-value
Modified Dickey-Fuller t	-5.1727	0.0000				
Dickey-Fuller t	-4.0023	0.0000				
Augmented Dickey-Fuller t	-4.8869	0.0000	-2.7762	0.0027		
Unadjusted modified Dickey-Fuller t	-5.4921	0.0000				
Unadjusted Dickey-Fuller t	-4.1034	0.0000				
Modified Phillips-Perron t			3.8428	0.0001		
Phillips-Perron t			-2.0218	0.0216		
Variance ratio					0.8707	0.1920

The panel cointegration testing results are shown in Table (6). The results reveal that, to varying degrees, the null hypothesis of no cointegration is rejected. indicating that local capital formation and external debt cointegrate in lower-middle-income countries in Africa.

The optimal lags for the model:

The study identifies the optimal lag value for the "ARDL model (p, q, q, q, q, q)". After that, an analysis of the results of the various estimators is made, with a particular emphasis on the PMG and DFE. Optimal lags for the countries' samples are shown in Table (7).

Table (7) The optimal lag selection

	GCF	FDI	EXD	GDPPC	GDS	TRA
Algeria	1	1	0	0	1	1
Angola	1	1	1	0	0	1
Benin	1	1	1	1	1	1
Cameroon	1	0	1	0	0	0
Comoros	1	1	1	0	1	1
Congo	1	0	1	0	1	1
Cote d'Ivoire	1	0	0	0	0	0
Egypt	1	0	1	0	0	1
Eswatini	1	1	0	0	0	1
Ghana	1	1	1	1	1	0
Kenya	1	1	0	0	1	0
Mauritania	1	0	1	0	0	1
Morocco	1	0	1	0	0	0
Nigeria	1	0	0	0	0	0
Senegal	1	0	0	0	0	1
Tanzania	1	0	0	1	0	1
Tunisia	1	0	0	1	0	0
Zimbabwe	1	0	1	0	1	1

The most typical time disparities across nations are chosen. The AIC criteria is used to determine the value that occurs most frequently across all countries and variables. The ARDL selected is (1 0 1 0 0 1).

Hausman test:

The Hausman test can be applied to evaluate the long-run coefficient homogeneity hypothesis to select between the PMG and DFE estimates (Zardoub, 2021). The PMG estimator, according to the findings, is more efficient and consistent and is chosen above the DFE based on the Hausman chi2 P value data which is 0.2602.

Estimate the model:

Table (8) demonstrates the short-run and long-run common coefficients for the dynamic fixed effect and pool mean group approaches.

Table (8) DFE and PMG Long-run and short-run results

	DFE		PMG	
Variable	**Coef.**	**Prob.**	**Coef.**	**Prob.**
Long Run				
FDI	0.16764	0.401	0.62688	0.001***
EXD L1.	-0.07525	0.008**	-0.00919	0.162
GDPPC	0.36235	0.125	0.36449	0.000***
GDS	0.24369	0.053	0.63837	0.000***
TRA L1.	0.06994	0.221	-0.00569	0.796
Short Run				
ECT	-0.33931	0.000***	-0.28703	0.001***
FDI D1.	0.02385	0.688	-0.00898	0.944
EXD D1.	-0.07491	0.004***	-0.00192	0.940
GDPPC D1.	-0.14094	0.043**	0.0565	0.341
GDS D1.	-0.19132	0.001***	-0.07669	0.494
TRA D1.	0.13713	0.000***	0.16977	0.001***
CONS	5.65759	0.000***	2.31905	0.004***

**, **, and * signify significance at 1%, 5%, and 10%, respectively.

The projected negative sign of the ECT "error correction term" in the PMG and DFE is exceedingly significant at the 1% level showing that

disequilibrium from previous periods of shock is restored despite encountering transient anomalies.

In the short term, all variables are significant in DFE except FDI. In PMG, trade is the only variable significant at 1%. Foreign direct investment, external debt, gross domestic product per capita, and gross domestic savings are not significant. On the other hand, in the long term, Foreign direct investment, gross domestic product per capita, and gross domestic savings are significant at 1% but the external debt has a negative insignificant effect which corresponds to Fonchamnyo, et al., (2021) as well as trade has a negative insignificant effect which resembles Clements et al., (2003).

Table (9) Short-Run Differential Coefficients for PMG

Variable	Coef.	Prob.	Variable	Coef.	Prob.
Algeria			**Angola**		
ECT	0.0838334	0.192	**ECT**	-0.3623204	0.012**
FDI D1.	0.7835974	0.285	**FDI D1.**	-0.2525199	0.184
EXD D1.	-0.0755191	0.738	**EXD D1.**	0.0140424	0.858
GDPPC D1.	0.502506	0.098*	**GDPPC D1.**	-0.3027571	0.179
GDS D1.	-0.9697235	0.000***	**GDS D1.**	0.3681117	0.013**
TRA D1.	0.5391954	0.01**	**TRA D1.**	-0.0164693	0.857
Benin			**Cameroon**		
ECT	-0.4829431	0.014**	**ECT**	-0.9452682	0.001***
FDI D1.	0.1812667	0.693	**FDI D1.**	-0.2004898	0.231
EXD D1.	0.2018874	0.007***	**EXD D1.**	0.0349726	0.161
GDPPC D1.	0.4518011	0.122	**GDPPC D1.**	-0.2837894	0.016**
GDS D1.	-0.2923728	0.317	**GDS D1.**	-0.3299991	0.175
TRA D1.	-0.068717	0.409	**TRA D1.**	0.0131953	0.735
Comoros			**Congo**		

ECT	-0.1328636	0.169	ECT	-0.2270792	0.044**
FDI D1.	-0.8430827	0.000***	FDI D1.	-0.8955843	0.273
EXD D1.	0.0349726	0.161	EXD D1.	-0.1965588	0.045**
GDPPC D1.	-0.2837894	0.016**	GDPPC D1.	-0.1936855	0.578
GDS D1.	0.2622336	0.036**	GDS D1.	-1.095727	0.001***
TRA D1.	0.581503	0.000***	TRA D1.	0.3143123	0.038**
Cote d'Ivoire			**Egypt**		
ECT	-1.170965	0.000***	ECT	-0.3039883	0.009***
FDI D1.	-0.8955843	0.273	FDI D1.	-0.1722337	0.234
EXD D1.	-0.0370757	0.339	EXD D1.	0.1025612	0.096*
GDPPC D1.	-0.1936855	0.578	GDPPC D1.	0.3260423	0.101
GDS D1.	-0.2334353	0.161	GDS D1.	0.1511744	0.109
TRA D1.	-0.1455688	0.044**	TRA D1.	0.0125971	0.743
Eswatini			**Ghana**		
ECT	-0.0933414	0.180	ECT	-0.1063745	0.473
FDI D1.	0.047055	0.427	FDI D1.	-0.5983894	0.203
EXD D1.	0.1025612	0.096*	EXD D1.	-0.1077433	0.166
GDPPC D1.	-0.1536527	0.113	GDPPC D1.	-0.1799223	0.446
GDS D1.	-0.0034305	0.967	GDS D1.	0.5720883	0.014**
TRA D1.	0.0127193	0.482	TRA D1.	0.1873731	0.02339**
Kenya			**Mauritania**		
ECT	-0.6218455	0.000***	ECT	0.4510256	0.007***
FDI D1.	-0.4639284	0.128	FDI D1.	0.078639	0.559
EXD D1.	-0.0046257	0.950	EXD D1.	0.1585963	0.244
GDPPC D1.	0.0585607	0.587	GDPPC D1.	-0.078492	0.655
GDS D1.	-0.2274811	0.31	GDS D1.	-0.2987776	0.217
TRA D1.	0.5073035	0.000***	TRA D1.	0.5073035	0.000***
Morocco			**Nigeria**		

ECT	-0.0803898	0.547	ECT	0.1003983	0.467
FDI D1.	0.0081001	0.960	FDI D1.	1.179217	0.252
EXD D1.	0.134043	0.274	EXD D1.	0.1636823	0.148
GDPPC D1.	0.104538	0.511	GDPPC D1.	-0.078492	0.655
GDS D1.	-0.1944094	0.566	GDS D1.	0.2188906	0.007***
TRA D1.	0.168004	0.001***	TRA D1.	-0.0034631	0.962
Senegal			**Tanzania**		
ECT	-0.3522641	0.014***	ECT	0.0340249	0.754
FDI D1.	0.808596	0.127	FDI D1.	0.0181099	0.949
EXD D1.	0.0251676	0.542	EXD D1.	-0.0402014	0.6
GDPPC D1.	0.3867882	0.007***	GDPPC D1.	-0.1053672	0.733
GDS D1.	0.1254545	0.629	GDS D1.	0.7686563	0.005***
TRA D1.	0.3405698	0.000***	TRA D1.	0.3581624	0.007**
Tunisia			**Zimbabwe**		
ECT	-0.0495121	0.498	ECT	0.1630855	0.322
FDI D1.	0.1005245	0.254	FDI D1.	0.1661334	0.773
EXD D1.	0.0062019	0.896	EXD D1.	-0.0040577	0.934
GDPPC D1.	0.1305679	0.574	GDPPC D1.	0.1747828	0.037**
GDS D1.	0.1360667	0.200	GDS D1.	0.4040492	0.001***
TRA D1.	0.0889998	0.003***	TRA D1.	0.1057305	0.053*

***, **, and * signify significance at 1%, 5%, and 10%, respectively.

Table (9) shows the short-run results for every country. The findings show that the effects of external indebtedness on capital formation vary greatly. The stock of foreign debt has a negative significant short-term influence on Congo, but a positive significant short-term impact on Egypt and Benin which applies that in short term these debts have a positive effect on the two countries on capital formation. When external debt rises by 1%, capital formation in Egypt rises slightly by 0.10% and

in Benin by 0.20%. However, for other nations, the coefficient for foreign debt stock is not statistically significant as Angola, Cameroon, Cote d'Ivoire, Kenya, Mauritania, and Senegal.

Conclusion:

Using the "dynamic fixed effect and pooled mean group panel ARDL estimate methods", this study investigates the external debt's impact on capital formation in Africa's lower middle-income countries. "Algeria, Angola, Benin, Cameroon, Comoros, Congo, Cote d'Ivoire, Egypt, Eswatini, Ghana, Kenya, Mauritania, Morocco, Nigeria, Senegal, Tanzania, Tunisia, and Zimbabwe" are among the nations studied. The annual data is used and encompasses the years 2000 through 2020. The presence of a negative and statistically significant error correction term specifies the presence of a long-run association. The PMG estimator is more dependable and effective. Increases in the stock of external debt, according to the study, are insignificant in both the long and short run on capital formation. The failure to integrate external debt with the capital formation in lower-middle-income countries might explain this result. This implies that the expanding debt is being used to fulfil the budget deficit rather than to support capital production, and as long as these nations cannot survive without foreign borrowing, the weight of this debt will rise, and governments will continue to borrow to repay preceding debts. As a result, these flows are misdirected to consumption, which may be explained by the debt dependency of some emerging economies. As a result of receiving several loans, developing countries have become increasingly reliant, pushing them into the well-known "debt overhang". Except for Egypt and Benin, foreign debt boosts capital production in the short run; but, as their load grows, their external debt becomes insignificant in terms of capital formation, and external loans are diverted to nonproductive uses.

Consequently, lower-middle-income countries in Africa must choose between increasing debt and deteriorating their financial predicament or exercising fiscal prudence and endangering their economic progress. When executing projects that increase public debt, policymakers must exercise great caution. There should also be regulated debt consolidation controls, notably in government spending by analyzing sponsored programs to evaluate money expenditure. It is also advised that the borrowing rate be decreased by locating other sources of finance for projects.

References:

Abdullahi, M. M., Hassan, S., & Bakar, A. (2016). Analyzing the impact of external debt on capital formation in Nigeria: an autoregressive distributed lag approach. *Mediterranean Journal of Social Sciences*, *7*(1), 173-183.
https://repo.uum.edu.my/id/eprint/18230/

Adegbite, E. O., Ayadi, F. S., & Ayadi, O. F. (2008). The impact of Nigeria's external debt on economic development. *International Journal of Emerging Markets*.
https://www.emerald.com/insight/content/doi/10.1108/17468800810883693/full/html

Anyanwu, J. C. (2014). Factors affecting economic growth in Africa: are there any lessons from Chi??. *African Development Review*, *26*(3), 468-493.
https://onlinelibrary.wiley.com/doi/pdf/10.1111/1467-8268.12105

Baddeley, M.C. (2003). Accelerator theory. In: Investment. Palgrave, London.
https://doi.org/10.1007/978-1-4039-1864-2_4

Cho, J. S., Greenwood-Nimmo, M., & Shin, Y. (2021). Recent developments of the autoregressive distributed lamodelingng framework. *Journal of Economic Surveys*.
https://onlinelibrary.wiley.com/doi/10.1111/joes.12450

Churchman, N. (2001). *David Ricardo on public debt*. Springer.
http://resistir.info/livros/david_ricardo_on_public_debt.pdf

Clements, B., Bhattacharya, R., & Nguyen, T. Q. (2003). External debt, public investment, and growth in low-income countries.
https://www.imf.org/external/pubs/ft/wp/2003/wp03249.pdf

Erbe, R. (1984). External borrowing, capital formation and growth in developing countries. *Intereconomics*, *19*(1), 16-23.
https://link.springer.com/content/pdf/10.1007/BF02928286.pdf

Erickson, L. A., & Dalgaard, C. J. (2007). Solow Versus Harrod-Domar: Reexamining the Aid Costs of the First Millennium Development Goal.
https://www.imf.org/external/pubs/ft/wp/2006/wp06284.pdf

Fonchamnyo, D. C., Dinga, G. D., & Ngum, V. C. (2021). Revisiting the nexus between domestic investment, foreign direct investment, and external debt in SSA countries: PMG-ARDL approach. *African Development Review*, *33*(3), 479-491.
https://onlinelibrary.wiley.com/doi/full/10.1111/1467-8268.12593

Estevao, M. (2022) "It's Time to Get a Better Handle on Debt in Developing Economies." *World Bank Blogs*, blogs.worldbank.org, 4 Jan. 2022,
https://blogs.worldbank.org/voices/its-time-get-better-handle-debt-developing-economies.

Hochstein, A. (2020). The Harrod-Domar Model, the Money Market and the Elasticity of the Investment Demand Curve. *International Advances in Economic Research*, *26*(2), 197-198.
https://link.springer.com/article/10.1007/s11294-020-09784-2

IMF. (2022). *MAKING DEBT WORK FOR DEVELOPMENT AND MACROECONOMIC STABILITY*. IMF.

https://www.imf.org/-/media/Files/Publications/PP/2022/English/PPEA2022019.ashx

Kassu, T., Mishra, D. K., & Asfaw, M. (2014). Public External Debt, Capital Formation and Economic growth in Ethiopia. *Journal of Economics and Sustainable Development*, *15*. https://core.ac.uk/download/pdf/234646518.pdf

King, J.E. (2008) Post Keynesian Economics. In: Palgrave Macmillan (eds) The New Palgrave Dictionary of Economics. Palgrave Macmillan, London. https://doi.org/10.1057/978-1-349-95121-5_1634-2

Kocha, C. N., Iwedi, M., & Sarakiri, J. (2021). The Dynamic Impact of Public External Debt on Capital Formation in Sub-Saharan Africa: The Pooled Mean Group Approach. *Journal of Contemporary Research in Business, Economics and Finance*, *3*(4), 144-157. http://learning-gate.com/index.php/2641-0265/article/view/157

Kripfganz, S., & Schneider, D. C. (2022). *ardl: Estimating autoregressive distributed lag and equilibrium correction models* (No. 18). Graduate School of Economics and Management, Tohoku University. https://econpapers.repec.org/paper/tohtupdaa/18.htm

Krugman, P. (1988). Financing vs. forgiving a debt overhang. *Journal of Development Economics*, *29*(3), 253-268. https://doi.org/10.1016/0304-3878(88)90044-2

Imbs, J. M., & Rancière, R. G. (2005). The overhang hangover. https://documents1.worldbank.org/curated/pt/929321468330044143/pdf/wps3673.pdf

Ndemange, F. N. (2018). The Impact of External Debt Servicing on Capital Formation and Gross Domestic Product in Kenya. *Kenyatta University, Kenya*. https://ir-library.ku.ac.ke/handle/123456789/18846

Panizza, U. (2008, March). Domestic and external public debt in developing countries. In United Nations Conference on Trade and Development Discussion Paper (No. 188). https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1147669

Pattillo, C. A., Poirson, H., & Ricci, L. A. (2002). External debt and growth. *Available at SSRN 879569*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=879569

Pattillo, C. A., Poirson, H., & Ricci, L. A. (2004). What are the channels through which external debt affects growth? https://www.imf.org/external/pubs/ft/wp/2004/wp0415.pdf

Pesaran, M. H., Shin, Y., & Smith, R. P. (1999). Pooled mean group estimation of dynamic heterogeneous panels. *Journal of the American statistical Association*, *94*(446), 621-634. https://www.tandfonline.com/doi/abs/10.1080/01621459.1999.10474156

Salsman, R. M. (2012). *The political economy of public credit* (Doctoral dissertation, Duke University). https://dukespace.lib.duke.edu/dspace/bitstream/handle/10161/6171/salsman_duke_0066d_11710.pdf?sequence=1

Siddique, A., Selvanathan, E. A., & Selvanathan, S. (2016). The impact of external debt on growth: Evidence from highly indebted poor countries. *Journal of Policy Modeling*, *38*(5), 874-894.

https://www.sciencedirect.com/science/article/pii/S0161893816300096

Teng, J. Z., Khan, M. K., Khan, M. I., Chishti, M. Z., & Khan, M. O. (2021). Effect of foreign direct investment on CO2 emission with the role of globalization, institutional quality with pooled mean group panel ARDL. *Environmental Science and Pollution Research*, *28*(5), 5271-5282. https://link.springer.com/article/10.1007/s11356-020-10823-y#Sec4

Tsoulfidis, L. (2007). Classical economists and public debt. *International Review of Economics*, *54*(1), 1-12. https://link.springer.com/content/pdf/10.1007/s12232-007-0003-8.pdf

UKEssays. (November 2018). Theories of Growth and Debt. Retrieved from https://www.ukessays.com/essays/economics/literature-review-of-growth-and-debt-theories-economics-essay.php?vref=1

World Bank, (2021). International Debt Statistics 2022. Washington, DC: World Bank. doi:10.1596/978-1-4648-1800-4.

World Bank, (2022). Middle-Income Countries overview. Retrieved 28 June 2022, from https://www.worldbank.org/en/country/mic/overview

Yousaf, A., & Mukhtar, T. (2020). External Debt and Capital Accumulation Nexus: Evidence from Pakistan. *The Pakistan Development Review*, *59*(1), 29-44.

Zardoub, A. (2021). Exploring the links between financial flows and economic growth: A panel ARDL approach. *PSU Research Review* https://www.emerald.com/insight/content/doi/10.1108/PRR-05-2020-0016/full/pdf