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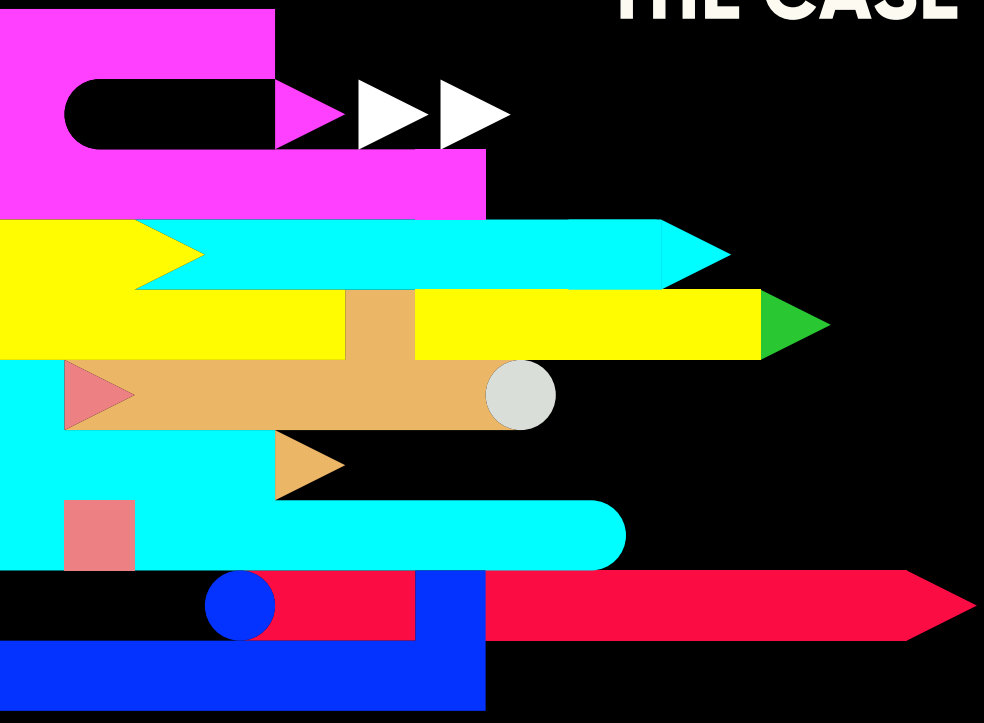
PROMOTING A PANDEMIC RECOVERY:
EVIDENCE TO SUPPORT MANAGING THE GROWING DEBT CRISIS PROJECT

A TWO-EDGED SWORD: THE IMPACT OF PUBLIC DEBT ON ECONOMIC GROWTH THE CASE OF ETHIOPIA



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Red Sur Working Document N°14/2023

A TWO-EDGED SWORD: THE IMPACT OF PUBLIC DEBT ON ECONOMIC GROWTH: THE CASE OF ETHIOPIA

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The project was led by Fernando Lorenzo (Centro de Investigaciones Económicas, CINVE/Red Sur). The academic direction of the project and the process of elaboration of this document was carried out by Red Sur Regional Technical Coordination team, composed of Andrés López (IIEP-UBA-CONICET/Red Sur), Ramiro Albrieu (Red Sur), Luis Miguel Galindo (Universidad Nacional Autónoma de México, UNAM) and Álvaro Ons (CINVE/Red Sur).

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Number	Title	Authors/Institution
Policy Brief No 1/2022	G20 Policy Brief Indonesia 2022. Policy Proposals for External Debt Management and Sustainability in Developing and Low-Income Countries TF7 - International Finance and Economic Recovery	Fernando Lorenzo (Centro de Investigaciones Económicas), Luis Miguel Galindo (Universidad Nacional Autónoma de México), Ramiro Albrieu (CIPPEC), Dionisio Borda (Centro de Análisis y Difusión de la Economía Paraguaya), Paul Lakuma (Economic Policy Research Centre), Mma Amara Ekeruche, Alemayehu Geda (Addis Ababa University), and Arjan de Haan (IDRC)
Policy Brief No 2/2023	LAC Policy Brief "Results and Policy Implications in Latin America"	Miguel Galindo (UNAM), Fernando Lorenzo (CINVE/Red Sur) and Ramiro Albrieu (Red Sur)
Policy Brief No 3/2023	Construyendo un futuro sostenible en el Sur Global	Ramiro Albrieu (Red Sur)
Policy Brief No 4/2023	Policy Brief I - Ethiopia: Profile of Ethiopian Debt and its Institutional Challenges: An Exploratory Analysis	Getnet Alemu and Alemayehu Geda (Addis Ababa University/AAU)
Policy Brief No 5/2023	Policy Brief II - Ethiopia: Fundamental and Proximate Drivers of Public Debt in Ethiopia (1980-2023)	Alemayehu Geda and Addis Yimer (Addis Ababa University/AAU)
Policy Brief No 6/2023	Policy Brief III - Ethiopia: A Two-Edged Sword: The Impact of Public Debt on Economic Growth—The Case of Ethiopia	Addis Yimer and Alemayehu Geda (Addis Ababa University/AAU)
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Working Paper No 5/2023	Estudio País: Construyendo un Futuro Sostenible en Bolivia (in Spanish)	Omar Velasco, Wilson Jiménez, Josué Cortez and Diego Peñaranda (Fundación ARU)
Working Paper No 6/2023	Estudio País: Construyendo un Futuro Sostenible en Honduras (in Spanish)	Gerson Urtecho, Sergio Sánchez and Luis Miguel Galindo (UNAM)
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Working Paper No 11/2023	Sustainable, Inclusive and Environmentally Responsive Debt in Uganda: Implication of COVID 19	Economic Policy Research Centre (EPRC)
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Working Paper No 13/2023	Fundamental and Proximate Drivers of Public Debt in Ethiopia	Alemayehu Geda and Addis Yimer (Addis Ababa University/AAU)
Working Paper No 14/2023	A Two-Edged Sword: The Impact of Public Debt on Economic Growth: The Case of Ethiopia	Addis Yimer, African Child Policy Forum (ACPF) and Department of Economics Addis Ababa University (AAU) and Alemayehu Geda, Addis Ababa University (AAU)

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ABSTRACT

This study investigates the dynamic effects of public debt on economic growth in Ethiopia using annual data from 1980 to 2021. The empirical results obtained using the Autoregressive Distributed Lag (ARDL) modelling approach showed that public debt hinders long-term growth. However, it has a growth-enhancing effect in the short term by boosting investment. On the other hand, debt servicing has been proven to have a detrimental impact on growth, both in the short and long term, as it requires a significant reduction in vital resources that could have otherwise been allocated to investment. Thus, debt is a two-edged sword for economic growth in Ethiopia. On the one hand, public debt can provide financing for investments in infrastructure and other projects that can stimulate economic growth. On the other hand, high levels of debt can hinder economic growth. Prudent fiscal discipline, domestic revenue mobilization to address the growing financing needs in the country, efficient debt management strategies to prevent the misuse of debt and corruption, and improved prioritization of needs are some of the policy options to mitigate the adverse impact of public debt on economic growth.

Keywords: Public debt, Domestic debt, External debt, Economic growth, Ethiopia
JEL Classification: F21; F34; O10; O40

"*Debt is a two-edged sword. Used wisely and in moderation, it clearly improves welfare. But, when it is used imprudently and in excess, the result can be a disaster. For a country, too much debt impairs the government's ability to deliver essential services to its citizens.*"

Cecchetti, S, M Mohanty and F Zampolli (2011).

I. INTRODUCTION

Public debt can have both positive and negative effects on economic growth, depending on how it is used and managed. On the positive side, public debt can be used to finance investments in infrastructure, education, and healthcare, which can contribute to long-term economic growth. For example, investments in transportation infrastructure can enhance the productivity of businesses and reduce transportation costs, while investments in education and healthcare can improve the quality of the workforce and lower healthcare costs.

However, public debt can also burden the economy, as it requires a significant portion of the government's revenue to be allocated towards interest payments. This, in turn, can diminish the amount of funding available for other crucial sectors, such as education, healthcare, and infrastructure. The borrowed money could also be vulnerable to abuse such as corruption or/and spent in non-meaningful projects. Thus, if public debt is not appropriately managed, it can negatively affect economic growth. Studies have also found that public debt negatively impacts growth by crowding out private investments (see, e.g., Woo & Kumar, 2015; Panizza & Presbitero, 2014; Reinhart & Rogoff, 2010). It can also increase the cost of borrowing for private businesses (see, e.g., Woo & Kumar, 2015; Cecchetti et al., 2011; Pattillo et al., 2006; Clements et al., 2003). In addition, high levels of public debt can lead to inflation, currency depreciation (devaluation), and other macroeconomic vulnerabilities, which can have a negative impact on the economy (see, e.g., Woo & Kumar, 2015). The 'debt overhang' problem could

also adversely affect private investment if economic agents expect high public debt to mean future high taxes (Pattillo et al., 2006).

In the case of Ethiopia, the country's public debt is accumulating in large amounts due to increasing financing needs, both domestic and external shocks, and structural macroeconomic imbalances. The debt-to-GDP ratio reached 53% in 2022 and as high as 60% in 2018. While some of this debt has been used to finance infrastructure and other vital projects, there are concerns about the sustainability of the debt and its potential negative impact on economic growth. Bad governance, natural disasters, and emergencies such as conflicts, the climate crisis, and the COVID-19 pandemic further exacerbate the increasing public debt and the challenge of servicing it. The growing accumulation of debt could become unsustainable, resulting in difficulties with debt repayment, hindering growth, and impeding the achievement of other development goals.

Understanding the pathways and nature of the relationship between public debt and economic growth in Ethiopia is more crucial than ever. This is particularly true as the government intensifies its efforts to transform the country into a middle-income nation by 2030. This transformation requires a sustainable method of financing its ambitions. This is because the causal relationship between sovereign debt variables and economic growth has direct policy implications, particularly on tax and investment choices—and consequently on economic growth (see Gómez-Puig & Sosvilla-Rivero, 2018; 2015).

Therefore, it is essential for policymakers in Ethiopia to carefully analyze the relationship between debt and economic growth and take measures to manage the debt sustainably. This may include implementing fiscal reforms, increasing revenue generation, and improving debt management practices. By doing so, Ethiopia can ensure that public debt is effectively utilized to promote long-term economic growth and development.

While numerous studies have examined the impact of public debt on economic growth in general (see, e.g., D'Andrea, 2022; de Soyres et al., 2022; Gómez-Puig et al., 2022; Mohsin et al., 2021; Huang et al., 2018; Donayre & Taivan, 2017; Ewaida, 2017), little has been done, however, to investigate this relationship in Ethiopia. This is consistent with the paucity of literature on the subject in Africa in general. In addition, the relationship between debt and economic growth is specific to each country and period. Therefore, it is crucial to analyze the specific impact of public debt on economic growth in every country, including Ethiopia. While the few available country-case studies on Ethiopia provide valuable insights into the relationship between debt and growth in the country, their primary focus is on determining whether debt impacts growth in Ethiopia. However, they fail to address the policy-relevant question of how debt affects growth in the country, specifically the mechanisms through which it affects growth (e.g., Gebrekidan, 2023; Alani, 2020; Getinet & Ersumo, 2020). They also predominantly focused on the growth impact of the external component of public debt, disregarding the domestic (or internal) debt that constitutes approximately half of the total public debt. Furthermore, they also suffer from methodological and data-related problems (see, e.g., Gebrekidan, 2023; Alani, 2020; Getinet & Ersumo, 2020).

Thus, this study complements previous research on Ethiopia and aims to address some of the gaps in the existing literature by conducting a comprehensive analysis of the relationship between debt and economic growth. The study examines public debt's short- and long-term impacts on economic growth using a combination of theoretical approaches. Specifically, it focuses on analyzing the 'crowding out' and 'debt overhang' hypotheses. Based on this approach, the study aims to answer the following research questions: a) Does Ethiopia's public debt affect the country's economic growth? b) If so, is the investment channel important? and c) How does this influence vary in the short and long run? Using annual data from 1980 to 2021, the study employs the autoregressive distributive lag (ARDL) modelling approach to address these questions.

The remainder of the study is organized as follows: Section 2 briefly discusses the general outlook of public debt and economic growth in Ethiopia. Section 3 presents a review of the relevant literature. Section 4 discusses the methodology and data used. Section 5 presents the findings and discusses the results. Section 6 concludes the study.

II. THE OUTLOOK OF PUBLIC DEBT AND ECONOMIC GROWTH IN ETHIOPIA

This section briefly overviews the general patterns and evolution of Ethiopia's public debt and economic growth from 1980 to 2021. However, it should be emphasized at the outset that the evolution of public debt and economic performance are closely connected to the dynamics of the political-economic landscape of the period being examined. For instance, political instability and drastic policy changes and reversals have characterized Ethiopia's long political history (Geda & Degefe, 2005). Such political processes significantly impact the behaviour of economic agents, macroeconomic balance and performance, domestic borrowing, and external financial flows to the country (Geda, 2008; Geda & Degefe, 2005).

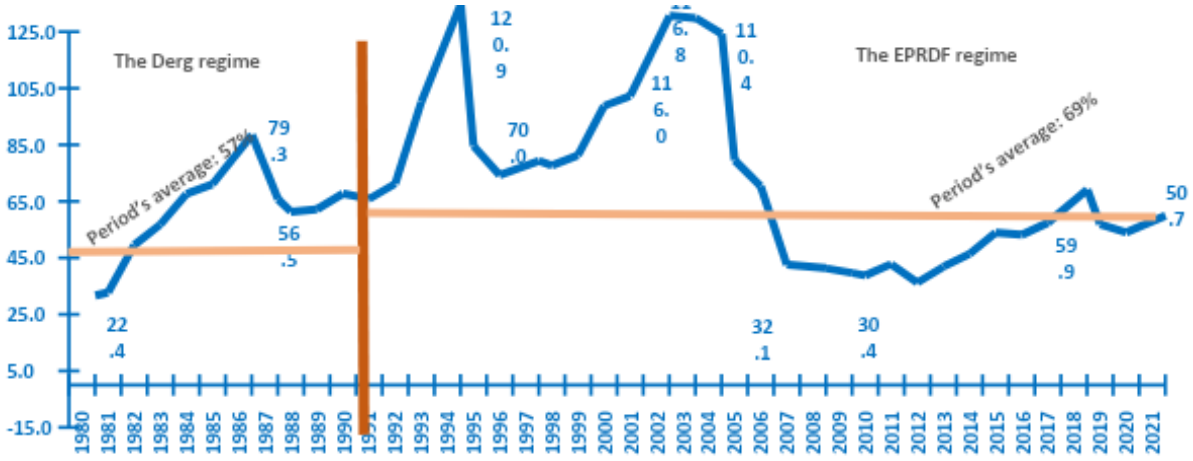
The analysis in this study focuses on two of the most recent regimes that the country has witnessed: the "Derg" (the military regime) and the Ethiopian People's Revolutionary Democratic Front (EPRDF) regime. The period 1974–1991 corresponds to the Derg (military) regime. The Derg experimented with socialism, in which a centralized command system controlled all spheres of decision-making in the country (Geda, 2008). This period is characterized by the prolonged civil war between the Derg and the then-opposition parties, mainly the EPRDF and Eritrean People's Liberation Front (EPLF), the Ethiopian Revolutionary Party (EPRP), the All-Ethiopian Socialist Movement (AESM), the war with Somalia, deliberate market and private sector repression policies, nationalization policies, and drought. These factors contributed to highly erratic economic performance during this period (Geda & Yimer, 2016). Due to the Cold War effect, the primary source of the Ethiopian debt was Russia (USSR, at that time).

The second period, from 1991-2018, began with the Tigray People's Liberation Front (TPLF)-led Ethiopian People's Revolutionary Democratic Front (EPRDF) taking power in 1991, militarily ousting the Derg. The regime supported free market policies and implemented market liberalization and various reform programs with financial help from International Financial Institutions such as the World Bank, IMF, and Western countries (Geda, 2008; Geda & Yimer, 2016). Thus, source countries for debt-creating flows also became the IFIs and Western countries, followed by China, especially after the 2005 failed election and government violence on civilians. However, this period has also been marked by numerous episodes of conflict. These include the war with Eritrea (1998–2000), violence on protesting civilians following the rigging of the result of the 2005 democratic election, the countrywide political unrest (2015–2018) and change of EPRDF leadership since 2018, sporadic ethnic-based conflicts in various parts of the country (mainly in the post-2018 period), and the Tigray war (November 2020–November 2022). Thus, the analysis in this study needs to be understood in the context of these two regimes and the events that characterize each period (see Yimer, 2023a; Geda & Yimer, 2023 for details).

II.1 PUBLIC DEBT OUTLOOK IN ETHIOPIA

Figure 1 depicts the evolution of public debt (the sum of external and domestic debt) as a percentage of GDP in Ethiopia over the last four decades.

Figure 1: Public debt outlook in Ethiopia (% of GDP), 1980–2021



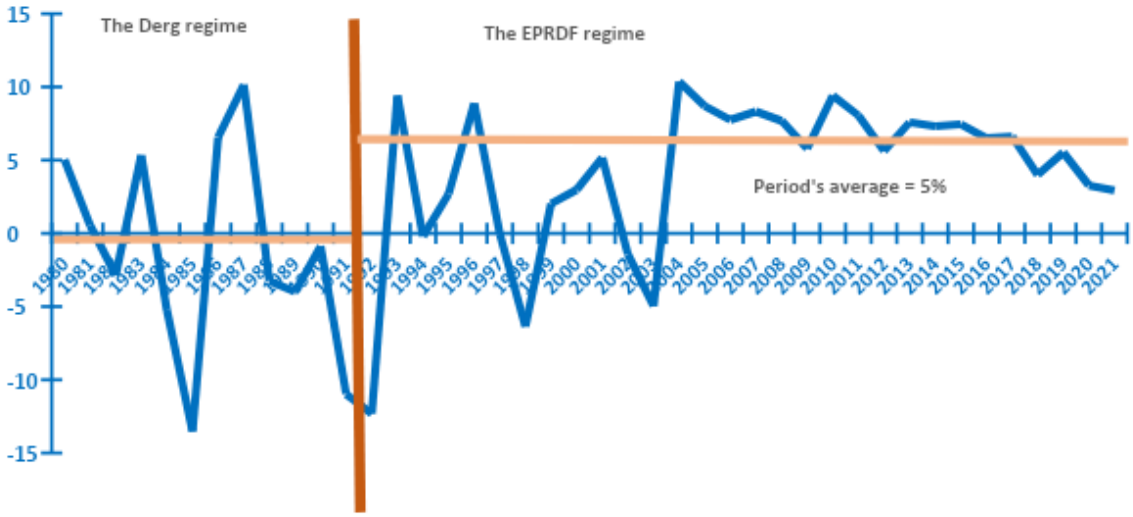
Source: Authors' computation based on the Ministry of Finance and Economic Development (MOFED) various years' annual reports.

As shown in Figure 1, the country has a high dependency on public debt. During the TPLF-led EPRDF period, there were some of the highest peaks, with an average of 69% of the domestic output. This significantly increased from 57% during the Derg regime (Figure 1). As of 2022, the public debt stood at 53% of the country's GDP. In some years of the TPLF-led EPRDF regime, this rate has reached as high as 110 to 121% of GDP (Figure 1).

II.2. ECONOMIC GROWTH OUTLOOK IN ETHIOPIA

Figure 2 depicts the growth pattern measured by real per capita GDP growth over the last four decades. During the study period, i.e., 1980–2021, economic growth in Ethiopia had two distinct features, depending on the regime considered (Figure 2).

Figure 2: Real per capita GDP growth in Ethiopia (1980–2021)



Source: Authors' computation based on the National Bank of Ethiopia's (NBE) various years' annual reports.

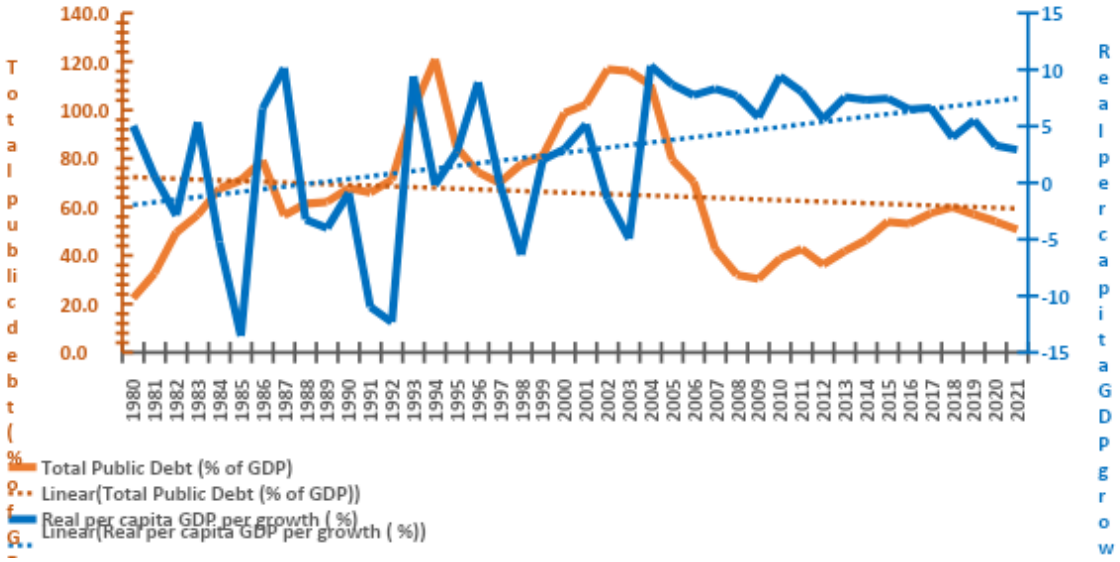
During the Dreg regime, economic growth was very erratic and low (see Figure 2). Growth decelerated in 1981, reaching a negative rate in 1982. The instability induced by the emerging new policies of the Derg, such as the nationalization policy, drought, the war with Somalia, and internal civil war, explain a significant portion of this decelerating and negative growth performance. Partly due to relative political stability and favourable weather conditions, a growth rate of 5.3% was recorded in 1983. In 1984 and 1985, growth decelerated quickly and reached -5.2% and -13.5%, respectively, primarily due to a devastating drought. Growth became positive again in 1986 and 1987, reaching 10.1% in the latter year. Following the intensified civil war and adverse weather conditions, economic growth turned negative again between 1988 and 1991. Overall, growth during this period was very erratic and had a negative average rate of -0.2%.

In May 1991, the TPLF-led EPRDF came into power. Following low economic activity and political uncertainty, growth remained negative in 1992 (-12.3%). Growth regained momentum and increased to 9.4% in 1993. Except for the three years, namely 1997, 1998, and 2003, where growth was negative (primarily due to drought in those years), the growth was hailed as impressive for most of the remaining period under the EPRDF. The growth success is attributed to market-oriented liberalization, excellent weather outturn and significant inflow of external debt-creating flows (aid) form IFIs and Western Countries (Geda, 2008; Geda & Yimer, 2016). Other notable episodes of real GDP growth in the country

include the deceleration of growth in 2006 and 2009, following the failed democratic election and government violence in 2005 and the global financial crisis in 2008/09. Partly due to the fall in global commodity prices in 2011 and thereafter, growth decelerated in the successive years of 2011 and 2012. The political unrest in the country from 2015 through 2018 has also contributed to the slowdown of economic growth during the same period. In 2020, amidst the COVID-19 pandemic and the war in Tigray, economic growth slowed but remained positive. Overall, growth during the post-Derg period has been quite good, with real GDP per capita growing by an average of 4.5% per year (Figure 2). The availability of internal and external debt to finance growth is an important factor to explains a significant portion of this growth. Notwithstanding the strong economic growth and Ethiopia's status as one of Africa's fastest-growing economies, it remains one of the poorest countries in the world, with an official data-based per capita income of US$ 835 in 2021[1] (World Bank, 2023).

Overall, there seems to be a general negative correlation between public debt and economic growth during the study period, with a limited episode of positive association (Figure 3). This will be further examined econometrically in Section 5.

Figure 3: Total public debt (% of GDP) and real per capita GDP growth in Ethiopia (1980–2021)



Source: Authors' computation based on growth data from NBE and debt data from MOFED's various years' annual reports.

III. REVIEW OF LITERATURE

There is no consensus on the effects of public debt on economic growth. The literature has identified various channels through which debt affects economic growth. The discussion in this section focuses on highlighting the theoretical and empirical literature that has broadly shaped the debt-growth literature and the relevant studies that have guided this study.

[1] See Geda and Yimer (2016) for a critique of the growth rate data of the period and the possibility of its exaggeration.

III.1. THE THEORY

The effects of public debt on economic growth can be broadly examined using three theoretical growth models: classical and neoclassical growth theories, Keynesian, and post-Keynesian growth theories, and endogenous (new) growth theories.

The mainstream classical school considers public debt detrimental to long-term growth and economic development (see, e.g., Smith, 1776; Ricardo, 1817; Mill, 1848). Under the principle of "laissez-faire," in the neoclassical version of classical economics, proponents argue for limiting the state's role to ensure the proper operation of the market economy, such as maintaining the rule of law, national security, and diplomatic relations. According to this principle, the government is not permitted to interfere in the economy. They argue that economic resources are managed more efficiently in the private than the public sector. Additionally, public debt diverts capital from its productive function to non-productive uses, negatively impacting capital accumulation. This diversion of investment undermines long-term growth (Smith, 1776; Ricardo, 1817; Mill, 1845). Ricardo (1817), in his concept of Ricardian Equivalence, noted that government borrowing in the present requires future tax rates to be raised above the normal rate to repay the borrowed amount (see also Shoup, 1957; Roberts, 1942). This means that efforts to stimulate the economy by increasing public spending through debt financing will be ineffective. Taxpayers know that the debt repayment will ultimately have to be funded through future taxes. Because taxpayers save to pay the anticipated future taxes imposed to finance the debt repayment, this will offset the macroeconomic benefits of increased aggregate demand resulting from increased public spending – the 'Ricardian equivalence' (Churchman, 2001; Barro, 1989, 1979, 1974). Thus, in the classical school, public debt is considered a societal burden (Woo & Kumar, 2015; Kumar & Woo, 2010; Elmendorf & Mankiw, 1999).

Similarly, in neoclassical growth theories, public debt is viewed as harmful to long-term economic growth due to its crowding-out effect on physical capital formation (investment) (see, e.g., Dombi & Dedák, 2019; Saint-Paul, 1992; Blanchard, 1985; Diamond, 1965; Modigliani, 1961; Solow, 1957, 1956). In the Solow (1957, 1956) growth model, fiscal policy (and, by extension, public debt) could potentially positively impact the per capita output level. Such a policy, however, has no impact on long-term economic growth, implying that debt is growth-neutral (Solow, 1957, 1956). Modigliani (1961) also argued that public debt could crowd out private investment by reducing credit availability or raising long-term interest rates on public borrowing, negatively impacting long-term growth. In the Diamond/Overlapping Generation models, public debt has two effects in the long run, both stemming from the taxes required to fund debt repayments. An increased taxation level reduces the individual taxpayer's available lifetime consumption (Dombi & Dedák, 2019; Diamond, 1965). Furthermore, taxes have the effect of reducing an individual taxpayer's disposable income, which in turn reduces their ability to save and contribute to capital formation. This negative impact on long-term growth has been discussed in various studies (see, e.g., Dombi & Dedák, 2019; Saint-Paul, 1992; Blanchard, 1985; Diamond, 1965). In line with this, the monetarist school also emphasized the issue of the crowding-out effect caused by public sector debt. They argue that a high level of indebtedness crowds out private investment through higher interest rates, negatively affecting growth (see, e.g., Barik & Sahu, 2022; Elmendorf & Mankiw, 1999).

While classical and neoclassical theories emphasize debt's long-run negative or zero effects on growth, the Keynesian paradigm is concerned with the short-run (Akram, 2015). According to Keynesians, the market cannot achieve full employment on its own. Thus, the government must intervene to overcome such market failures (including low effective demand), reduce economic fluctuations, and promote

balanced growth. In this process, public debt is viewed as one of the essential policy tools (Barik & Sahu, 2022) and a key source of financing the domestic saving-investment gap, which is required for output growth, primarily through the expenditure multiplier effect (Todaro & Smith, 2006; Eisner, 1989). This view takes an extreme form in the recent development of what is called the 'modern monetary theory' (MMT), which was also previously noted by Kalecki (1954). Given their emphasis on endogenous money, the post-Keynesian view of debt is closer to MMT, although they emphasize the importance of its prudent management and its distributional implications (Lavoie, 2006; Davidson, 1995).

In endogenous growth models (the new growth models), public debt, like that of the classical and neoclassical schools, is viewed as potentially harmful to long-term growth (see, e.g., Jafarov et al., 2020; Lo & Rogoff, 2015; Josten, 2000; Aizenman et al., 2007; Saint-Paul, 1992; Barro, 1990; Villanueva, 1972). This is because future cuts in government spending must finance the repayments to reduce primary deficits (i.e., the difference between government revenues and spending, excluding interest payments) or by distortionary taxation, both of which harm growth (Lo & Rogoff, 2015). Moreover, high debt may signal future financial repression (Jafarov et al., 2020; Abiad & Mody, 2005), raise real interest rates, and reduce private investment (Engen & Hubbard, 2005; Spiro, 1988), adversely affecting growth.

In addition, a significant number of studies that are difficult to classify in a particular school have analyzed and argued that the debt-growth nexus varies across countries depending on several country-specific characteristics related to debt composition, past and current macroeconomic outlook, governance, and institutional framework (see, e.g., Eberhardt & Presbitero, 2015; Dell'Erba et al., 2013; Reinhart et al., 2012; Manasse & Roubini, 2009; Kraay & Nehru, 2006; Reinhart et al., 2003). In this regard and in contrast to the above mainstream theories, it is imperative to note the miraculous growth in East Asia, including China, using the developmental state model, where the role of development finance through development banks was crucial (Geda, 2019).

Aside from the previously mentioned theoretical arguments, there is another theory and a substantial body of empirical literature on the non-linear (asymmetric or threshold) effects of public debt on economic growth (see, e.g., Augustine & Rafi, 2023; Makun, 2021; Eberhardt & Presbitero, 2015; Reinhart & Rogoff, 2010; Aguiar et al., 2009; Pattillo et al., 2006; Perotti, 1999; Sutherland, 1997; Krugman, 1988). Debt's non-linear effect implies that moderate and low levels of debt boost growth, while excessive and unsustainable levels of debt stifle it (Chudik et al., 2017; Pattillo et al., 2006; Clements et al., 2003; Krugman, 1988). The theoretical literature on the non-linear effects of debt primarily focuses on the concept of "debt overhang." Debt overhang is a scenario in which "the expected present value of potential future resource transfers is less than its debt" (Krugman, 1988). In this situation, a country's debt service burden is so heavy that a significant portion of its output goes to foreign lenders, which creates disincentives for investment (Sachs, 2002; 1989; Krugman, 1988). Excessive borrowing leads to high levels of indebtedness and debt traps. The need to repay the accumulated debt and the costs associated with servicing it hinders economic growth by discouraging private investment (Sachs, 2002, 1989; Krugman, 1988). This will happen because the debt overhang creates a perception among investors that any new investment returns will be subject to higher taxes to pay off the debt, which reduces their willingness to invest (see, e.g., Gordon & Cosimo, 2018; Aguiar et al., 2009; Deshpande, 1990; Sachs, 1989; Krugman, 1988). In this sense, the idea is also similar to what is called 'Ricardian Equivalence". Furthermore, the debt overhang harms growth by reducing the availability of public funds for private investment (financial crowding-out) and altering the allocation of government spending (Coccia, 2017; Obstfeld & Rogoff, 1996; Krugman, 1988). High indebtedness also signals creditors to charge higher interest rates due to the increased risk of default (Obstfeld & Rogoff,

1996). The latter will increase financing costs, decrease domestic investment, and consequently hinder economic growth.

We note in passing here that this literature ignores the other important costs of such debt to developing countries, such as exerting pressure on them for the lender's or donor's geopolitical and ideological interests – IFIs loans to developing countries through policy conditionality being the best examples. This is because the theory is typically based on the experiences of developed countries. For developing countries, the costs mentioned above are just as crucial, if not more so, than the investment and financial costs (see Geda & Yimer, 2023).

In summary, the relationship between public debt and economic growth is complex, and several theories attempt to explain this relationship. The most frequently cited channels are the financial crowding out of private investments, the effect on macroeconomic vulnerability, and the debt-overhang hypothesis. The traditional view is that high public debt levels can crowd out private investment and reduce economic growth. This is because when the government borrows a large amount of money, it increases the demand for loanable funds, which, in turn, drives up interest rates. Higher interest rates can discourage private investment as it becomes more expensive for firms to borrow money. This can then lead to a reduction in economic growth. However, some economists argue that public debt can actually stimulate economic growth in certain circumstances – the crowding-in hypothesis (see Geda, 2002). For example, during an economic recession, the government can use public debt to finance fiscal stimulus measures such as infrastructure spending. These measures can subsequently stimulate economic growth. Thus, empirical scrutiny of such theories in the context of each country is important.

III.2 THE EMPIRICAL REGULARITY

Although country-specific empirical studies are scarce on the debt-growth relationship in Ethiopia, there is a substantial body of empirical literature on this topic. This literature primarily focuses on the external debt component of public debt and includes studies conducted in developed countries (see, e.g., Lim 2019; Herndon et al., 2014; Reinhart & Rogoff, 2010; Kumar & Woo, 2010) as well as developing countries (see, e.g., Siddique et al., 2016; Zouhaier & Fatma, 2014; Elbadawi et al., 1997). This section summarizes the results from some of the most important and recent studies on developing countries, focusing on Africa. Please refer to Table A1 in Annex A for a more comprehensive list of studies.

Based on studies conducted in both cross-country[2] and single-country[3] contexts, mixed results have been reported on the effects of public debt on economic growth. Some studies have found a negative relationship between public debt and economic growth (see, e.g., Heimberger, 2022; Sandow et al., 2022; Asteriou et al., 2021; Siddique et al., 2016; Calderón & Fuentes, 2013; Mohamed, 2013; Fosu, 1999), while others have found no significant relationship (see, e.g., Tchereni et al., 2013; Schclarek,

[2] See, for example, Asteriou et al. (2021), Siddique et al. (2016), and Fosu (1999).

[3] See, for example, Hilton (2021) and Owusu-Nantwi & Erickson (2016) for Ghana; Sharaf (2021) for Egypt; Adamu and Rasiah (2016) for Nigeria; Mohamed (2013) for Tunisia; Tchereni et al. (2013) for Malawi; Akram (2011) for Pakistan; and Were (2001) for Kenya.

2004)[4] or even a positive relationship (Owusu-Nantwi & Erickson, 2016; Amin & Audu, 2006).[5] Some other studies found a non-linear (positive, negative, or insignificant) effect of public debt on economic growth (see, e.g., Eberhard & Presbitero, 2015; Baum et al., 2013).[6] However, the findings from the majority of the empirical studies reviewed suggest a negative relationship between public debt and economic growth (see, e.g., Sandow et al., 2022; Maitra, 2019; Adamu & Rasiah, 2016; Doğana & Bilgili, 2014; Kumar & Baldacci, 2010; Pattillo et al., 2006; Clements et al., 2003; Table A1 in Annex A).

Several studies have also examined the non-linear effect of public debt on economic growth, with a particular focus on external debt. According to the debt-overhang hypothesis, debt only has a damaging impact on growth once it surpasses a certain threshold level (see Pattillo et al., 2006; Imbs & Ranciere, 2005). Several of these studies agree that ‘debt overhang' is a major reason for slowing down economic growth in indebted countries. They argue that heavy debt burdens prevent countries from investing in their productive capacity, which is necessary to spur economic growth. Disincentives to investment also arise mainly due to investors' expectations about the economic policies required to service debts that would be costly for their investment (see, e.g., Baum et al., 2013; Cecchetti et al., 2011). For example, Presbitero (2012) analyzed the link between debt and economic growth in developing countries using a panel of low- and middle-income countries. The study found a threshold effect for debt-to-GDP ratios above 90%. This finding is consistent with influential studies conducted on advanced and emerging economies, such as Woo and Kumar (2015), Cecchetti et al. (2011), and Reinhart and Rogoff (2010). In contrast, Mohamed (2013) examined the effects of external debt on the economic growth of Tunisia and found evidence of debt overhang even at relatively low levels of debt. He found that although the ratio of public external debt to GDP is relatively low in his country of study, even a low level of external debt of GDP ratio was detrimental to economic growth. He estimated that the threshold for the 'debt overhang' phenomenon in Tunisia is around 30% of GDP (see also Clements et al., 2003).

In summary, the existing empirical literature offers relatively strong evidence of how public debt could harm medium- and long-term growth through various channels. The crowding out of private investments, caused by excessive public debt, can have a negative impact on capital accumulation and growth due to higher interest rates. Debt can also create macroeconomic vulnerability, leading to increased future discretionary taxation and inflation. The empirical evidence for a nonlinear effect of public debt on growth suggests that, although thresholds may exist, there may not be a universal threshold level, and they may largely depend on other factors, such as a country's level of development.

While the findings presented in previous studies broadly support the debt overhang hypothesis, most available studies are based on panel data analysis, focusing on either mixed samples of countries or samples from advanced countries. While such studies help identify the general relationship between

[4] Tchereni et al. (2013) analyzed the effect of foreign debt on Malawi's economic growth from 1975 to 2003 and found a statistically insignificant negative relationship between foreign debt and economic growth. Schclarek (2004) assessed the impact of gross external debt (both private and public) on economic growth for a panel of 59 developing and 24 industrial countries. The data was averaged across each of the seven 5-year periods between 1970 and 2002. For industrialized countries, no robust relationship between debt and growth is found. On the other hand, in developing countries, lower levels of total external debt are found to be associated with higher growth rates. This negative relationship is driven by the incidence of public external debt.

[5] Owusu-Nantwi and Erickson (2016) examined the long-term and causal relationship between public debt and economic growth in Ghana from 1970 to 2012. They found a positive and statistically significant long-term relationship between public debt and economic growth. Additionally, in the short run, a bidirectional Granger causality between public debt and growth is found. Amin and Audu (2006) also reported a positive effect of external debt on economic growth in Nigeria during the period 1990–2004.

[6] Baum et al. (2013) investigated the relationship between public debt and growth in 12 European countries from 1990 to 2012. The empirical results suggest that the short-run impact of debt on growth is positive and significant, but it decreases to around zero and loses significance beyond public debt-to-GDP ratios of 67%. On the other hand, when the debt-to-GDP ratios are high (above 95%), additional debt has a negative impact on growth.

public debt and growth, they have little relevance for country-specific debt management policies. This is because the relationship between debt and economic growth is influenced by many country-specific dynamics that can vary significantly from country to country. In addition, most existing studies entirely neglect domestic debt, which constitutes a significant portion of public debt. Furthermore, most available studies do not seek to explore the channels through which public debt may hinder economic growth, such as the investment channel emphasized in influential theories. This omission prevents a more rigorous explanation for the various mechanisms through which debt may adversely affect growth.

Thus, to fill some of the gaps in the literature noted above, this study revisits the debt-growth relationship in Ethiopia and explores the short- and long-run effects of public debt on economic growth along the lines of the 'crowding out' and 'debt overhang' hypotheses. The study aims to answer the following research questions: a) Does Ethiopia's public debt affect the country's economic growth? b) If so, is the investment channel, which is emphasized in influential theories about the debt-growth nexus, important? c) How does this influence vary in the short and long run? Using annual data from 1980 to 2021, the study employs the autoregressive distributive lag (ARDL) modelling approach to address these questions.

IV. THE EMPIRICAL APPROACH

This section presents the study's basic theoretical growth and investment model and the econometric technique used to estimate the empirical models.

IV.1 THE GROWTH EQUATION: THE THEORETICAL MODEL AND DESCRIPTION OF VARIABLES

This study employs an augmented and modified version of Mankiw et al.'s (1992) neoclassical theoretical growth model,[7] as well as the specifications used in the debt-growth studies of Fosu (1999) and Pattillo et al. (2006), to investigate the effects of public debt on economic growth in Ethiopia during 1980–2021. Furthermore, both linear and nonlinear effects are investigated. The details of the empirical approach used in the study are discussed in the next section.

Assume a production function given in per capita terms, wherein public debt is explicitly incorporated as a determinant of growth given as follows:

$$y_t = \alpha + \sum_{j=1}^{k} \beta_j Z_{tj} + \sum_{m=1}^{p} \phi_m pd_{tm} + \varepsilon_t \qquad (1)$$

Where y represents the natural logarithm of real GDP per capita, Z is a vector of control variables, and pd represents the natural logarithm of the public debt variables. In this study, we use two indicators for the public debt variable: total public debt as a percentage of GDP (including external and domestic debt), and public debt service as a percentage of exports (all in their natural logarithm transformation). The subscript "t" refers to years, and ε_t represents the usual error term.

Several studies have examined the effects of various potential determinants on economic growth. Most have questioned the robustness of the parameter estimates, as they are often sensitive to many other conditional variables (Sala-i-Martin, 1997; Levine & Renelt, 1992). Considering this, several authors

[7] See also Yimer (2023b & 2023c), Sala-i-Martin et al. (2004), Islam (1995), and Romer (1994).

recommend using a core set of factors that have consistently and robustly impacted growth. They also suggest assessing the significance of other variables conditional on including the core set (see, e.g., Bosworth & Collins, 2003). This is the method that we used in this study.

Against this background, the selection of variables in the control vector (Z_t) is informed by theoretical and empirical literature on growth analysis in general, specifically on the relationship between debt and growth. $Z_{i,t}$ contains population growth ($popg$), domestic investment (k), trade openness (op), and government consumption (gc) – all variables are used in their natural logarithm form. The reasons for including these variables are provided below. The definitions of variables in the empirical model and the data sources are provided in Table B1 in Annex B.

Data availability considerations solely informed the choice of the period. The dependent variable is the real per capita GDP level (see, e.g., Yimer, 2023b & 2023c; Mohamed, 2013; Chowdhury, 2001). For the public debt variable, the sum of the public external and domestic debt stock is used (see, e.g., Akram, 2015; Woo & Kumar, 2015; Mohamed, 2013).

Labour force growth is included to account for the potential negative effects of high labour force growth on steady-state per capita output. This is because when the labour force grows, each worker has less capital to work with, which can impact output (Yimer, 2023b & 2023c; Iamsiraroj, 2016). Domestic investment is included because it is consistently found to be a robust determinant of economic growth in the literature. It also theoretically shows the rate of capital accumulation, which is crucial for growth (see, e.g., Iamsiraroj, 2016; Yimer, 2023b).

Several studies have also reported a consistent and robust relationship between economic growth, trade openness, and government consumption (see, e.g., Yimer, 2023b & 2023c). Trade openness allows for a more efficient allocation of resources and also facilitates the transfer of skills, know-how, and technology, all of which impact efficiency and productivity – an aspect usually emphasized in the endogenous growth models (Barro & Sala-i-Martin, 1997). Government consumption could have both positive and negative effects on growth. It positively affects growth through its expansionary effect on output or aggregate demand effect (Barro, 1990; Blanchard & Perotti, 2002). On the other hand, it has a negative impact on growth by increasing the fiscal deficit (and resulting in inflation in a supply-constrained economy) and crowding out the private sector (Yimer, 2023c), as well as wastage of resources, say through governance problems. Given that the Ethiopian economy has a significant state presence, it is vital to consider the size of the government in the analysis.

Thus, by substituting the control variables in Equation 1, we can investigate the growth effects of debt using Equation 2, as shown below:

$$y_t = \alpha + \beta_1 popg + \beta_2 k_t + \beta_3 op_t + \beta_4 gc_t + \beta_5 pd_t + \beta_6 pds_t + \varepsilon_t \qquad (2)$$

All the variables are as defined before and given in their natural logarithm form.

IV.2 THE INVESTMENT EQUATION: THE THEORETICAL MODEL AND DESCRIPTION OF VARIABLES

Considering the crucial role of investment in growth and the debt-overhang effect on investment, many studies (see, e.g., Akram, 2015) suggest that it is vital to analyse the relationship between public debt and investment. To do so, we will also estimate the following reduced-form investment equation (see Geda, 2002).

$$k_t = \gamma + \sum_{j=1}^{k} \delta_j w_{tj} + \sum_{m=1}^{p} \theta_m pd_{tm} + \xi_t \qquad (3)$$

where γ denotes the intercept, k_t represents investment at t time w_{tj} is a vector of control variables, δ_j is a vector of the coefficients of control variables. The vector pd_{tm} represents various public debt indicators, θ_m represents the vector of the coefficients of public debt indicators, and ξ_t is the usual error term. To analyze the impacts of public debt on investment in Ethiopia, we used time series data from 1980 to 2021 (see Table B1 in Annex B for the list of variables, their measurement, and the data sources).

Following the literature on the determinants of investment in general and the relationship between public debt and economic growth in particular (see Geda, 2002), the investment equation in this study includes the following variables as regressors: per capita real GDP (y), trade openness (op), interest rate (ir), inflation (inf) and two public debt indicators, total public debt (pd) and public debt service – all variables are used in their natural logarithm form. Thus, by substituting the control variables in Eq. (3), we can investigate the investment effects of debt using Eq. (4) as shown below:

$$k_t = \alpha + \beta_1 y_t + \beta_2 op_t + \beta_3 ir_t + \beta_4 inf_t ++ \beta_5 pd_t + \beta_6 pds_t + \xi_t \qquad (4)$$

IV.3 THE ECONOMETRIC TECHNIQUE: THE AUTOREGRESSIVE DISTRIBUTED LAG (ARDL) APPROACH

Several cointegration techniques exist in the literature, including the Engle-Granger (1987), Johansen (1988), Johansen-Juselius (1990), Phillips and Hansen (1990), Gregory and Hansen (1996), Saikkonen and Lütkepohl (2000), and Pesaran et al. (2001). This study employs the ARDL approach advanced by Pesaran et al. (2001) to empirically examine the effects of debt on economic growth (and investment) in Ethiopia for the period 1980–2021.

The ARDL approach has several advantages over other cointegration techniques. First, it can be used regardless of whether the variables are integrated of order 0 (I(0)) or 1 (I(1)) or have a combination of these integration orders. Traditional approaches require that all series have identical orders of integration (Phillips & Hansen, 1990; Johansen & Juselius, 1990; Engle & Granger, 1987). The ARDL approach, however, will be inefficient in the presence of I(2) or higher-order series. Second, unlike other multivariate cointegration techniques (see, e.g., Johansen & Juselius, 1990), this method is relatively simple and allows for estimating a cointegration relationship using the ordinary least squares (OLS)

method. Third, it is comparatively more robust and efficient in small samples comprising 30 to 80 observations (Pesaran et al., 2001).

In addition, traditional cointegration techniques may also encounter issues of endogeneity, whereas the ARDL technique typically yields unbiased estimates of the long-run model and valid t-statistics, even when the regressors are endogenous (Narayan & Smyth, 2005; Harris & Sollis, 2003; Pesaran et al., 2001; Pattichis, 1999; Pesaran & Shin, 1999; Pesaran et al., 1996). Furthermore, the appropriateness of using an ARDL model lies in the fact that it is based on a single-equation framework. ARDL cointegration simultaneously estimates short- and long-run relationships and provides unbiased and efficient estimates (Pesaran & Shin, 1999). An error correction model (ECM) can also be derived from an ARDL model through a simple linear transformation (Pesaran & Shin, 1999). As Pesaran and Shin (1999) noted, ECM combines short-term adjustments with long-term equilibrium while retaining long-term information. These advantages of the ARDL technique over other standard cointegration techniques justify its application in this study.

The estimation procedure in the ARDL framework involves two steps. First, the existence of a long-run relationship between the model's variables is tested by considering F-statistics, referred to as a "bound test". If evidence of a long-run relationship is found, the ARDL method is used in the second stage to estimate the short-run and long-run parameters. Following Pesaran et al. (2001), the ARDL model in this study can be written as follows:

$$y_t = \alpha \sum_{i=1}^{p} \gamma_i y_{t-i} + \sum_{j=1}^{k} \sum_{i=0}^{q_j} X'_{j,t-i} \beta_{j,i} + \varepsilon_t \qquad (5)$$

An ARDL is a least squares regression that includes the lags of both the dependent variable (y) and the explanatory variables (the X's) in Eq. 5. ARDL models are typically represented as ARDL ($p, q_1, \ldots, q_h$), where p represents the number of lags of the dependent variable, q_1 represents the number of lags of the first explanatory variable, and q_h represents the number of lags of the k-th explanatory variable. For an ARDL model written as Eq. (5), some of the explanatory variables, X_j, may have no lagged terms in the model ($q_j = 0$). These variables are referred to as static or fixed regressors. Explanatory variables with at least one lagged term are called dynamic regressors.

To specify an ARDL model, we must first determine the number of lags for each variable to be included (*i.e.,* specify $p, q_1, \ldots, q_h$) in the models. In this study, the optimal lag order of the ARDL is determined using the Schwarz Information Criterion (SIC). The SIC is particularly suitable for small sample sizes and offers a more concise specification than other information criteria in the literature (Pesaran & Pesaran, 2009).

Long-run relationships

Since an ARDL model estimates the dynamic relationship between a dependent variable and explanatory variables, it can be transformed into a long-run representation. This representation shows the long-run impact of changes in the explanatory variables, including public debt indicators, on the dependent variable in our models. The calculation of these estimated long-run coefficients, once the estimation is complete, is given by Eq. (6) as:

$$\theta_j = \frac{\alpha \sum_{i=1}^{q_j} \hat{\beta}_{j,i}}{1 - \sum_{i=1}^{p} \gamma_i} \qquad (6)$$

Cointegrating relationships and the ECM

The ECM-based cointegrating regression from an ARDL model is obtained by transforming Eq. (5) into differences and substituting the long-run coefficients from Eq. (6) into the resulting equation, resulting in (7):

$$\Delta y_t = -\sum_{i=1}^{p-1} \gamma_i^* \Delta y_{t-i} + \sum_{j=1}^{k} \sum_{i=0}^{q_j-1} \Delta X'_{j,t-i} \beta^*_{j,i} - \hat{\phi} EC_{t-1} + \varepsilon_t \qquad (7)$$

where $EC_t = y_t - \alpha - \sum_{j=1}^{k} X'_{j,t} \hat{\theta}_j$; $\hat{\phi} = 1 - \sum_{i=1}^{p} \hat{\gamma}_i$; $\beta^*_{j,i} = \sum_{j=1}^{q_j} \beta_{j,m}$

Bounds testing.

Using the cointegrating relationship form in Eq. (7), Pesaran et al. (2001) provided a methodology for testing whether the ARDL model contains a level (or long-run) relationship between the dependent variable and the regressors. The Bounds test procedure transforms Eq. (7) into the following representation:

$$\Delta y_t = -\sum_{i=1}^{p-1} \gamma_i^* \Delta y_{t-i} + \sum_{j=1}^{k} \sum_{i=0}^{q_j-1} \Delta X'_{j,t-i} \beta^*_{j,i} - \rho y_{t-1} - \alpha - \sum_{j=1}^{k} X'_{j,t-1} \delta_j + \varepsilon_t \qquad (8)$$

The test for the existence of level relationships is then simply a test of

$$\rho = 0$$

$$\delta_1 = \delta_2 = \ldots = \delta_k = 0 \qquad (9)$$

The coefficient estimates used in the test can be obtained from a regression using Eq. (5) or can be estimated directly from a regression using Eq. (8).

The test statistic based on Eq. (9) has a distinct distribution under the null hypothesis (which assumes no level relationships). This distribution varies depending on whether the regressors are all I(0) or all I(1). Further, in both cases, the distribution is non-standard. Pesaran et al. (2001) provide critical values for cases where all regressors are I(0) and cases where all regressors are I(1). They suggest using these critical values as upper and lower bounds for the more typical cases where the regressors are a mixture of I(0) and I(1).

At this stage, when the order of integration of all the variables is found to be I(1), the decision is made based on the upper critical bound. On the other hand, if all the series are I(0), the decision is made

based on the lower critical bound. If the F-statistic is higher than the upper bound critical value, we reject the null hypothesis (H_0) of no cointegration and conclude in favour of a long-run relationship. In contrast, if the F-statistic is below the lower critical bound, we cannot reject the null hypothesis of no cointegration, indicating no long-run relationship. However, the inference would be inconclusive if the F-statistic falls between the upper- and lower-bound critical values.

The standard ordinary least squares (OLS) model calculates the coefficient covariance matrix assuming no issues of autocorrelation or heteroskedasticity in the error terms (Geda & Yimer, 2016; White, 1980). If these assumptions do not hold, inferences based on the resulting error-correction model (ECM) will be invalid (Wooldridge, 2000; Roecker, 1991; White, 1980). However, heteroskedasticity and autocorrelation are common issues encountered in time series analysis. Thus, in such studies, estimating the coefficient covariance matrix is essential under the assumption that errors are conditionally heteroskedastic and serially correlated (Newey & West, 1987). The resulting estimator for the coefficient covariance is, which is known as the Heteroskedasticity and Autocorrelation Consistent Covariance (HAC) or Newey-West estimator is used in this study. This later procedure will only modify the standard errors of the estimated coefficients without altering the coefficients (Newey & West, 1987).

Finally, a series of diagnostic tests are conducted to assess the robustness and reliability of the ARDL model. These tests include assessing the normality of the error term, checking for serial correlation and heteroscedasticity, and verifying the functional form of the empirical model. All the models that have been reported have passed these tests. The models reported here are, thus, the best models we came up with after experimenting by estimating various models with different specifications, data points, and a battery of diagnostic tests.

This study estimates two versions of the growth and investment equations. The first model uses the total public debt stock variable. In contrast, the second model disaggregates the total public debt stock variable into external and domestic public debt in both the growth and investment equations. The ARDL specification of the models used to investigate the effects of public debt on economic growth and the public debt-investment nexus can be written as follows:

$$\Delta y_t = \alpha + \beta_1 y_{t-1} + \beta_2 popg_{t-1} + \beta_3 k_{t-1} + \beta_4 op_{t-1} + \beta_5 gc_{t-1} + \beta_6 pd_{t-1} + \beta_7 pds_{t-1} + \sum_{i=0}^{p_1} \gamma_{1i} \Delta popg_{t-i} + \sum_{i=0}^{p_2} \gamma_{2i} \Delta k_{t-i} + \sum_{i=0}^{p_3} \gamma_{3i}$$

$$\Delta y_t = \alpha + \beta_1 y_{t-1} + \beta_2 popg_{t-1} + \beta_3 k_{t-1} + \beta_4 op_{t-1} + \beta_5 gc_{t-1} + \beta_6 epd_{t-1} + \beta_7 dpd_{t-1} \beta_8 pds_{t-1} + \sum_{i=0}^{p_1} \gamma_{1i} \Delta popg_{t-i} + \sum_{i=0}^{p_2} \gamma_{2i} \Delta k_{t-i} + \sum_{i=0}^{p_3} \gamma_{3i} \Delta op_{t-1} + \sum_{i=0}^{p_4} \gamma_{4i} \Delta gc_{t-i} + \sum_{i=0}^{p_5} \gamma_{5i} \Delta epd_{t-i} + \sum_{i=0}^{p_6} \gamma_{6i} \Delta dpd_{t-i} + \sum_{i=0}^{p_7} \gamma_{7i} \Delta pds_{t-i} +$$

$$\Delta k_t = \alpha + \beta_1 k_{t-1} + \beta_2 y_{t-1} + \beta_3 op_{t-1} + \beta_4 ir_{t-1} + \beta_5 inf_{t-1} + \beta_6 pd_{t-1} + \beta_7 pds_{t-1} \sum_{i=0}^{p_1} \gamma_{1i} \Delta y_{t-i} + \sum_{i=0}^{p_2} \gamma_{2i} \Delta op_{t-1} + \sum_{i=0}^{p_3} \gamma_{3i} \Delta ir_{t-i} + \sum_{i=0}^{p_4} \gamma_{4i} \Delta inf_{t-i} + \sum_{i=0}^{p_5} \gamma_{5i} \Delta pd_{t-i} + \sum_{i=0}^{p_6} \gamma_{6i} \Delta pds_{t-i} + \xi_t \quad (12)$$

$$\Delta k_t = \alpha + \beta_1 k_{t-1} + \beta_2 y_{t-1} + \beta_3 op_{t-1} + \beta_4 ir_{t-1} + \beta_5 inf_{t-1} + \beta_6 epd_{t-1} + \beta_7 dpd_{t-1} + \beta_8 pds_{t-1} \sum_{i=0}^{p_1} \gamma_{1i} \Delta y_{t-i} + \sum_{i=0}^{p_2} \gamma_{2i} \Delta op_{t-1} + \sum_{i=0}^{p_3} \gamma_{3i} \Delta ir_{t-i} + \sum_{i=0}^{p_4} \gamma_{4i} \Delta inf_{t-i} + \sum_{i=0}^{p_5} \gamma_{5i} \Delta epd_{t-i} + + \sum_{i=0}^{p_6} \gamma_{6i} \Delta dpd_{t-i} + \sum_{i=0}^{p_7} \gamma_{7i} \Delta pds_{t-i} + \xi_t$$

V. DISCUSSION OF RESULTS

In this section, we will begin by presenting the pre-estimation tests that were conducted. The estimated model results are then presented, along with a test to assess the robustness of these results.

V.1 THE ECONOMETRIC RESULTS

Before estimating the models, we tested the stationarity of the variables (Table 1, with reported p-values). The results indicate that most of the variables are I(1), while two of them are I(0) (Table 1).

Table 1: ADF unit-root test results

Variable	Level		First difference		Inference
	Intercept	Intercept & trend	Intercept	Intercept & trend	
y	0.99	0.92	0.00	0.00	**I(1)**
k	0.38	0.14	0.00	0.00	**I(1)**
$popg$	0.00	0.00	0.00	0.00	**I(0)**
h	0.82	0.13	0.04	0.08	**I(1)**
op	0.53	0.12	0.00	0.00	**I(1)**
gc	0.47	0.31	0.00	0.00	**I(1)**
ir	0.22	0.46	0.00	0.00	**I(1)**
inf	0.00	0.00	0.00	0.00	**I(0)**
pd	0.10	0.17	0.00	0.00	**I(1)**
epd	0.30	0.30	0.00	0.00	**I(1)**
dpd	0.11	0.17	0.00	0.00	**I(1)**
pds	0.66	0.91	0.06	0.00	**I(1)**

Note: All the variables are as defined previously (see also for Table B1 in the Annex).

After determining the order of integration in the variables of our empirical model, as given in Eqs, (10)–(13), the bounds test for cointegration is conducted using the appropriate lag length. One of the most critical issues in applying the ARDL approach is choosing the order of the distributed lag functions.[8]

The results from the bounds test for the four models estimated in this study (i.e., two for the growth and two for the investment models) are presented in Table 2. Based on the bounds test for cointegration shown in Table 2, the null hypothesis of no long-run relationship among the variables in the respective models (i.e., the growth and investment models) is rejected - the computed F-statistic for the test equation is greater than the upper-bound critical value even at the one-percent level of significance for both the growth and the investment models.

[8] Since we have a small data sample (42 annual observations), SIC is the criterion used for choosing lag lengths. Pesaran et al. (2001) showed that SIC is preferable to other lag-length selection criteria because it is suitable for small sample sizes.

Table 2: The bound-test to cointegration: The growth model

Method: ARDL Bounds Test
Sample: 1980–2021
Null Hypothesis: No long-run relationships exist

Model 1	**The growth model** (Total public debt variable used as a regressor)	**Test Statistic**	**Value**	**k**
		F-statistic	6.37	7
		Significance	I0 Bound	I1 Bound
		10%	2.12	3.23
		5%	2.45	3.61
		1%	3.15	4.43
Model 2	**The growth model** (External public debt and domestic public debt replace total public debt as regressors.)	**Test Statistic**	**Value**	**k**
		F-statistic	7.84	7
		Significance	I0 Bound	I1 Bound
		10%	2.38	3.45
		5%	2.69	3.83
		1%	3.31	4.63
Model 3	**The investment model** (Total public debt variable used as a regressor)	**Test Statistic**	**Value**	**k**
		F-statistic	5.16	6
		Significance	I0 Bound	I1 Bound
		10%	2.12	3.23
		5%	2.45	3.61
		1%	3.15	4.43
Model 4	**The investment model** (External public debt and domestic public debt replace total public debt as regressors.)	**Test Statistic**	**Value**	**k**
		F-statistic	6.12	7
		Significance	I0 Bound	I1 Bound
		10%	2.38	3.45
		5%	2.69	3.83
		1%	3.31	4.63

Note: In Model 1, the cointegration test equation includes the dependent variable (y) and the following regressors: pd, pds, $popg$, k, op, and gc. In Model 2, pd is replaced by its components, epd and dpd, while keeping all other variables in Model 1 unchanged. In Model 3, the cointegration test equation includes the dependent variable (k) and the following regressors: pd, pds, ir, inf, and op. In Model 4, pd is replaced by its components, epd and dpd, while keeping all other variables in Model 1 unchanged. All the variables are as defined previously and also in Table B1 in Annex B. Pesaran, Shin, and Smith's (2001) critical values for the bounds test are used and reported.

V.1.1 THE GROWTH EFFECT: THE LONG-RUN AND SHORT-RUN MODELS RESULTS.

This section aims to answer the question, "Does public debt affect economic growth in Ethiopia?" and presents the results of the estimated models for this exercise (Tables 3 and 4). Specifically, the estimation results for Eq. (10) and Eq. (11) are discussed.

Table 3 shows the estimated results of the growth model given in Eq. (10). The results show that public debt has a statistically significant negative association with real output per capita in the long run. However, its short-run effect on a net basis is found to be zero, although it can be both negative and positive depending on the time lag. Debt service is found to have a statistically significant negative effect in both the long and short run. However, when compared to the short run, the effect's magnitude is more substantial in the long run (Table 3). In Ethiopia, high public debt service payments have a negative impact on economic growth, especially when the government's fiscal space is limited. As a result of high debt service payments, the government has less room to maneuver when dealing with economic downturns, which can result in reduced public investment, lower productivity, and slower economic growth. Moreover, the government may sometimes rely on increased taxation to service its debt, which can reduce consumer and business confidence, lowering economic growth in both the short and long run. Finally, Ethiopia's high public debt service payments often lead to inflationary pressures and stress on reserves. If the government monetizes the deficit (prints more money) to finance its domestic debt service obligations, this can lead to inflation, further reducing economic growth in the long run.

Table 3: The short-run and long-run model result: The growth model (Eq. 10)

Model: ARDL Cointegrating and Long Run Form			
Sample: 1980 2021			
The short-run model (Error Correction Model (ECM)) result			
Dependent Variable: Δ ln real GDP per capita			
Selected Model: ARDL(3, 1, 1, 2, 2, 2, 2)			
Variable	**Coefficient**	**Standard error**	**Prob.**
Δ(ln real GDP per capita(-1))	-0.20**	0.06	0.01
Δ(ln real GDP per capita(-2))	-0.82***	0.09	0.00
Δ(ln population growth)	-0.19***	0.04	0.00
Δ(ln gross capital formation as % of GDP)	0.16***	0.04	0.00
Δ(ln government consumption as % of GDP)	0.01	0.04	0.90
Δ(ln government consumption as % of GDP(-1))	-0.07***	0.04	0.00
Δ(ln openness)	0.09*	0.04	0.07
Δ(ln openness(-1))	-0.08**	0.03	0.03
Δ(ln total public debt as % of GDP)	-0.14***	0.04	0.00
Δ(ln total public debt as % of GDP(-1))	0.14**	0.05	0.03
Δ(ln public debt service as % of exports)	-0.02***	0.03	0.08
Δ(ln public debt service as % of exports(-1))	-0.02***	0.02	0.00
Δ(Regime dummy)	-0.08***	0.01	0.00
EC(-1)	-0.25***	0.05	0.00
The long-run model result			
Dependent Variable: ln real GDP per capita			
ln population growth	-1.72**	0.64	0.02
ln gross capital formation as % of GDP	0.88**	0.28	0.01
ln government consumption as % of GDP	-0.08	0.15	0.58
ln trade openness	0.69***	0.14	0.00
ln total public debt as % of GDP	-0.93***	0.19	0.00
ln public debt service as % of exports	-0.17***	0.02	0.00
Regime dummy	-0.30***	0.06	0.00
Constant	6.81***	0.62	0.00
Model diagnostic tests			
Test statistics	**Value**		
R-squared	0.99		
Adjusted R-squared	0.99		
F-statistic	28.11		
Prob(F-statistic)	0.00		
Jarque - Berra	2.55		
Prob(Jarque - Berra)	0.28		
Breusch-Godfrey Serial Correlation LM Test♣	0.23		
Heteroskedasticity Test: ARCH♠	0.82		
Ramsey RESET Test♠	0.71		

Note: Δ denotes change and ***, **, * indicates 1 %, 5% and 10% level of significance, respectively. EC is the adjustment coefficient (the error correction term). ♠ in the diagnostic tests indicates that the P-value for the F-Statistics is reported.

Table 4 presents the estimated results of the growth model given in Eq. (11), specifically the growth model with a disaggregated public debt variable. The results show that public debt can have both negative and positive effects, depending on the sources of borrowing in the short-run.

Table 4: The short-run and long-run model result: The growth model (Eq. 11)

Method: ARDL Cointegrating And Long Run Form Sample: 1980 2021			
The short-run model (Error Correction Model (ECM)) result			
Dependent Variable: Δ ln real GDP per capita			
Selected Model: ARDL(3, 2, 1, 1, 2, 0, 2, 2)			
Variable	**Coefficient**	**Standard error**	**Prob.**
Δ(ln real GDP per capita(-1))	-0.02	0.07	0.82
Δ(ln real GDP per capita(-2))	-0.80	0.11	0.00
Δ(ln population growth)	-0.25	0.04	0.00
Δ(ln population growth (-1))	0.16	0.05	0.01
Δ(ln gross capital formation as % of GDP)	0.20	0.01	0.00
Δ(ln government consumption as % of GDP)	0.04	0.02	0.06
Δ(ln openness)	0.02	0.01	0.30
Δ(ln openness(-1))	-0.09	0.01	0.00
Δ(ln external public debt as % of GDP)	-0.13	0.01	0.00
Δ(ln domestic public debt as % of GDP)	0.05	0.01	0.00
Δ(ln domestic public debt as % of GDP (-1))	0.20	0.02	0.00
Δ(ln public debt service as percent of exports)	0.01	0.03	0.74
Δ(ln public debt service as percent of exports (-1))	-0.07	0.02	0.00
Δ(Regime dummy)	-0.05	0.01	0.00
EC(-1)	-0.31	0.02	0.00
The long-run model result			
Dependent Variable: ln real GDP per capita			
ln population growth	-2.30	0.32	0.00
ln gross capital formation as % of GDP	0.79	0.06	0.00
ln government consumption as % of GDP	-0.40	0.06	0.00
ln openness	0.44	0.10	0.00
ln external public debt as % of GDP	-0.42	0.02	0.00
ln domestic public debt as % of GDP	-0.33	0.12	0.02
ln public debt service as % of exports	-0.25	0.01	0.00
Regime dummy	-0.17	0.03	0.00
Constant	6.18	0.34	0.00
Model diagnostic tests			
Test statistics	**Value**		
R-squared	0.99		
Adjusted R-squared	0.99		
F-statistic	46.22		
Prob(F-statistic)	0.39		
Jarque - Berra	0.39		
Prob(Jarque - Berra)	0.82		
Breusch-Godfrey Serial Correlation LM Test♣	0.24		
Heteroskedasticity Test: ARCH♠	0.11		
Ramsey RESET Test♠	0.72		

Note: Δ denotes change and ***, **, * indicates 1 %, 5% and 10% level of significance, respectively. EC is the adjustment coefficient (the error correction term). ♠ in the diagnostic tests indicates that the P-value for the F-Statistics is reported.

As shown in Table 4, the analysis reveals that external debt has a detrimental impact on the real per capita output of the country, both in the short and long run. In contrast, domestic debt is found to have a positive effect on economic growth in the short run, but its long-run impact is negative. Like our earlier

finding (Table 3), we found that debt servicing has a statistically significant negative effect on the real per capita output of the country, both in the short run and the long run (Table 4).

Based on the results in Tables 3 and 4, the estimated coefficient for the error-correction term (EC) is also statistically significant in both specifications. This finding suggests that, as Banerjee et al. (1998) noted, a significant negative coefficient for the error-correction term provides additional evidence of a stable long-term relationship among the variables used in the model. However, the EC's potency is not strong, indicating the difficulty of adjustment back to equilibrium once the country deviates from its long-run path – only 25 to 30 percent of deviation from the equilibrium is adjusted (corrected) in each period.

Regarding the control variables, the results of both models are generally consistent with the findings of previous studies on economic growth. For instance, in the long run, population growth and government consumption have a negative impact on real per capita output. On the other hand, gross capital formation and trade openness have a statistically significant positive impact on the country's per capita output. These findings on the control variables align with the results of existing literature and are consistent with theoretical expectations (see, for example, Yimer, 2023a; Yimer, 2023b).

In summary, the long-term negative effects of public debt on real per capita output may be due to the necessity of diverting resources away from productive activities to service the debt. While the short run positive effect of public debt (especially domestic debt) suggests that public debt can help stimulate economic growth through capital formation and boosting demand. A similar result has been found in other studies conducted in different countries (see, e.g., Akram, 2015; Mohamed, 2013). The long-run negative effect of public debt on per capita GDP aligns with the widely held view that public debt has a detrimental impact on economic growth (see, e.g., Table A1 in Annex A for further details).

A battery of model diagnostic tests was applied to assess the robustness of the estimated models (see Tables 3 and 4). The tests indicate that the estimated models have the desired statistical properties. Both models have a good fit and successfully passed a battery of tests, including tests for normality, heteroskedasticity, serial correlation, model specification, and stability. The Jarque-Bera statistic confirms the normality of the residuals, as the null hypothesis that "errors are normally distributed" is not rejected in each of the specifications of the growth model. Based on the results of the Breusch-Godfrey Lagrange Multiplier (LM) test and the Autoregressive Conditional Heteroskedasticity (ARCH) test, we do not have enough evidence to reject the null hypotheses of no serial correlation and no heteroscedasticity of the residuals, respectively. Thus, the estimated models have no serial correlation or heteroskedasticity issues. The Ramsey Regression Equation Specification Error Test (RESET) supports the null hypothesis of the correct functional form (Tables 3 and 4).

Model parameter stability is one of the requirements for a well-specified ARDL model (Murthy & Okunade, 2016). The stability of the regression coefficients is evaluated through stability tests, which can determine whether the regression equation remains stable over time (Pesaran & Pesaran, 2009). To assess the stability of the estimated coefficients, we conducted cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests on the recursive residuals derived from the estimated ARDL models for each specification of the growth equation, i.e., Eq. 10 and Eq. 11 (Figure 4 and 5).

Figure 4: Parameter stability tests: the growth model reported in Table 3

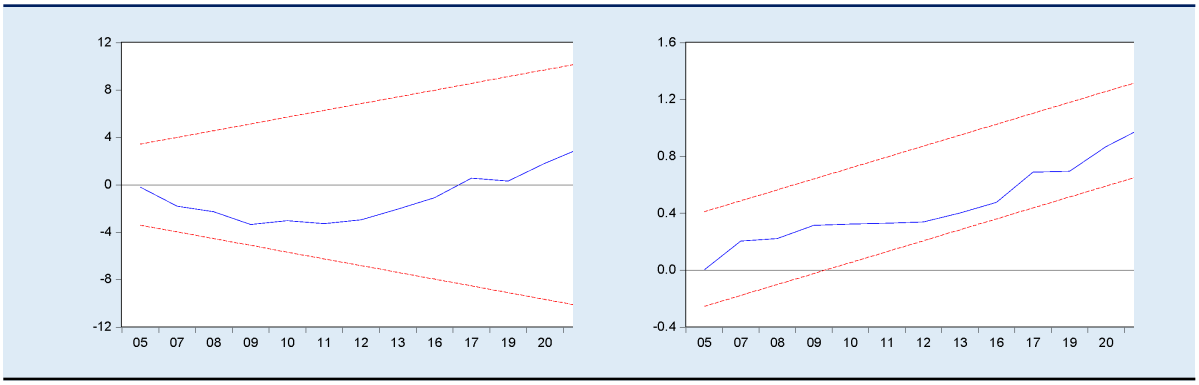
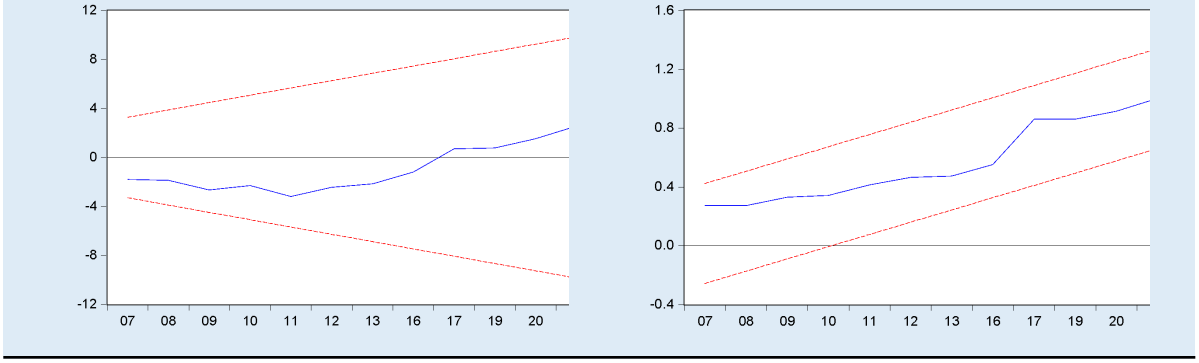


Figure 5: Parameter stability tests: the growth model reported in Table 4



The plots of CUSUM and CUSUMSQ statistics both fall within the critical bounds at the 5% significance level and do not cross the lower and upper critical limits in any of the estimated models (see Figures 4 and 5). This indicates that the estimated coefficients exhibit the desired parameter stability characteristics throughout the estimated model's entire sample period.

Regarding the robustness check, the estimated baseline growth models were examined to assess the robustness of the results. Although the results from such exercises are not reported here, alternative specifications using different sets of control variables of the estimated models have shown that the findings are robust across different specifications. The general conclusion is that the coefficients of the public debt variables are consistently estimated.[9]

[9] Interested readers are advised to refer to the working paper version of this study for a detailed presentation of the alternative robustness check estimation cited in the reference section as Yimer and Geda (2023).

V.1.2 THE INVESTMENT EFFECT: THE LONG-RUN AND SHORT-RUN MODELS RESULTS

The finding that public debt variables have a strong negative association with real per capita growth raises a crucial policy-relevant question: "How does public debt affect the country's growth?". The following section aims to provide insights into this by examining the relationship between public debt and investment in the country. Like the estimation of the growth model, we have estimated two versions of the investment equation. The first version uses the total public debt variable (Eq. 12). In contrast, the second one uses a disaggregated public debt variable (Eq. 13), where external and domestic public debt components replace the total public debt variable.

Table 5: The short-run and long-run model result: The investment model (Eq. 12)

Method: ARDL Cointegrating and Long Run Form **Sample:** 1980 2021			
The short-run model (Error Correction Model (ECM)) result **Dependent Variable:** Δ ln gross capital formation as % of GDP **Selected Model:** ARDL(2, 1, 0, 1, 0, 1, 1)			
Variable	**Coefficient**	**Standard errors**	**Prob.**
Δ(ln gross capital formation as % of GDP(-1))	-0.33***	0.05	0.00
Δ(ln real GDP per capita)	2.36***	0.13	0.00
Δ(ln trade openness)	0.19***	0.06	0.00
Δ(ln public debt as % of GDP)	0.28***	0.08	0.00
Δ(ln total public debt service as % of exports)	-0.02***	0.01	0.00
Δ(ln interest rate)	0.25	0.23	0.29
Δ(ln inflation)	-0.06***	0.01	0.00
Δ(Regime dummy)	0.10	0.12	0.43
EC(-1)	-0.33***	0.08	0.00
The long-run model result			
Dependent Variable: ln gross capital formation as % of GDP			
ln real GDP per capita	0.03	0.04	0.51
ln trade openness	0.60***	0.04	0.00
ln total public debt as % of GDP	-0.32***	0.04	0.00
ln public debt service as % of exports	-0.07***	0.00	0.00
ln interest rate	-0.07	0.64	0.91
ln inflation	-0.56***	0.09	0.00
Regime dummy	0.29	0.29	0.33
Constant	3.98***	1.37	0.01
Model diagnostic tests:			
Tests	**Test Statistic**		
R-squared	0.954		
Adjusted R-squared	0.929		
F-statistic	38.76		
Prob(F-statistic)	0.00		
Jarque - Berra	2.65		
Prob(Jarque - Berra)	0.27		
Breusch-Godfrey Serial Correlation LM Test♣	0.57		
Heteroskedasticity Test: ARCH♣	0.72		
Ramsey RESET Test♣	0.89		

Note: Δ denotes change; *** indicates 1 % level of significance. EC is the adjustment coefficient (the error correction term). ♣ in the diagnostic tests indicates that the P-value for the F-Statistics is reported.

Table 6: The short-run and long-run model result: The investment model (Eq. 13)

Method: ARDL Cointegrating and Long Run Form			
Sample: 1980 2021			
The short-run model (Error Correction Model (ECM)) result			
Dependent Variable: Δ ln gross capital formation as % of GDP			
Selected Model: ARDL(2, 1, 0, 1, 1, 0, 1, 1)			
Variable	**Coefficient**	**Standard errors**	**Prob.**
Δ(ln gross capital formation as % of GDP (-1))	-0.52***	0.01	0.00
Δ(ln real GDP per capita)	2.95***	0.03	0.00
Δ(ln trade openness)	0.19***	0.01	0.00
Δ(ln external public debt as % of GDP)	0.07***	0.00	0.00
Δ(ln domestic public debt as % of GDP)	0.34***	0.00	0.00
Δ(ln public debt service as % of exports)	-0.01**	0.00	0.01
Δ(ln interest rate)	0.18***	0.01	0.00
Δ(ln inflation)	-0.08***	0.00	0.00
Δ(Regime dummy)	0.31***	0.00	0.00
EC(-1)	-0.17***	0.01	0.00
The long-run model result			
Dependent Variable: ln gross capital formation as % of GDP			
ln real GDP per capita	1.01***	0.14	0.00
ln trade openness	1.09***	0.03	0.00
ln external public debt as % of GDP	-0.26***	0.01	0.00
ln domestic public debt as % of GDP	-0.06**	0.02	0.02
ln public debt service as % of exports	-0.03**	0.01	0.02
ln interest rate	-0.68***	0.04	0.00
ln inflation	-1.22***	0.09	0.00
Regime dummy	1.78***	0.15	0.00
Constant	-0.57	0.47	0.24
Model diagnostic tests			
Test statistic	**Value**		
R-squared	0.982		
Adjusted R-squared	0.965		
F-statistic	60.44		
Prob(F-statistic)	0.00		
Jarque - Berra	3.09		
Prob(Jarque - Berra)	0.21		
Breusch-Godfrey Serial Correlation LM Test♣	0.71		
Heteroskedasticity Test: ARCH♠	0.25		
Ramsey RESET Test♠	0.52		

Note: Δ denotes change; *** indicates 1 % level of significance. EC is the adjustment coefficient (the error correction term). ♠ in the diagnostic tests indicates that the P-value for the F-Statistics is reported.

As shown in Tables 5 and 6, public debt, both domestic and external, is found to have a positive impact on short-term gross capital formation (investment) – the short-run domestic debt effect being more potent. Public debt, particularly external public debt, can be a foreign currency source to finance imports and other forms of capital, thereby stimulating the economy. This can be particularly useful in countries like Ethiopia, where access to foreign currency is limited, making it difficult to finance investments through domestic sources. In addition, public debt can also help stabilize the economy during periods of volatility. A government can issue debt to finance programs and initiatives that can stimulate the economy, mitigate the negative impact of a crisis, and enable businesses and individuals to continue investing in the economy.

On the other hand, the result also shows that domestic and external public debt negatively impact long-term investment/gross capital formation – the external debt effect is four times more potent than the domestic debt effect, however. Some of the ways in which domestic public debt can negatively impact long-term capital formation include crowding-out private investment. When a government borrows heavily from domestic markets to finance its spending, it can financially crowd out private investors from accessing the same pool of funds. This can reduce private investment in the economy, which, in turn, can slow down the rate of capital formation and growth. In addition, high levels of domestic public debt can also reduce a government's fiscal space, which limits its ability to respond to future economic shocks or crises. That is, if a significant portion of the government's income is already committed to servicing debt and its repayments due to a high level of debt, it may be more challenging to allocate funds to crucial investments that could stimulate long-term development investment. Moreover, debt overhang problems and the inflationary effect of domestic debt, if it is created through monetization of deficit, could also negatively affect investment and growth.

Debt service payments are found to negatively impact gross capital formation both in the short and long run. In the short run, debt service payments can reduce the funds available for investment. When a government is required to make large debt payments, it may need to reduce spending in other areas, such as investment in infrastructure, education, and research and development. This can slow down the rate of capital formation and lower economic growth in the short term. In the long run, the negative impact of debt service payments on gross capital formation can be even more significant. If a government is consistently required to make large debt repayments over a long period, it can limit its ability to invest in sectors that are crucial for long-term economic growth. In a foreign exchange-constrained economy, this also means diverting the scarce foreign exchange available from its domestic use for production and investment towards repayment of the debt. Additionally, high debt levels can increase the risk of a financial crisis and potentially high taxes, as investors may become concerned about the government's ability to service its debt. The resulting economic instability and expected possible future tax burden can further reduce investment in the economy and lead to a long-term slowdown in growth.

Overall, Tables 5 and 6 reveal that in the long run, there is a negative and significant relationship between both external total public debt as a percentage of GDP and external debt servicing as a percentage of exports with investment in Ethiopia. However, changes in the public debt stock (i.e., debt-creating flows, as can be seen from the variable measured in changes) are found to have a positive relationship with investment. In contrast, debt servicing negatively affects investment in the short run. This aligns with the widely accepted belief that, in the short term, debt-creating flows positively impact growth by increasing domestic investment and stimulating the economy. On the other hand, debt service payments invariably indicate a reduction in the financial resources available for productive investments. This is especially true when the payments are made in foreign currency. This finding has extensive empirical support in previous studies (see, e.g., Akram, 2015; Fosu, 1999).

In summary, the cumulative effects of public debt and external debt servicing indicate that "debt overhang" and financial (including foreign exchange availability for all) "crowding-out" are the primary mechanisms that hinder investment and impede real per capita income growth.

A battery of model diagnostic tests was also applied to check the robustness of the estimated investment model. The tests indicate that the estimated models possess the desired statistical properties (see the diagnostic test results reported in Tables 5 and 6).

Model parameter stability tests have also confirmed that the estimated investment equation remains stable over time (Pesaran and Pesaran, 2009). Figures 5 and 6 present the results of these tests for the model results presented in Tables 5 and 6. The plots of CUSUM and CUSUMSQ statistics both fall

within the critical bounds at the 5 percent significance level and do not cross the lower and upper critical limits in the estimated investment models (Figures 5 and 6). This indicates that the estimated coefficients exhibit the desired characteristics of parameter stability over the sample period for both specifications of the investment model as well.

Figure 5: Parameter stability tests: the investment model reported in Table 5

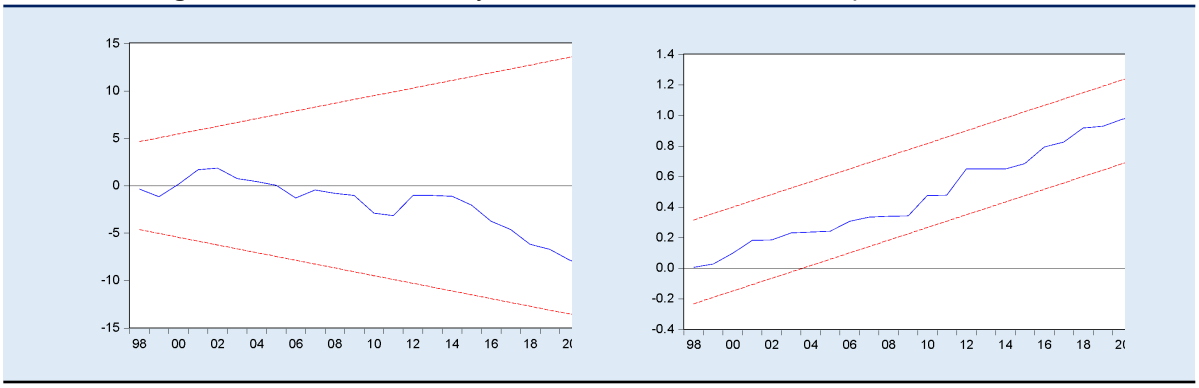
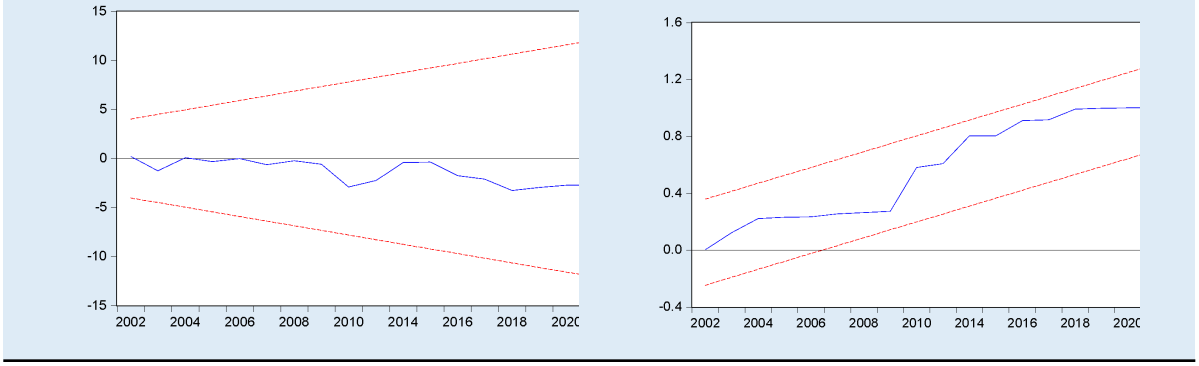


Figure 6: Parameter stability tests: the investment model reported in Table 6



Concerning the robustness check of the estimated baseline investment models (reported in Table 5 and Table 6), alternative specifications using different sets of control variables of the estimated model have shown that the findings are robust across various specifications (see the working paper version of this study for a more in-depth presentation of the alternative robustness check estimation, which is referenced as Yimer and Geda (2023).

VI. CONCLUSION

This study modestly attempts to contribute to the literature on economic growth and debt by revisiting the relationship between debt and growth in Ethiopia. The study examines the effects of public debt on economic growth in Ethiopia, both in the short and long run. In addition, it also examined the principal channel through which the impact of public debt is transmitted to economic growth, which is the investment channel.

Understanding the pathways and nature of the relationship between public debt and economic growth in Ethiopia is more crucial than ever. This is particularly true as the government intensifies its efforts to transform the country into a middle-income nation by 2030 and confronted with multiple shocks to

handel (both internal and external). This transformation and handling shocks requires a sustainable method of financing its ambitions. This is because the causal relationship between sovereign debt variables and economic growth has direct policy implications, particularly on tax, development financing and investment choices—and consequently on economic growth.

Therefore, it is essential for policymakers in Ethiopia to carefully analyze the relationship between debt and economic growth and take measures to make informed choices for financing growth and managing the debt sustainably. This may include implementing fiscal reforms, increasing revenue generation, and improving debt management practices. By doing so, Ethiopia can ensure that public debt is effectively utilized to promote long-term economic growth and development.

Using the ARDL modelling approach on annual data from 1980 to 2021, the empirical results obtained showed that public debt hinders long-term growth in Ethiopia. However, it (especially domestic debt) has a growth-enhancing effect in the short term, inter alia, by boosting investment.

As part of the debt issue, debt servicing has been proven to have a detrimental impact on growth and investment, both in the short and long term, as it requires a significant reduction in vital resources that could have otherwise been allocated to investment. In addition, while debt positively affects investment in the short run, its long-term impact is negative and significant.

Thus, debt is a two-edged sword for economic growth in Ethiopia. On the one hand, it can provide financing for investments in infrastructure and other projects that can stimulate economic growth. On the other hand, high debt levels can hinder economic growth, especially in the long run. Our results have some interesting policy implications.

Firstly, it is necessary to examine why increases in the public debt-to-GDP ratio negatively affect long-term growth in Ethiopia. Is it because public debt is used to finance projects of little value to future economic growth and is also inefficiently used? Or is it because the rise in public debt has benefited a few elites and corrupt officials at the expense of burdening the rest of the population with more debt and its servicing? The answer may be that a combination of all the elements comes into play.

Secondly, given the negative growth effect of debt from this study, the country should consider implementing institutional improvements in the effective and efficient use of debt-creating flows. This could be in areas of project analysis, selection and monitoring, and control mechanisms that ensure fiscal and ethical (non-corrupt) discipline by the government and its agencies. A detailed direction of such policy related to institutional challenges is provided in a companion study about “institutional aspect of the debt problem in Ethiopia” (Geda and Alemu, 2023).

This means it needs to enhance its institutional capacity to manage debt and debt-financed projects at large. The latter includes prudent fiscal discipline, domestic revenue mobilization to address the growing financing needs in the country, efficient debt management strategies to prevent the misuse of debt-creating inflows of captial and corruption, and improved prioritization of needs are some of the policy options to mitigate the adverse impact of public debt on economic growth.

In addition, to address the long-term negative growth effect of public debt, the country needs to implement prudent policy changes to ensure the best use of its spending (including public investment) and monitor private investment, as investment is the principal channel through which debt affects growth. One such policy direction, for instance, is using investment to address the structural trade deficit problem of the country, which is one of the crucial drivers of debt in the country.

Nonetheless, reducing budgetary and trade deficits and using such resources effectively may not be easy, nor will it be sufficient to address the debt problem. Thus, it is crucial to seriously consider

implementing additional public policies and strategies to address the domestic and external debt problems effectively. One way of doing this is directing deb-creating flows to areas and sectors that led to the high indebtedness in the first place. That will be the first step to address the country's debt challenge in a lasting manner. A detailed direction of such a strategy is given in a companion study about "drivers of debt" in Ethiopia (Geda and Yimer, 2023).

However, achieving this could be challenging in the short term due to the country's current political and economic context. The economy is being negatively affected by significant macroeconomic imbalances (inflation, shortage of foreign exchange and inability to service debt being the major ones), which in turn are partly the result of past wrong financing policies that are impacting the social and economic conditions of the population today, leading to high unemployment and poverty. The latter conditions are aggravated by periodic conflict. These challenges, in turn, require significant social spending and increased public investment, which will inevitably exacerbate the budget deficit and the indebtedness problem. That is why a strategic approach to transit from debt/aid dependency in the medium term and debt restructuring in the short run needs to be pursued.

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Annexes

Annex A: An overview of the empirical literature on the effects of public debt on economic growth

Table A1: An overview of the empirical literature on the effects of public debt on economic growth

Author	Scope	Debt type	Method	Effect on growth	
				Linear	Non-linear (Threshold effect)
Developing countries					
Sandow et al. (2022)	31 sub-Sahara African (SSA) countries (2005–2017)	External debt	System generalized method of moments (SGMM) and panel smooth transition regression (PSTR)	Negative	45% of GDP
Mohsin et al., (2021)	South Asian countries (Afghanistan, Bangladesh, Bhutan, India, Pakistan, Sri Lanka, Maldives, and Nepal) (2000–2018)	External debt	Panel ordinary least square, fixed effect, Quantile regression, and robust output regression were used to analyze the World Bank data from 2000 to 2018. South Asian countries,	Negative	
Maitra (2019)	Sri Lanka (1977–2016)	External debt	ARDL	Negative	
Mhlab & Phiri (2019)	South Africa (2002–2016)	Domestic debt	ARDL	Negative	
Burhanudin et al. (2017)	Malaysia (1970–2015)	Domestic debt	ARDL	Positive	
Onafowora & Owoye (2017)	Nigeria (1970–2014)	External debt	Vector autoregressive (VAR)	Negative	
Taher (2017)	Lebanon (1989–2014)	Domestic debt	Ordinary least square (OLS), Autoregressive moving average (ARMA)		>90% of GDP
Adamu & Rasiah	Nigeria (1970–2013)	External debt	ARDL	Negative	

(2016)					
Owusu-Nantwi & Erickson (2016)	Ghana (1970–2012)	External debt t	Johansen cointegration and Vector Error Correction Model (VECM)	Positive	
Siddique et al. (2016)	40 heavily indebted poor countries (HIPCs) (1970-2007)	External debt	ARDL	Negative	
Doğana & Bilgili (2014)	Turkey (1974–2009)	External debt	Markov Regime-switching approach	Negative	
Zouhaier & Fatma (2014)	19 developing countries (1990-2011)	External debt	Dynamic panel regression (Arellano-Bond estimator)	Negative	
Mohamed (2013)	Tunisia (1970–2010)	External debt	Engel and Granger error correction model (ECM)	Negative	>30% of GDP
Tchereni et al. (2013)	Malawi (1975–2003)	External debt		zero	
Adegbite et al. (2008)	Nigeria (1975–2005)	External debt	OLS and generalized least squares (GLS)	Negative	
Pattillo et al. (2006)	93 developing (1969–1998)	External debt	OLS; Instrumental variables (IV); FE; and SGMM	Negative	35–40% of GDP
Clements et al. (2003)	55 low-income countries (1970–1999)	External debt	Fixed effects (FE) & SGMM	Negative	>35% of GDP
Fosu (1999)	35 sub-Saharan Africa (SSA) (1980–1990)	External debt	OLS	Negative	
Elbadawi et al. (1997)	99 developing countries spanning SSA, Latin America, Asia, and the Middle East	External debt	Cross-section Regression (Fixed and random effect)	Negative	

Developed countries					
Liaqat (2019)	39 high income countries (1980–2017)	Domestic debt	Panel VAR	Negative	
Pegkas (2019)	Greece (1970–2016)	Domestic debt	Regression model with multiple thresholds		21%—50% & >90% of GDP
De Vita et al., 2018)	10 EMU, US, UK and Japan (1970–2014)	Domestic debt	Granger causality & ARDL cointegration	Negative	
Esteve & Tamarit, 2018)	Spain (1851–2013)	Domestic debt	Dynamic Ordinary Least Square (DOLS)		No threshold
Gómez-Puig & Sosvilla-Rivero (2018)	Euro area countries (1961–2015)	Domestic debt	Panel ARDL	Positive	
Shahor (2018)	Israel (1983–2013)	Domestic debt	Undefined		
Snieska & Burksaitiene (2018)	EU countries (2004–2016)	Domestic debt	Least square & autoregressive AR(p) model	Negative	
Pegkas (2018)	Greece (1970–2016)	Domestic debt	ARDL & VAR		>90% of GDP
Amann & Middleditch (2017)	United Kingdom (1995–2013)	Domestic debt	Granger causality & cointegration tests	Negative	
Kempa & Khan (2017)	11 major Euro zone countries (1991–2014)	Domestic debt	Panel VAR	zero	
Lee et al. (2017)	Advanced economies (1946–2009)	Domestic debt	Median regression		21%—50% of GDP
Panizzaa & Presbitero (2014)	17 developed OECD countries	Public debt (Domestic debt & external debt)	IV	zero	No threshold
Reinhart and Rogoff					

(2010)					
Mixed countries (Developing and Developed)					
Asteriou et al. (2021)	14 countries in Asia (1980–2012)	Public debt (Domestic debt & external debt)	Pooled mean group (PMG), mean group (MG), dynamic fixed effects (DFE) allowing for common correlated, and asymmetric panel Autoregressive Distributed Lag Model (ARDL) method	Negative	
Lim (2019)	41 advanced & emerging economies (1952–2016)	Total Debt (private & public debt)	Panel VAR	Negative	
Shkolnyk & Koilo (2018)	Ukraine & 10 emerging economies (2006–2016)	External debt	ADL model and correlation analysis		51%—70% of GDP
Intartaglia, Antoniades, & Bhattacharyya (2018)	48 developing & developed countries. (1961–2015)	Domestic debt	Panel VAR	Negative	
Arčabić, Tica, Lee, & Sonora (2018)	OECD & non-OECD countries (1960–2009)	Domestic debt	Panel VAR, FE, FE with IV, SGMM	zero	No threshold
Butkus & Seputiene (2018)	152 countries (1996–2016)	Domestic debt	SGMM, Pooled OLS (POLS) & LSDV		<20% & >90% of GDP
Karadam (2018)	135 countries (1970–2012)	Domestic debt	PSTR		71%—90% & >90% of GDP
Ramos-Herrera & Sosvilla-Rivero (2017)	115 developed & developing economies. (1970–2013)	Public debt (Domestic & external debt)	Mean, median, winsorized mean & trimmed mean	Negative	
Chudik et al.	40 countries	Domestic	Panel ARDL	Nega	

(2017)	(1965–2010)	debt		tive	
Ewaida (2017)	Highly indebted countries in Euro & non-Euro zone (1993–2013)	Domestic debt	POLS	Nega tive	
Awdeh & Hamadi (2017)	18 MENA countries (2002–2016)	Domestic debt	Cointegration and Vector Error Correction Modeling (VECM)	Nega tive	
Kim et al. (2017)	77 countries (1990–2014)	Domestic debt	POLS, FE & SGMM		No threshold
Chiu & Lee (2017)	61 countries (1985–2009)	Domestic debt	PSTR	Positi ve & Nega tive	
Brida et al. (2017)	16 countries in Euro & non-Euro (1977–2015)	Domestic debt	Minimal spanning tree & hierarchical tree		71%—90% of GDP
Ahlborn & Schweickert (2016)	111 developing & developed economies. (1971–2010)	Domestic debt	FE & 2SLS		51%—70% of GDP
Chen et al. (2016)	65 developing & developed economies. (1991–2014)	Domestic debt	PSTR		21%—50% of GDP
Woo & Kumar (2015)	38 advanced and emerging economies (1970–2008)	Public debt (Domestic debt & external debt)	POLS, robust regression, between estimator (BE), fixed effects (FE) panel regression and system GMM (SGMM) dynamic panel regression	Nega tive	>90% of GDP
Calderón & Fuentes (2013)	136 developed and developing countries (1970-2010)	Public debt (Domestic debt & external debt)	Time series, cross-country growth regressions	Nega tive	
Kumar & Woo (2010)	38 advanced & emerging	Public debt (Domestic	Between estimators (BE); Pooled OLS; FE;	Nega tive	>90% of GDP

	economies (1970–2007)	debt & external debt)	SGMM		
Reinhart & Rogoff (2010)	44 advanced & emerging economies (1946-2009)	Public debt (Domestic debt & external debt)	Descriptive data analysis		90% of GDP

Annex B: Definition, measurement and data sources of the variables

Table B1: Definition, measurement, and data sources of the variables

Variable	Definition and measurement	Source
y_t	The natural log of real GDP per capita at 2017 US$ constant prices	NBE various years annual reports
k	The natural log of gross capital formation as a percentage of GDP	NBE various years annual reports
pd	The natural log of total public debt as a percentage of GDP	MOFED various years annual reports
pd	The natural log of external public debt as a percentage of GDP	MOFED various years annual reports
pd	The natural log of domestic public debt as a percentage of GDP	MOFED various years annual reports
pds	The natural log of public debt service as a percentage of exports	World Bank (2023a)a
$popg$	The natural log of population growth rates	World Bank (2023b)
op	The natural log of trade openness (TO) where $TO = \left(\frac{\frac{(exports+imports)}{2}}{GDP}\right) * 100$	Calculated based on NBE various years annual reports
gc	The natural log of government consumption expenditure as a percentage of GDP	NBE various years annual reports
inf	The natural log of inflation calculated as ln (1+inflation)	
ir	Nominal lending interest rate	NBE various years annual reports

Note: y represents the natural logarithm of real GDP per capita. k represents the natural logarithm of gross capital formation as a percentage of GDP. $popg$ represents the natural logarithm of population growth rates. h represents the natural logarithm of the human capital index. op represents the natural logarithm of trade openness. gc represents the natural logarithm of government consumption as a percentage of GDP. ir represents the natural logarithm of the lending interest rate. pd represents the natural logarithm of the total public debt as a percentage of GDP. epd represents the natural logarithm of the external public debt as a percentage of GDP. dpd represents the natural logarithm of the domestic public debt as a percentage of GDP. pds represents the natural logarithm of the total public debt service as a percentage of exports.

Annex C: Summary statistics and correlation matrix

Table C1: Summary statistics: The growth model in Eq. (10)

	y	$popg$	k	gc	op	pd	pds
Mean	5.87	1.06	3.01	2.49	2.95	4.11	2.64
Median	5.70	1.10	3.12	2.54	3.02	4.12	2.85
Maximum	6.73	1.14	3.65	3.04	3.66	4.80	3.80
Minimum	5.37	0.33	2.18	2.07	2.07	3.11	1.03
Std. Dev.	0.41	0.12	0.44	0.25	0.36	0.39	0.75
Skewness	0.91	-5.57	-0.17	0.08	-0.28	-0.32	-0.45
Kurtosis	2.40	34.55	1.80	2.03	2.79	2.80	2.30
Observations	42.00	42.00	42.00	42.00	42.00	42.00	42.00

Table C2: Correlation matrix: The growth model in Eq. (10)

	y	$popg$	k	gc	op	pd	pds
y	1.00						
$popg$	0.24	1.00					
k	0.74	0.19	1.00				
gc	-0.68	-0.02	-0.56	1.00			
op	0.67	0.10	0.84	-0.49	1.00		
pd	-0.47	-0.22	-0.14	0.35	-0.12	1.00	
pds	-0.04	-0.10	-0.40	0.24	-0.41	0.31	1.00

Table C3: Summary statistics: The growth model in Eq. (11)

	y	$popg$	k	gc	op	epd	dpd	pds
Mean	5.87	1.06	3.01	2.49	2.95	-0.83	4.11	2.64
Median	5.70	1.10	3.12	2.54	3.02	-0.72	4.11	2.85
Maximum	6.73	1.14	3.65	3.04	3.66	0.32	4.78	3.80
Minimum	5.37	0.33	2.18	2.07	2.07	-2.28	3.10	1.03
Std. Dev.	0.41	0.12	0.44	0.25	0.36	0.71	0.39	0.75
Skewness	0.91	-5.57	-0.17	0.08	-0.28	-0.27	-0.31	-0.45
Kurtosis	2.40	34.55	1.80	2.03	2.79	2.14	2.81	2.30
Observations	42	42	42	42	42	42	42	42

Table C4: Correlation matrix: The growth model in Eq. (11)

	y	$popg$	k	gc	op	epd	dpd	pds
y	1.00							
$popg$	0.24	1.00						
k	0.74	0.19	1.00					
gc	-0.68	-0.02	-0.56	1.00				

op	0.67	0.10	0.84	-0.49	1.00			
epd	-0.60	-0.31	-0.44	0.38	-0.41	1.00		
dpd	-0.47	-0.21	-0.13	0.35	-0.12	0.81	1.00	
pds	-0.04	-0.10	-0.40	0.24	-0.41	0.52	0.31	1.00

Table C5: Summary statistics: The investment model in Eq. 12

	k	y	op	pd	ds	ir	inf
Mean	3.01	5.87	2.95	4.11	2.64	2.33	2.91
Median	3.12	5.70	3.02	4.12	2.85	2.38	3.01
Maximum	3.65	6.73	3.66	4.80	3.80	2.74	4.22
Minimum	2.18	5.37	2.07	3.11	1.03	1.92	0.00
Std. Dev.	0.44	0.41	0.36	0.39	0.75	0.23	0.77
Skewness	-0.17	0.91	-0.28	-0.32	-0.45	-0.40	-1.83
Kurtosis	1.80	2.40	2.79	2.80	2.30	2.70	7.68
Observations	42	42	42	42	42	42	42

Table C6: Correlation matrix: The investment model in Eq. 12

	k	y	op	pd	ds	ir	inf
k	1.00						
y	0.74	1.00					
op	0.84	0.67	1.00				
pd	-0.14	-0.47	-0.12	1.00			
ds	-0.40	-0.04	-0.41	0.31	1.00		
ir	0.46	0.13	0.59	0.17	-0.37	1.00	
inf	0.17	0.29	0.11	-0.33	-0.15	0.08	1.00

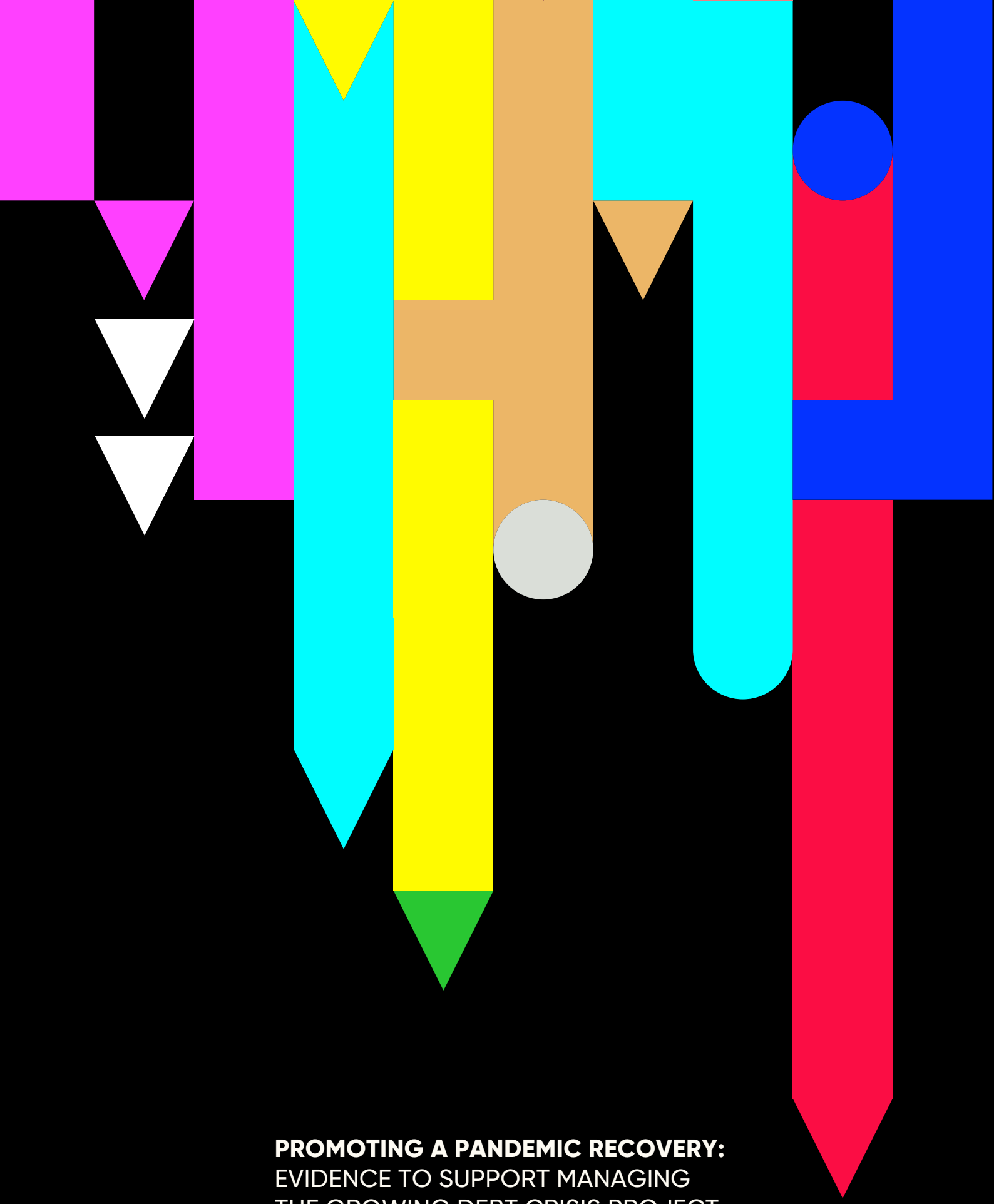
Annex C7: Summary statistics: the investment model in Eq. 13

	k	y	op	epd	dpd	ds	ir	inf
Mean	3.01	5.87	2.95	-0.83	4.11	2.64	2.33	2.91
Median	3.12	5.70	3.02	-0.72	4.11	2.85	2.38	3.01
Maximum	3.65	6.73	3.66	0.32	4.78	3.80	2.74	4.22
Minimum	2.18	5.37	2.07	-2.28	3.10	1.03	1.92	0.00
Std. Dev.	0.44	0.41	0.36	0.71	0.39	0.75	0.23	0.77
Skewness	-0.17	0.91	-0.28	-0.27	-0.31	-0.45	-0.40	-1.83
Kurtosis	1.80	2.40	2.79	2.14	2.81	2.30	2.70	7.68
Observations	42	42	42	42	42	42	42	42

Annex C8: Correlation matrix: the investment model in Eq. 13

	k	y	op	epd	dpd	ds	ir	inf
k	1.00							
y	0.74	1.00						
op	0.84	0.67	1.00					
epd	-0.44	-0.60	-0.41	1.00				
dpd	-0.13	-0.47	-0.12	0.81	1.00			

ds	-0.40	-0.04	-0.41	0.52	0.31	1.00		
ir	0.46	0.13	0.59	0.05	0.17	-0.37	1.00	
inf	0.17	0.29	0.11	-0.42	-0.33	-0.15	0.08	1.00



PROMOTING A PANDEMIC RECOVERY:
EVIDENCE TO SUPPORT MANAGING
THE GROWING DEBT CRISIS PROJECT