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The link between public debt and public investment in Tanzania

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WIDER Working Paper 2022/155

The link between public debt and public investment in Tanzania

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In partnership with



This publication results from [Sustainable development solutions for Tanzania – strengthening research to achieve SDGs](#), a collaborative project between the [UONGOZI Institute](#) in Dar es Salaam, Tanzania, and [UNU-WIDER](#) in Helsinki, Finland, with a main research objective of informing the development and implementation of policies aiming for economic transformation and sustainable development in Tanzania and the East African region. With financial support provided by the Ministry for Foreign Affairs of Finland, the joint project was launched in 2018 with key research questions giving the partners a framework for collaboration and the research work to be undertaken. The project focuses on macroeconomic perspectives, domestic resource mobilization, extractives, industrialization, sustainable livelihoods, and gender as a cross-cutting issue. The project provides local stakeholders a platform for research and policy discussions on Tanzania and bridges these discussions to the regional and international development debate.

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Abstract: In a bid to realize its development aspirations, Tanzania has made concerted efforts to increase public investment, particularly in the last decade. A significant proportion of these investments are financed by contracting debt, manifested by the rapid accumulation of public debt, especially external debt, with a notable rise in debt-servicing obligations. In view of these developments, this study sought to investigate the relationship between public debt and investment in Tanzania. The empirical analysis was conducted using the autoregressive distributed lag estimation approach based on data for the period 1976–2020. The results show that an increase in external debt has a positive impact of boosting public investment. However, the lagged effect of external debt accumulation is negative in the long run. Arguably, this could be attributable to the need to service and repay the debt which, depending on the cost of debt servicing, limits the net resources available for additional investment. Thus, it is of essence to ensure optimal use of resources by prioritizing and enhancing efficiency of public investment. Additionally, other avenues of funding such as public–private partnerships and financial market development could be explored to reduce dependence on external debt.

Key words: public investment, Tanzania, public debt

JEL: E20, E22, H60, H63

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1 Introduction

One of the reasons why governments contract debts is to overcome budget constraints and grow their economies. This could be achieved through funding investments and other potential income or employment generating activities and services that increase returns to investment and foster development. Public investments,¹ it is generally believed, lead to higher productivity and living standards due to their large scope and positive externalities that accrue to the wider society in comparison to private investment (Bivens 2012). While appropriate use and management of public debt potentially facilitate higher economic growth and socio-economic development, higher debt levels particularly in low-income countries can lead to debt overhang, and ultimately inhibit growth. This could for instance arise if the debt service burden substantially reduces the resources available for spending on growth-enhancing activities or leads to higher tax burden in a bid to repay the debt. It is often argued that high public debt burden may crowd-out private investment which, in turn, would weaken the positive effect of government investment on economic growth. Thus, whereas public debt can boost private and public investment, challenges emerge when a country's ability to meet its debt servicing and debt obligations becomes a strain on the economy and erodes the benefits of acquired investments or discourages potentially viable investments, especially if future earnings are earmarked to pay creditors. Following the 2008 global financial crisis and the recent COVID-19 pandemic, most countries have struggled to navigate the narrow path of maintaining an intricate balance of deploying an expansionary fiscal policy to revive economies and avoiding a fall into a debt trap.

Tanzania is a developing country with the aspiration of becoming a semi-industrialized economy. However, the country is faced with a number of challenges, including low investment and employment opportunities for its growing population estimated at 61.7 million in 2022 (URT 2022).² Over the last decade, Tanzania has made unprecedented efforts to improve physical (transport and energy), social (education, health, water, sanitation), as well as information and communication technology (ICT) infrastructure in a bid to realize its development objectives as outlined in the Tanzania Development Vision 2025 (URT 2000). A significant proportion of these efforts have been financed by publicly contracted debt, manifested by a rapid accumulation of public debt, especially external debt, with a notable rise in debt-servicing obligations in recent years. External debt accounts for slightly over 70 per cent of public debt. Given the limited domestic resources including relatively low tax revenues and dwindling foreign aid, the government has to borrow to finance the increased demand for public investments—including physical infrastructure development (roads, electricity, bridges, rail lines, airports, water storage and distribution facilities, health facilities)—that are, ideally, also expected to crowd-in private investments.

Although Tanzania experienced debt distress in the 1990s, the debt relief support received in the early 2000s under the heavily indebted poor countries (HIPC) and Multilateral Debt Relief

¹ Public investments are expenditures by the state and/or local governments devoted to building a country's capital stock by constructing the basic physical infrastructure, funding innovative activity (e.g. research), undertaking green investments (clean power sources and environmental conservation), spending on education and health, social amenities, among others (Bivens 2012).

² The United Republic of Tanzania (URT) comprises of Tanzania Mainland and Zanzibar Isles, borne of the union of two independent states of Tanganyika (by then) and Zanzibar (comprising of the Islands of Unguja and Pemba), in 1964. The 61.7 million is comprised of 59.8 million for Tanzania Mainland and 1.9 million for Zanzibar. The study pertains to Tanzania Mainland only and hence, unless otherwise stated, the word 'Tanzania' is in reference to the mainland.

Initiative (MDRI) relieved the debt burden substantially and provided fiscal space for increased borrowing. However, with the fiscal space having narrowed amid growing expenditure needs, the rising accumulation of debt, especially commercial debt, is a matter of concern, particularly in light of challenges posed by global shocks including the COVID-19 pandemic. Given the relatively large share of external debt, shocks and uncertainty in the global economy has heightened debt vulnerability with implications on the domestic economy. Besides debt sustainability concerns, the question is whether the increased acquisition of public debt has the desired positive outcomes.

Several studies generally show there is a limit to the positive effects of accumulating public debt, particularly in light of public debt challenges in developing economies, which can constrain its effectiveness (Reinhart and Rogoff 2010; DiPeitro and Anoruo 2012; Eberhardt and Presbitero 2015; Baharumshah et al. 2017; Chen et al. 2017; Law et al. 2021). Whereas there is a growing literature on the debt–growth nexus in developing economies (Clements et al. 2003; Lotto and Mmari 2018; Salama and Said 2018; Yusuf and Said 2018; Ogunjimi 2019; Ehikioya et al. 2020), the link between public debt and public investment has not attracted much attention, notwithstanding the challenges developing and low-income countries like Tanzania face in revamping public investments to catch up, amidst binding financing constraints. Moreover, most of the empirical literature is mostly based on cross-country studies. However, country case studies are best suited to provide ample scope for the analysis of specific country characteristics and reforms, demonstrate heterogeneity, and underscore the importance of domestic political economy. For instance, Tanzania’s socialist background underpinned by the historical dominance of the role of state in the economy makes its case unique. The role of the private sector became only more apparent following the fiscal reforms and liberalization of the economy in the 1990s.

Against this background this paper empirically investigates the relationship between public debt and public investment in Tanzania, particularly in the context of the rising debt accumulation and debt service obligations. Empirical analysis was conducted using the autoregressive distributed lag (ARDL) approach based on time series data for the period 1976–2020. The empirical findings show that whereas an increase in external debt has the desired positive impact of expanding current public debt investment, the lagged effect of debt accumulation is negative. Arguably, this could be due to various factors including the need to repay accumulated debt and cost of debt servicing, which limits the net resources available for additional investment. Given the limiting long-run effects of accumulating external debt, prioritization of projects and increased efficiency of public investment could help ensure optimal use of borrowed resources, while keeping the rapid debt accumulation, especially commercial debt, in check.

The rest of the paper is organized as follows: Section 2 outlines general trends of key economic and fiscal indicators, public debt, and public investment. Section 3 provides a brief review of the literature, including the theoretical underpinnings of the relationship between public investment and public debt and a synopsis of empirical literature. The empirical model and estimation methodology are outlined in Section 4. The results of the analysis are presented and discussed in Section 5. Section 6 concludes and provides some policy implications.

2 Overview of fiscal, public debt, and public investment trends

2.1 General economic performance and fiscal trends

Tanzania recorded notable economic growth averaging 6.9 per cent over the past decade. Prior to the COVID 19 pandemic, the country was among the fastest growing economies in sub-Saharan Africa (SSA) with real gross domestic product (GDP) growth of 7.0 per cent in both 2018 and

2019. The fairly higher growth was underpinned by strong performance in construction, agriculture, mining and quarrying, and transport and storage activities. Thanks to the steady economic growth, the country transitioned from a low-income to a lower middle-income country status in 2020. However, although Tanzania's economic growth did not slip to the negative territory in 2020 as was the case for most economies, it slowed down considerably to 4.8 per cent, owing to the adverse impact of the COVID-19 pandemic on some sectors, particularly tourism, hotels and accommodation, trade, education, and some social activities. Additionally, the excessive rains during the year caused damage to an already weak infrastructure base, which inhibited transportation and delayed the implementation of some development projects. Nonetheless, for the most part, at least in the past five years or so, the macroeconomic environment has remained stable, with annual inflation rate³ averaging 4.7 per cent between 2013 and 2020. Whereas the value of the Tanzanian shilling (TZS) depreciated by 44.2 per cent from 1,598.7 Tanzanian shillings per US dollar (US\$) to 2305.6 in 2020,⁴ it was fairly stable between 2016 and 2020 during which the shilling depreciated by 5.9 per cent.

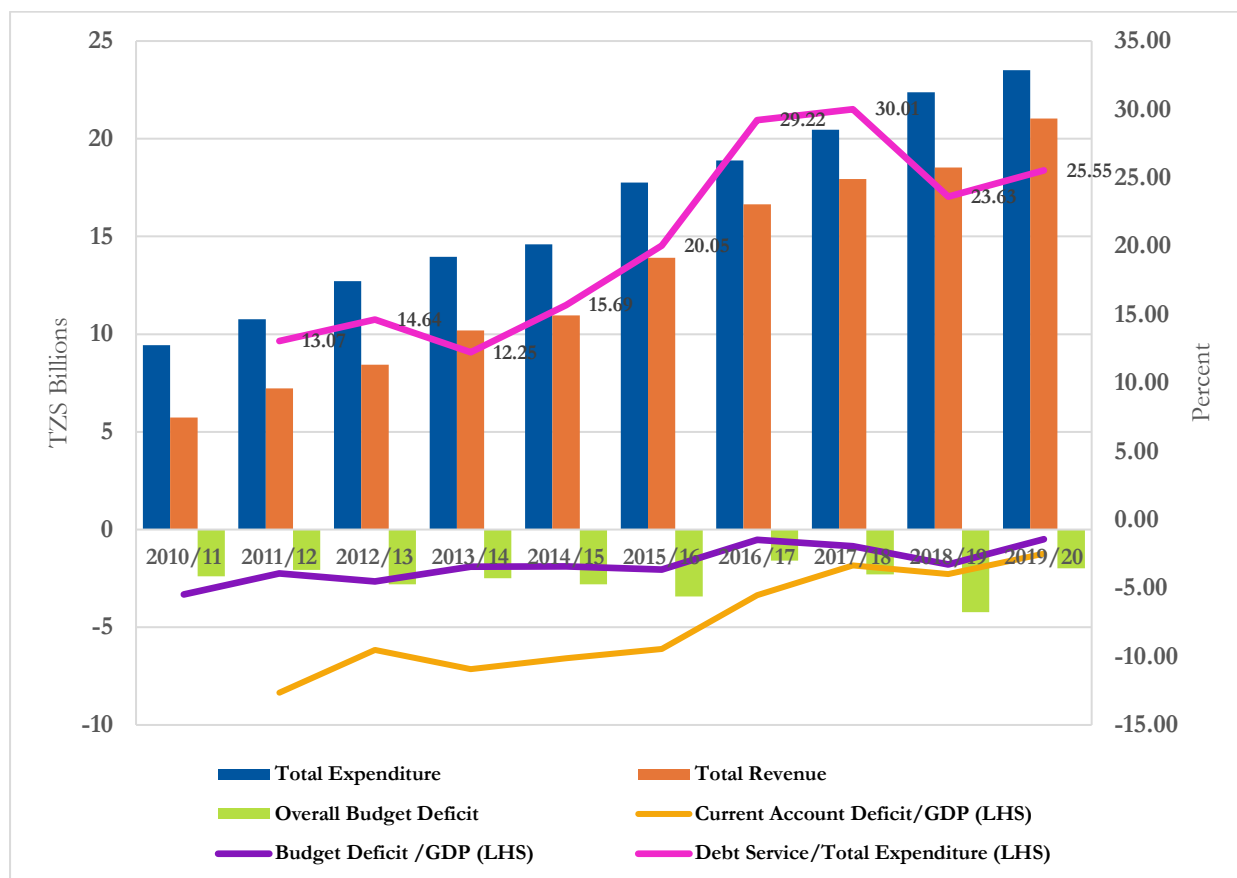
In terms of external balance, the ratio of current account deficit to GDP was high at 12.6 per cent in 2011, but has been on a narrowing trend since then, reaching 2.5 per cent in 2019 (Figure 1). The narrowing was on the account of good performance of particularly non-traditional exports (gold, manufacturing, tourism, and horticulture). The current account deficit ratio averaged 6.3 per cent of GDP over the last decade, with the average narrowing to 3.4 per cent of GDP in the last five years to 2019.

Overall budget deficit to GDP ratio ranged between 5.46 and 1.42 per cent in the past decade (Figure 1). The fairly low and stable budget deficit has been largely supported by external financing. It increased to 3.4 per cent of GDP in 2021 following weak revenue performance and increased financing needs to address the impacts of COVID-19. A closer scrutiny of the budget trends indicates overall deficit has tended to fluctuate in line with the growth of total revenues and total expenditures, with deficits expanding when the total expenditures grow relatively faster than total revenues and vice versa.

³ End of period rates.

⁴ Period average.

Figure 1: Selected budgetary and current account deficit trends 2010/11–19/20

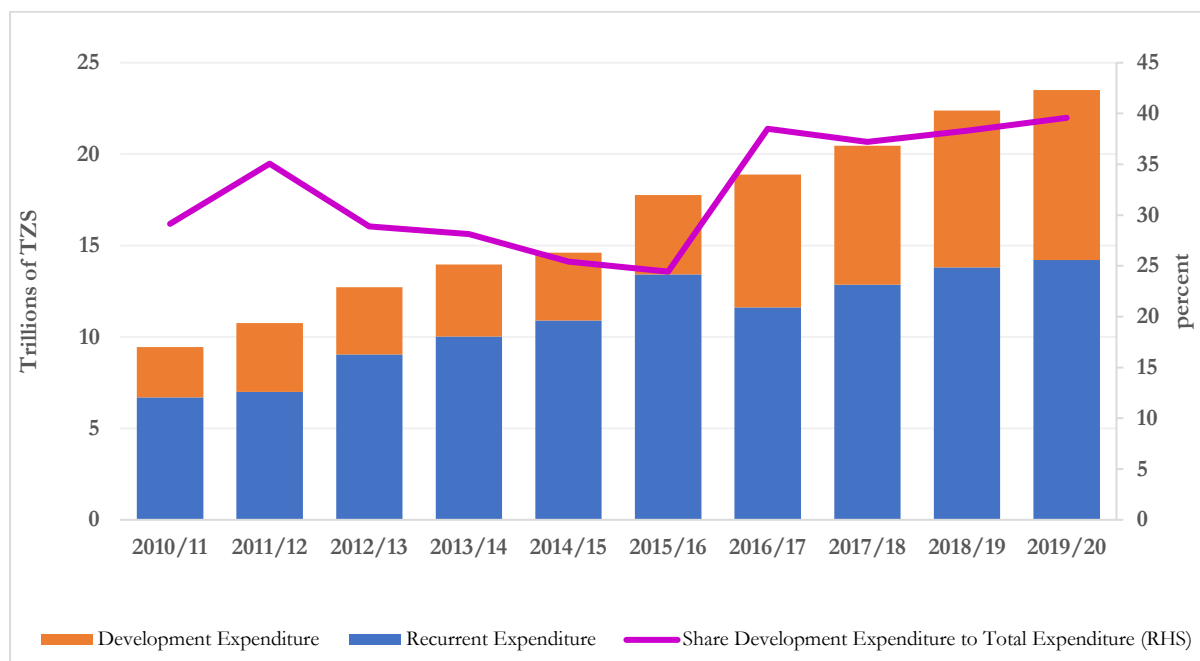


Source: authors' illustration based on data from various Bank of Tanzania (BOT) annual reports.

In terms of expenditure composition, both recurrent and development expenditures have increased over time (Figure 2). However, there has been a significant increase in the share of development expenditure since 2016/17, having risen sharply from about 24.4 per cent in 2015/16 to 38.5 in 2016/17. This was propelled by a 67 per cent increase in annual development expenditure following the government's resolve to implement the National Five-Year Development Plan 2016/17 (FYDP II) under the late President John Magufuli. The expenditure involved huge outlays, particularly on flagship projects such as construction of the new standard gauge railway line across the central corridor, revamping of the ailing national carrier, construction of Julius Nyerere Hydropower Project along the Rufiji River Basin, and various other energy projects. There was also significant investment spending on revamping transport infrastructure (roads and bridges) as well the construction and/or rehabilitation of social infrastructure (hospitals, health centres, dispensaries, clean and wastewater pipes, etc.). The increase was higher compared to the 35.1 per cent increase observed in 2011/12 when the National Five-Year Development Plan 2011/12–15/16 (FYDP I) came into force.

Notwithstanding the fairly stable macroeconomic indicators, of concern is the rapidly rising trend in the share of debt service to expenditure, concomitant with the rise in development expenditure, particularly over the last decade (Figures 1 and 2). The increase in the debt service burden is mainly attributable to increased accumulation of commercial debt, which is more expensive than concessional debt. Moreover, access to international financial markets, while providing opportunities for financial government spending, has introduced new risks, such as vulnerability to changes in financing conditions (DFI 2009).

Figure 2: Recurrent and development expenditure trends 2010/11– 19/20



Source: authors' illustration based on data from various BOT annual reports.

2.2 Recent public debt developments⁵

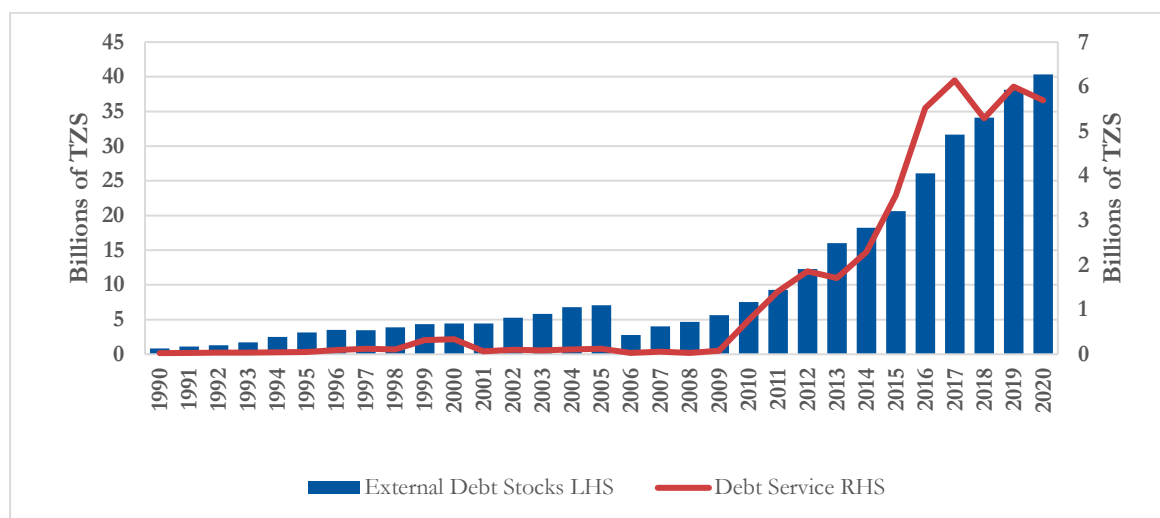
Tanzania's public debt more than tripled from US\$6.1 billion (24.5 per cent of nominal GDP) in June 2008 to US\$22.5 billion (38.7 per cent of nominal GDP) by June 2018. As of June 2020, the stock of public debt stood at US\$24.5 billion, out of which 72.6 per cent was external debt (BOT 2021). The increased accumulation of debt can in part be attributed to the government's strive to improve and upgrade transportation and energy infrastructure. External debt has continued to account for a significant proportion of the public debt, having increased to US\$16.7 billion (72 per cent of total public debt) by June 2019, from US\$4.4 billion by June 2008 (44.8 per cent of total public debt). The share of domestic public debt to total public averaged 16.2, 25.24, and 27.7 per cent between 1997–2000, 2001–10, and 2011–20, respectively.

Equally important is the change in the composition of public debt, particularly the considerable increase in non-concessional sources whose proportion rose from below 10 per cent of the external public debt in June 2011 to 41 per cent in June 2019 (Were and Mollel 2020). In line with this trend, Tanzania is increasingly sourcing its financing from commercial sources, which are relatively more costly. As of June 2019, 33.4 per cent of the public debt was accrued from commercial sources, up from 18.0 per cent in June 2012. On the other hand, the proportion of debt held by multilateral and bilateral creditors declined from 54.7 per cent and 17.7 to about 46.6 and 9.4 per cent, respectively, over the same period. This led to a sharp increase in debt service payments (Figure 3). Besides infrastructure, other uses of external debt include balance of payment (BOP) and budget support. For instance, in the fiscal year 2020/21, the latter accounted for about 15 per cent, while the key sectors included transport and telecommunication (25.6 per cent), energy

⁵See Were and Mollel (2020) for a detailed discussion of Tanzania's public debt dynamics including historical developments.

and mining (13.8 per cent), social welfare and education (17.8 per cent), and real estate and construction (7.5 per cent).

Figure 3: Trends in external debt and debt service



Source: authors' illustration based on data from various BOT annual reports.

Despite the rapid accumulation of debt, debt sustainability assessments (DSAs) conducted using the IMF-World Bank debt sustainability framework for low-income countries (LICs) have generally showed Tanzania's external debt to be sustainable. However, as noted by Were and Mollel (2020), the IMF-World Bank's debt sustainability framework has several limitations. Furthermore, in contrast with previous DSAs that indicated low risk of debt distress,⁶ Tanzania's recent DSA for 2021 undertaken jointly by the IMF and World Bank shows the risk of external debt distress increased from 'low' to 'moderate'. The increased risk was mainly attributed to the reduced capacity to service external debt following the negative impact of the COVID-19 pandemic on exports, and the reclassification of debt-carrying capacity from strong to medium (IMF 2021). A number of debt indicators were found to be sensitive to shocks, particularly exchange rate volatility and export shocks. The revised debt sustainability assessment generally portends increased debt vulnerability, especially in the wake of the COVID-19 pandemic and other emerging global challenges.

Table 1: External DSA indicators: Baseline scenario 2020–41

	Threshold	2019/20	2020/21	2021/22	2022/23	2023/24	2030/31	2040/41
<i>Per cent</i>								
PV of debt to GDP	40	17.6	17.9	18.8	19.0	18.5	14.2	11.9
PV of debt to exports	180	117.6	135.1	140.4	140.0	132.8	97.7	82.4
Debt service to exports	15	13.4	14.4	15.1	13.0	12.8	10.9	14.8
Debt service to revenue	18	13.7	14.3	14.9	12.2	12.2	10.8	14.9

Source: authors' elaboration based on data in IMF (2021).

The rapidly accumulating debt levels and the attendant rise in debt-servicing obligations, coupled with the high demand for development projects, make it prudent to investigate the relationship

⁶ Including one conducted by the government in 2019 (MoFP 2019).

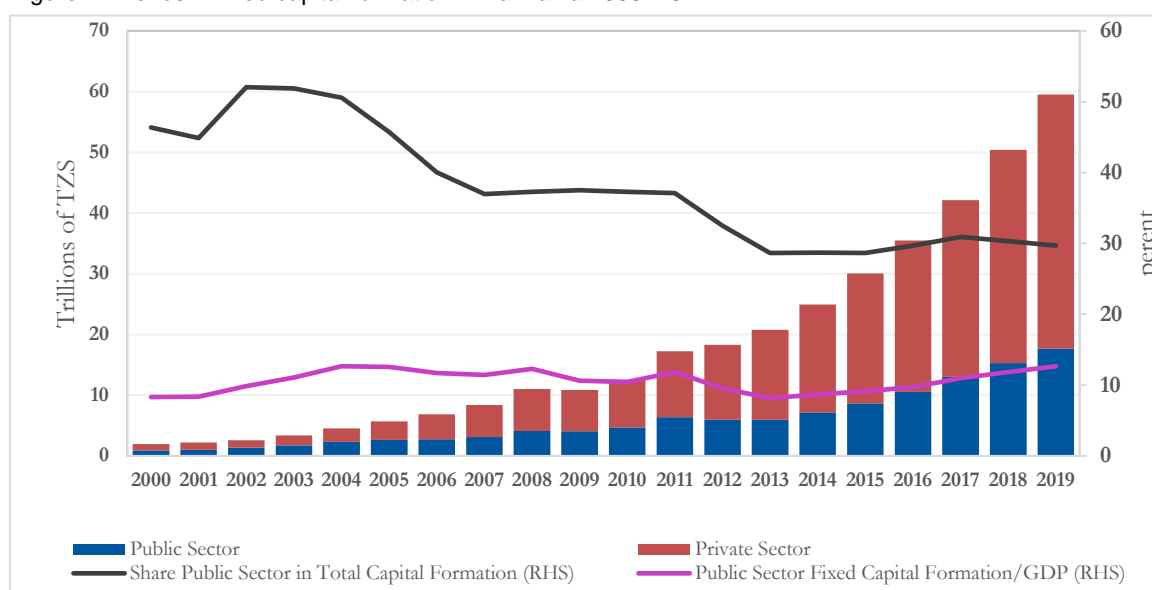
between public investment and public debt, and what that portends for the country’s economic growth and development aspirations.

2.3 Public investment trends

Historically, Tanzania’s investment levels (private and public) have been relatively low, particularly before 2000, during which state-owned enterprises (SOEs) were the key players—SOEs are estimated to have accounted for over a fifth of medium and large manufacturing firms, even by the mid-1990s, and were more likely to export than private firms (Grenier et al. 1999). Most of them were, however, privatized following nearly a decade of macroeconomic and fiscal reforms that started in the mid-1980s to pave way for a more prominent role of the private sector. However, according to Danielson (2000), a viable private sector capable of leading rapid growth had, by 2000, not emerged due to various obstacles including bureaucracy, credit constraints, and overly high cost of production, partly attributable to poor infrastructure and tax regime. That notwithstanding, both private and public investments have been on an upward trend in the last two decades. The level of public investment proxied by public fixed capital formation increased almost 18-fold to TZS17.6 trillion in 2019 from TZS891.5 billion in 2000 (Figure 4). The increase has, however, varied over the years, with a peak of 35.5 per cent in 2002 during the period 2000–10, and 36.9 per cent in 2011 in the subsequent 2010–19 decade. In the six years leading up to 2019, with the concerted implementation of medium-term development plans, the rate somewhat stabilized, averaging about 20 per cent, with a high growth of 25.4 per cent in 2017.

As a share of GDP, fixed capital formation in the public sector has been rather stable, having increased from 8.3 per cent in 2000 to 12.6 per cent in 2019, albeit with variations (Figure 4). With the exception of the sharp increase observed in the early 2000s, capital formation in the public sector has trailed that in the private sector, in line with the government’s efforts to withdraw from purely commercial activities that are deemed profitable to the private sector. Thus, despite the increase in absolute terms, the share of the public sector capital formation has gradually declined, reaching a low of 28.65 per cent in 2014. However, from 2014 it increased and remained stable at about 30 per cent.

Figure 4: Trends in fixed capital formation in Tanzania 2000–19



Source: authors’ illustration based on data from the National Bureau of Statistics (NBS).

3 Literature review

3.1 Theoretical literature

The importance of public investment in promoting economic growth and employment is theoretically underpinned by the seminal work of Keynes (1936), which brought to light and solidified the significant role of government spending on the economy. The latter was practically exemplified by the critical role of public policy in addressing the great depression of the 1930s (Olaleye et al. 2014). Following the Solow growth model (Solow 1956), different variants of augmentation have been used to analyse various aspects of the growth–investment–debt nexus (Borensztein 1990; Megersa and Cassimon 2015; Chikalipah 2021). Ideally, government expenditure on capital formation is expected to crowd-in private investment, which in turn propels an increase in economic growth. Whereas there are advantages of using debt financing to fund such investments, there are limitations. Challenges arise when the increased debt accumulation leads to a high debt burden and/or less productive investments, to the point where it ceases to contribute positively to economic growth. The potential detrimental effect of public debt on growth has led scholars to conjecture that there exists a threshold level above which public debt changes from being a growth catalyst to an obstacle. However, debate remains on the threshold or the point at which public debt accumulation becomes a deterrent to growth, given a myriad of factors that affect growth, and the variations that exist across countries and regions. Phelps (2022), in an assessment of Keynesian, neo-Keynesian, classical, and neoclassical treatises regarding the impact of public debt on capital formation, concluded that it was safe to infer that the public debt, when quite large, pulls down capital and wage rates to lower growth paths, and that deficit spending could not be counted on to boost consumption or investment when public debt was very high.

Studies have shown that high debt burden can impede investment and economic growth and could lead to debt overhang. Clements et al. (2003), quoting Krugman (1998), outlined the definition of debt overhang as a situation in which the debt burden becomes so enormous that the expected repayment on external debt falls short of the contractual value of debt—the accumulated debt therefore acts as a tax on future output, discouraging productive investment plans of the private sector and adjustment efforts on the part of government. Debt overhang has been the main argument used by proponents of debt relief to mostly low-income countries, with a number of studies pointing to debt reduction as a means to stimulate economic growth and disentanglement from debt traps (Clements et al. 2003).

3.2 Empirical literature

The empirical literature on the debt–growth nexus has been growing over time, particularly after the debt crisis of the 1980s in developing and low-income countries (see Sundell and Lemdal 2011). Several studies have attempted to estimate optimal public debt levels globally, regionally, or nationally (Reinhart and Rogoff 2010; DiPeitro and Anoruo 2012; Eberhardt and Presbitero 2015; Baharumshah et al 2017; Chen et al. 2017). For instance, Eberhardt and Presbitero (2015) uncover a negative effect of public debt on growth, demonstrating strong heterogeneity and threshold effects. Baharumshah et al. (2017) tested the causal interplay of the debt–growth nexus in Malaysia and showed that below a threshold of 54.7 per cent of GDP, debt Granger-caused economic growth, and thus cautioned that expansionary fiscal policies that increase the level of debt relative to the indicated threshold may negate positive effects of a fiscal stimulus by ultimately reducing economic growth.

Whajah et al. (2019) examined the relationship between government size, public debt, and inclusive growth using fixed effect estimation for a panel of 54 African countries over the period 2000–16.

They established that while the size of government as measured by total government expenditure had a positive effect on inclusive growth, the extent of public indebtedness (an important component of government size) had a negative effect on inclusive growth. They observed that public debt, *ceteris paribus*, had a negative effect on inclusive growth, whereas labour productivity and gross fixed capital formation had positive effects. They further explained the outcome using DiPeitro and Anoruo's (2012) argument that any existing optimal level of resulting government size and public debt may have been long exceeded by the various economies in their sample.

Chen et al. (2017) assessed the optimal levels of government investment and public debt using a panel dataset of 65 developed and developing economies over the period 1991–2014. The empirical results showed that the effect of government investment on economic growth decreased as the level of expenditure rose. With government investment to GDP ratio higher than 20.04 per cent, the effect on growth could change from positive to negative due to government investment crowding out private consumption, reducing productive investments, and thus reducing the multiplier effect of fiscal expansion, in some cases leading to waste or inefficient use of resources which lowers production efficiency. The relationship between government investment and economic growth in most developing and emerging countries was positive, while it was found to be negative for many developed countries in the sample. The effect of public debt on economic growth demonstrated a similar pattern with excessive public debts inhibiting long-run economic growth by crowding out private investment through reducing personal incomes, raising and amplifying the distortionary costs of taxation, and raising capital cost. The results showed that the effects of public debt on economic growth decreased as the level of debt rose, especially when the public debt to GDP ratios were higher than 59.72 per cent. However, Law et al. (2021) provide new evidence suggesting a much lower public debt to GDP threshold value of 51.65 per cent based on a study of 71 developing countries.

Other studies that examine the relationship between public debt and economic growth include Kasidi and Said (2013), Babu et al. (2015), Gómez-Puig and Sosvilla-Rivero (2015), Okwu et al. (2016), Yusuf and Said (2018), Senadza et al. (2018), among others. Overall, the findings generally suggest there is a limit to the positive effects of expansionary fiscal policy associated with debt accumulation, particularly in light of public debt challenges in developing economies.

With regard to Tanzania, Yusuf and Said (2018) examined the impact of public debt on economic growth for the period 1970–2015. Using vector error correction mechanism (VECM) and Granger causality test, they found a negative relationship between public debt and economic growth. The Granger causality test revealed that there is no causal relationship between public debt and economic growth. Based on these findings, they cautioned against accumulation of external debt stock overtime. Similarly, Lotto and Mmari (2018) examined the impact of domestic debt on economic growth in Tanzania for the period 1990–2015 and found an inverse but insignificant relationship between domestic debt and economic growth. The weak relationship could be explained by the relatively small share of the domestic debt in total public debt.

While empirical studies on the debt–growth nexus are numerous, studies that analyse the public investment–public debt nexus are comparatively limited. The studies include Babu et al. (2014) who estimated the effect of external and public debt on public investment in the East African Community (EAC) using annual data from 1970–2010 and found that public debt and external debt negatively affected public investments in EAC. Based on their results, they concluded that higher debt service did indeed crowd out public sector spending. Sánchez-Juárez and García-Almada (2016) found that the public debt of state governments in Mexico was positively correlated with public investment, which in turn promoted economic growth. However, they concluded that although the absolute amount of debt of the respective states remained low, its trajectory was of concern, with a possibility of being unsustainable. In their study on financing government

investment and its implications for public capital, Hickey et al. (2020) show that using budget-neutral investment spending can generate long-term benefits of increased public capital stock, while at the same time limiting the negative consequences on public finances and trade balance. They argue that the best way of financing government investment in a manner that preserves fiscal and trade balances is by reducing other government spending, and the second-best option is through value-added tax. Financing government investment with debt worsens fiscal and trade balances.

Most empirical studies are generally based on a panel of countries. Although there are significant insights drawn from cross-country studies, it is also important to focus on specific country case studies to capture individual country dynamics and characteristics. This paper makes a contribution by examining the link between public debt and public investment in Tanzania, in light of the rapid debt accumulation and increased demand for public investment.

4 Empirical model and methodology

To estimate the relationship between public investment and public debt in Tanzania, we follow similar studies in the literature, such as Babu et al. (2014) and Clements et al. (2003). Most studies typically rely on the standard growth model augmented with debt variables to assess the impact of public debt on growth and/or investment. The equation to be estimated is specified as follows:

$$PI_t = \alpha + \delta PD_t + \beta X_t + \mu_t \quad (1)$$

where:

- PI_t is public investment as a share of GDP.
- PD_t is the public debt variable(s), i.e. public debt to GDP ratio. We mainly focus on external debt. Debt service indicators are also key indicators worth considering.
- X_t is a set of control variables. These include trade (exports and imports of goods and services) as a share to GDP used as a proxy to trade openness, share of development expenditure in total government expenditure and real GDP. Since the latter is likely to be highly correlated with the other variables, we use real GDP growth based on the assumption that high growth boosts domestic revenue generation, which is needed to fund public investment.
- μ_t is the error term.

The above model was estimated using the autoregressive distributed lag (ADRL) approach, following Pesaran and Shin (1999) and Pesaran et al (2001). This approach has gained popularity as a method of examining (cointegrating) relationships in time series data due to its inherent robustness to misspecification of integration orders of relevant variables. The latter for instance is known to arise from sample size and power challenges. Thus, ARDL was preferred since it is more robust and performs better for small sample sizes. Furthermore, it is suitably used when all or some variables are integrated of order one $[I(1)]$ or $[I(0)]$. Another advantage of the ARDL approach lies in the ability to simultaneously test for cointegration and estimate long-run and short-run relationships. Bounds test is used to test for cointegration. The ADRL bounds testing has advantages over the classical cointegration tests since it is used irrespective of whether the series are $I(0)$ or $I(1)$. The test is a standard F-test with the null hypothesis of no cointegration.

Stationarity test for the variables was conducted using the Augmented Dickely–Fuller (ADF) test before conducting the estimations. The unit root test results showed that real GDP growth was

$I(0)$, while the other variables were non-stationary $I(1)$, though the ADF test with a structural break indicated external public debt-to-GDP ratio was stationary (Appendix Table A1). The empirical estimations were undertaken using time series data for the period 1976–2020. The main data sources are Bank of Tanzania (BOT), Ministry of Finance and Planning (MoFP), and National Bureau of Statistics (NBS).

5 Empirical analysis and discussion

The empirical results are reported in Table 2. For robustness, three ARDL models are reported, starting with the basic specification in which public investment to GDP ratio is specified as a function of external debt and trade to GDP ratios in Model 1. Model 2 includes share of development expenditure in total expenditure as an additional variable, while Model 3 results are based on the specification encompassing real GDP growth instead of development expenditure ratio.⁷ Choice of appropriate lag length for each variable in the ARDL model is critical in order to have standard normal error terms that do not suffer from serial correlation. The lag-length in all the models was automatically determined as part of the estimation process based on the standard lag-length selection criteria. The post-estimation diagnostic tests are reported in Table 2 for each model. The Breuch Godfrey serial correlation test indicates no evidence of serial correlation, while the Jarque-Bera test shows normality of the residuals. Cointegration test results using ARDL bounds test are summarized in Table 3. Existence of long-run relationships among variables is confirmed across all the models, based on the calculated F-statistics which are greater than the upper bound values.

The empirical results in Table 2 show that whereas an increase in external debt has an instantaneous positive impact on public investment, the lagged effect is negative. The latter is evident at lag 1 and 3. The results are consistent across all the specifications. These suggest that whereas an increase in external debt borrowing is initially associated with the desired positive effect of boosting current public investment, the impact of debt accumulated one year or three years ago on investment is limiting. Various factors could account for the latter, including the extent of efficiency with which the borrowed resources are utilized, as well as debt repayment and debt-servicing costs, which limit the amount of available resources needed for additional or sustainability of public investment, especially if the costs associated with the external borrowing are high.⁸ The results further show that public investment in the preceding year has a positive and significant impact on current investment as expected. Whereas trade openness as proxied by trade to GDP ratio promotes current public investment, the lagged effect is negative. While trade openness provides an avenue to import capital goods and technology for expanding public investment, these have to be paid for and could imply more resource outflow, especially if foreign earning avenues are limited in raking in large amounts of foreign exchange to match the imports. Tanzania's imports far outweigh exports, leading to a negative trade balance. An increase in the share of budgetary allocation to development expenditure has the expected positive impact of

⁷ Development expenditure defined as a share of total public expenditure was preferred to development expenditure as a share of GDP, though both yielded similar results. Not surprisingly, real GDP was found to be correlated with other variables.

⁸ Though the results are not reported in the paper, we also examined the implications of debt-servicing costs on public investment. However, since the rising debt-servicing burden has been more pronounced in the last decade following a shift towards commercial debt, it is not surprising that the impact was not statistically significant/evident. Additionally, the estimation covers the debt relief period during which the debt burden was substantially reduced.

boosting public investment. The lagged effect is positive at lag 2. The impact of economic growth on public investment is negligible and only statistically significant at lag 2 (Model 3).

Table 2: ADRL estimation results

	Model 1 (ADRL 1,1,1)	Model 2 (ADRL 2,3,1,3)	Model 3 (ADRL 1,3,2,2)
Constant	0.06 (3.82)***	0.04 (1.60)	0.05 (2.50)**
Pub_inv(-1)	0.76 (10.3)***	0.83 (5.94)***	0.73 (8.28)***
Pub_inv(-2)		-0.21 -1.60	
Ext_pub_debt	0.08 (1.99)**	0.09 (2.37)**	0.086 (2.41)**
Ext_pub_debt(-1)	-0.10 (-2.66)***	-0.13 (-2.68)***	-0.10 (-2.0)**
Ext_pub_debt(-2)		0.16 (3.08)***	0.08 (1.75)*
Ext_pub_debt(-3)		-0.12 (-3.28)***	-0.08 (-2.25)**
Trade_ratio	0.09 (2.02)**	0.10 (2.48)**	0.06 (1.37)
Trade_ratio(-1)	-0.14 (-3.19)***	-0.14 (-3.54)***	-0.11 (-2.15)**
Trade_ratio(-2)			-0.05 (-1.27)
Dev_ratio		0.08 (1.88)*	
Dev_ratio(-1)		-0.06 (-1.29)	
Dev_ratio(-2)		0.12 (2.65)**	
Dev_ratio(-3)		-0.06 (-1.41)	
Rgdp_g			0.003 (1.30)
Rgdp_g(-1)			-0.002 (0.89)
Rgdp_g(-2)			0.003 (2.0)**
R-squared	0.80	0.87	0.87
Adjusted R-squared	0.76	0.82	0.82
Durbin-Watson statistic	1.99	2.07	2.06
Breuch Godfrey (BG) test [†]	0.10 (0.94)	0.91 (0.41)	0.86 (0.43)
Jarque-Bera (JB) test statistic [†]	0.34 (0.84)	0.22 (0.91)	0.89 (0.63)
No. of observations	42	42	42

Note: *** indicates 1%, ** 5%, and * 10% levels of significance; t-statistics in brackets. Pub_inv = public investment as a share of GDP, Ext_pub_debt = external public debt-to-GDP ratio, Trade_ratio = trade(exports and imports) as a share of GDP, Dev_ratio = development expenditure as a share of total public expenditure and Rgdp_g = real GDP growth. The numbers inside the parentheses are lags. Null hypothesis for BG test is no serial correction. † P-value for test statistics (BG and JB) in brackets.

Source: authors' computations based on data from BOT, MoFP, and NBS.

Table 3: Bounds test results for cointegration analysis

Model	F-statistic	Lower bound	Upper bound	Significance level
1	7.0	4.07	5.02	0.05
2	5.8	3.50	4.68	0.05
3	9.0	4.98	6.41	0.01

NB: the lower and upper bound values are for finite sample.

Source: authors' computations based on data from BOT, MoFP, and NBS.

Having confirmed that there is cointegration among variables, it is worth examining the speed of adjustment as captured by the error correction term (ECT). For simplicity, the latter, alongside the short-run effects, are only reported for Model 2. The ECT is negative as expected and statistically significant, with a coefficient of -0.386. This implies that about 38.6 per cent of deviations from the equilibrium public investment path are corrected for within one period. The results show that the short-run impact of external debt on public investment is generally positive.

Table 4: ARDL error correction regression

Variable	Coefficient	t-statistic	P-value
Constant	0.038***	4.83	0.0000
D(pub_inv (-1))	0.211*	1.82	0.0795
D(Ext_Pub_debt)	0.088*	2.73	0.0107
D(Ext_Pub_debt(-1))	-0.038	-1.11	0.2769
D(Ext_Pub_debt(-2))	0.114***	3.49	0.0016
D(Trade_Ratio)	0.097**	2.75	0.0101
D(Dev_Ratio)	0.077**	2.31	0.0281
D(Dev_Ratio(-1))	-0.060	-1.66	0.1078
D(Dev_Ratio(-2))	0.0630*	1.77	0.0874
ECT	-0.386***	-5.06	0.0000
R-squared	0.68		
Adjusted R-squared	0.60		
Durbin-Watson statistic	2.07		

Note: ECT is the error correction term. D stands for first difference. *** indicates 1%, ** 5%, and * 10% levels of significance; Pub_inv =public investment as a share of GDP, Ext_pub_debt=external public debt-to-GDP ratio, Trade ratio=trade (exports and imports) as a share of GDP, Dev_ratio =development expenditure as a share of total public expenditure. The numbers inside the parentheses are lags.

Source: authors' computations based on data from BOT, MoFP, and NBS.

The findings are generally in line with the empirical findings in the literature that suggest there are limits to relying on public debt as a sustainable source of government financing in developing economies, notwithstanding the fact that majority of the studies focus on the public debt–economic growth nexus. In the case of Tanzania, Yusuf and Said (2018) found a negative relationship between public debt and economic growth. However, the public debt–investment link is, arguably, a more robust and direct channel through which public debt impacts economic growth.

6 Conclusion and policy insights

Efforts to realize Tanzania's development vision of becoming a semi-industrialized country have been hampered by a number of challenges, including low levels of both public and private investment. This has led to concerted efforts to revamp infrastructure development, particularly in the recent past, underpinned by the potential positive externalities associated with such investments. However, these mostly require increased funding, which is largely financed through external borrowing, in light of limited domestic revenues. Public debt, especially external debt, has accumulated rapidly over the last decade, after a substantial decline witnessed following HIPC debt relief in 2001. Although Tanzania's DSAs routinely conducted jointly by the IMF and the World Bank have generally indicated low risk of debt, the latest DSA conducted in 2021 shows the risk of debt distress increased from low to moderate in the wake of the COVID-19 pandemic. These portend increased external debt vulnerabilities.

In view of the foregoing, this study sought to investigate the relationship between public investment and public debt. While studies on the public debt–economic growth nexus abound, there are limited studies that focus on the relationship between public debt and public investment, particularly in the context of developing countries like Tanzania. The analysis mainly focuses on public external debt, which accounts for over 70 per cent of the public debt. The ADRL approach is used to analyse the impact of the later on public investment.

The empirical results show that an increase in external debt boosts public debt investment. However, it has a negative lagged effect on public investment in the long run. Arguably, this could be due to various factors including the need to service and repay the acquired debt, and the efficiency with which the borrowed funds are utilized. Moreover, depending on the type of debt, the cost of debt servicing could be higher, especially in the case of commercial debt and thus, limit the net resources that are available for investment. Whereas increased trade openness proxied by exports and imports of goods as a share of GDP has a positive impact on public investment, the lagged impact by one year is negative. Ideally, trade openness provides avenues for importation of capital goods and technological transfer, but this comes at a cost. Public investment is also positively impacted with the development expenditure share in total expenditure. In the short run, the impact of all the explanatory variables on public investment including external public debt is generally positive.

Public investment such as investment in infrastructure and social amenities is generally considered essential in promoting development. The positive impact of public debt on public investment, especially in the short run, is consistent with the positive trends of both public investment and public debt that have been witnessed in the recent past. External public debt acquisition has the initial desired effect of boosting public investment as it enlarges the needed fiscal space. However, the negative lagged effect of accumulating public debt suggests that in the long run the impact of the accumulated debt could be limiting. The latter could be exacerbated by the rising cost of servicing debt if the country continues gravitating towards commercial sources of external debt, particularly given the challenges and uncertainty in the global economy. Mitigating factors include optimal use of borrowed resources, e.g. by enhancing efficiency and productivity of public investment, prioritizing projects to avoid white elephant projects, among others. Additionally, leveraging concessional debt and exploring other avenues of funding, as such as public–private partnerships and capital market development, could help reduce dependence on external debt.

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Appendix

Table A1: Unit root tests

	ADF test-statistic	P-value
Pub_inv_ratio	-2.35	0.18
Ext_Pub_debt+	-2.08	0.25
Trade_Ratio	-1.86	0.35
Dev_ratio	-2.02	0.27
Rgdp_g	-2.93	0.05**

Note: ** indicates stationarity at 5% significance level. + ADF test with structural break shows the variable is stationary at 1%.

Source: authors' computations based on data from BOT, MoFP, and NBS.