Original Research Article

Do Domestic and External Public Debt Enhance Economic Growth? Short-term and Long-term Evidence from Sri Lanka

ABSTRACT

Aims: The objective of this paper is to examine whether public debt enhance economic growth in Sri Lanka by separating debt into domestic and external debt.
Study design: The paper adopts the Keynesian demand-side model to estimate GDP on demand-side and supply-side factors such as domestic debt, external debt, gross fixed capital formation (investment in short), labour force, general price level, money supply, government spending and trade openness. In a model where debt causes investment, public debt effects are netted out from investment by removing the estimated investment effects of domestic and external debt.
Duration of Study:quarterly data from Q1 2010 to Q1 2023 to trace long-term and short-term GDP effects of debt.
Methodology: The ARDL method of estimation is used and the model is estimated in double log form so that estimated parameters indicate output elasticities. A general to specific modelling framework is adopted to find the best suited model.
Results: Variables such as government spending, money supply, general price level and labour force are not relevant while domestic debt, external debt, investment (debt effects netted out) and trade openness are significant in describing GDP. The long-term domestic debt elasticity of GDP is found to be 0.588 while short-term domestic debt elasticity (sum of contemporaneous and lag effects) is about 0.63. The cumulative effects of domestic debt on GDP tappers off to 0.60 in the long-run. The result suggests negative impacts (-0.272 and -0.254) of external debt on the economic growth in short-term and long-term respectively. The negative effect of external debt can be justified if recent external borrowings have been used to repay loans taken to finance war and unproductive projects.
Conclusion: The paper finds that debt effects on GDP have been significantly reduced when debt effect-ridden investment is included in the regression in place of debt-effect netted out investment.

Keywords: Domestic debt, External debt, Economic growth, ARDL short-term and long-term effects, the case of Sri Lanka.

1. INTRODUCTION

Governments generate revenues to meet expenditure on their day-to-day operations and investment projects for the enhancement of economic growth and development. In the case of Sri Lanka, these revenues are gained from many sources such as, taxes on income and properties, taxes on local and imported commodities, fees and surcharges, surpluses of public enterprises and service units, fine and penalties, printing of paper money and local and foreign borrowings [1]. The public finance literature welcome benign surpluses in government budgets, collecting more revenue than spending in a given fiscal year. Buchanan and Wagnar [2] recommend policymakers to maintain government

revenue and spending accounts at least in balance. The financing of the current excessive spending through bonds will have deleterious impact on future generations if the funds raised through bonds are spent on recurrent budget or unproductive investment projects [3,4]. According to Burkhead (1954), Buchanan (1958) and Buchanan and Wagnar (1967) [5,6 & 7] and many other researchers, free market economic policies advocate governments to run fiscal deficits only during extraordinary times such as man-made and natural disasters and economic recessions. However, habits of governments to incur more spending than revenue they generate results in fiscal or budget deficits[1]. Since tax and non-tax revenue and seigniorage (revenue from money printing) are insufficient to finance expenditure, governments often fall into borrowing from local and foreign sources to finance deficits. Such borrowings to finance continuous and large fiscal deficits may create severe macroeconomic imbalances and the ultimate collapse of the fiscal policy by paving the way for government bankruptcy.

The success of Keynesian economic policy that recommended US government to increase government spending in the economy to overcome great economic depression in 1930s led governments to run deficit budgetary policies and the accumulation of debt as the policy recognizes large deficits and accumulated debt are not really problematic if the governments use their excessive spending on productive means such as investing on production capacity (See Keynes,1936; Pierce,1971, Jayawickrama and Abeysinghe, 2012) [8,9 & 4]. According to Feldstein [10] this ideological shift in favour of large deficits and debt accumulation provided impetus for government to increase spending irrespective of revenue generation ability which resulted in large deadweight losses of deficits. In a non-Ricardian economy, fiscal deficits drive interest rates up, crowd out private investment and affect negatively on productivity enhancement (See Muhleisen, 2004; Adam and Bevan, 2005) [11,12]. Therefore, we observe that budget deficits are a common phenomenon worldwide and their impact on the economic performance is highly questionable and debatable due to positive and negative nature of debt economic effect reported in the literature.

The trends in the global economy emanated from the COVID-19 pandemic, slowdown of economic activities worldwide and man-made and natural disasters such as wars, droughts, famine, etc. drive public debt levels of countries to an increasing path in recent years. As per the IMF Annual Report 2021, the worldwide public debt was recorded as 226 trillion US dollars and 256 percent of global GDP in 2020 [13]. Furthermore, total global public debt increased by 3.3 trillion US dollars in the first quarter of 2022 [14]. At the same time, the public debt issue of developing countries become more severe than the issue in developed countries and are on the verge of high risk of debt defaulting, in fact some developing countries including Sri Lanka have already defaulted [15]. The developing countries currently possess external debt stock of about 11 trillion US dollars and the external debt service responsibility of about 3.9 trillion US dollars in 2020 [16]. The UNCTAD 2022 report revealed that government debt level of over 100 developing countries has increased by two trillion US dollars between 2019 to 2021 [17].

Sri Lanka is no exemption in terms of running continuous and large budget deficits and accumulation of debt and thus having serious macroeconomic consequences [3]. The government of Sri Lanka often spent more than its revenues and used domestic and foreign bond financing to cover the excess spending. Sri Lanka is one of the countries which runs continuous large budget deficits since 1950s. Since new borrowings grew at a higher rate than the repayment of previous debt, both local and foreign debt of the government accumulated over time [3,18]. The total public debt stock of Sri Lanka has reached its peak in recent years and amounted to LKR 13,908 billion at the end of the first quarter of 2022. Of which total domestic debt amounted to LKR 7,788.5 billion and total foreign debt amounted to LKR 6,119.6 [19]. The government debt to GDP ratio of Sri Lanka is expected to reach about 120 percent in 2023 and remain high in a range of 116 -120 percent in 2024 as well [20]. Jayasinghe[21] has shown that the government had a debt service of LKR 2 trillion in the year 2022.

The government of Sri Lanka, to the first time in its history, announced its inability to repay foreign debt and interest payments in April 2022. This bankruptcy of the country has been experienced on the verge of COVID-19 pandemic, global economic slowdown and more importantly in a mishap of local macroeconomic and sectoral policies. Since 2020, the country is experiencing massive tax cuts, tax frauds, inappropriate and non-transparent revenue dilution, productivity slowdown especially in the agricultural sector, government expenditure hikes, increased budget deficits, severe balance of payment crisis and depletion of foreign reserves. The intentional blocking of financing from international sources such as the IMF and other finding agencies based on populistic policy slogans couple with the country's very low foreign exchange earning capacity, pegging LKR USD exchange rate at LKR 202 per US dollar for nearly about two years, servicing debt

[1]In a different methodological framework, Abeysinghe and Jayawickrama (2008) show that the government of Singapore uses conservative growth forecasting at the stage of budget making to restrict government revenue to a targeted level so as to make a balance budget or deficit budget. However, the government has the information even at the budget making steps that the true economic growth in next financial year generates revenues exceeding the estimated level, thus borrowing is not required. In this case, unrevealed but expected economic growth is used to eliminate actual government debt.

using vital and limited foreign reserves, and thereby drastically depleting country's foreign reserves made the country more prone to internal and external shocks and crises and collapse of the financial and the real markets. The ill-fated policies of the government ultimately led the country to bankruptcy in which the country stopped its debt servicing, restrict import of goods and services making the economic recession faster, continue to finance excessive spending through new money which directly exaggerated already high inflation into triple digit levels and making the entire economy rapidly shrinking and living more difficult.

Though the long-term growth rate of the Sri Lanka's economy remains at a moderate rate of 3% from 1980s, recent years experienced a massive negative growth rate, for example -3.6% in 2020, -7.8% in 2022 and -2.3% growth rate in 2023. Despite massive increase in public debt stock of the country, this poor growth performance experienced in recent decades questions the productive use of public debt. As per the Keynesian economists, the government borrowing can act as an economic stimulus [22]. The government spending, financed by borrowing from local private sector and external sources, is considered as an injection to the economy which is expected to stimulate demand and supply side activities. Therefore, public debt especially raised through foreign sources is expected to promote economic growth. But as tax smoothing hypothesis suggests, high levels of debt will increase future tax liabilities and thus be a constraint to future growth performance. This suggests that public debt is expected to have a positively impact on short-term growth performance while it has a negative effect in the long-term growth of a country. The final effect of public debt on growth is ambiguous and needs a careful study.

Thus, the accumulation of public debt at an alarming rate is a concern and warrants careful attention and investigation. If a country become insolvent in paying its foreign public debt, it leads the country to face serious macroeconomic imbalances and to implement drastic policy reforms to get rid of the crisis, as Sri Lanka is experiencing today. But if a country borrows money for investment in productive means, debt will not be a serious issue as the GDP grows. In such circumstances, additional revenue for the government will be generated enabling the government servicing debt adequately. Thus, it is necessary to find whether public debt create an impact on GDP. This paper focusses on examining the impact of public debt on economic growth during the post war period of Sri Lanka using quarterly data from Q1 2010 to Q1 2023. We are interested in the post war period debt to GDP impact for several reasons: First, since the war expenditure recedes after the war, the government could have used most of the borrowed money for productivity enhancing projects; Second, this period is known as a period where public funds have largely been corrupted, misused and wasted, especially chiefly borrowed money from China under less stringent conditions; Third, this period experiences uneasy policy reversals focusing on domestic economy oriented trade restrictions and then again towards open economy and international market. We use quarterly data in the analysis to identify both short-term and long-term impacts of debt on economic growth. Further, we treat domestic and foreign debt separately to isolate their impacts on economic growth rather than using aggregate public debt.

The rest of the paper is organized as follows: Section two gives a brief and updated literature review on studies that examine debt to GDP effect in various countries including Sri Lanka. Section three in detail discusses the modelling framework of this study to identify growth effects of domestic debt and external debt. Section 4 provides a discussion on the results and findings of the paper and Section 5 gives conclusions.

2. Literature review

Makhoba et al. [23] examine the impact of public debt on economic growth of South Africa using smooth transition regression (STAR) and nonlinear autoregressive distributed lag (NARDL) approach. They reckon a non-linear relationship between debt and economic growth in which low debt regimes reveal a positive impact while high debt regimes reveal a negative impact on growth. Their recommendation is to restrict public borrowings to a low debt regime and allocate such limited and restricted public debt in productivity enhancing means. Abubakar and Mamman [24] examine both permanent and transitory impact of public debt on economic growth using data from 37 OECD countries. They find contrasting results as short-term debt to GDP effect is positive and long-term debt to GDP effect is negative. Menasah et al. [25] analyze the effect of public debt on economic growth of 38 African countries in a panel autoregressive distributed lag model. The findings of the study show that there is a negative effect of public debt on GDP when debt-to-GDP ratio is in between 50 to 80 percent and positive effect when debt-to-GDP ratio is in between 20 to 50 percent. Thus, 50% of debt-to-GDP is considered as a threshold level of public debt.

Khursheed and Siddiqui [26] investigate the debt and economic growth relationship in South Asian countries. Their results show that external debt positively affect economic growth. Ngotana [27] examines the public debt effect on economic growth in South Africa from 1990 to 2020 using vector autoregressive (VAR) model. The study concludes that there is no any long run relationship between public debt and GDP. Thus, in order to reduce debt-to-GDP ratio, he suggests to rationalize public spending and to increase tax collection. Yusuf and Mohd [28] analyze the impact of government debt on economic growth of Nigeria using ARDL model and show that domestic debt positively affects the long-term economic

growth. But it does not do so in the short run. On the contrary, external debt positively affect economic growth in the short run but not in the long run. Saungweme and Odhiambo [29] examine the impact of domestic and foreign debt on economic growth in Zimbabwe using ARDL approach. The results show that there is a negative effect of both domestic and foreign debt on economic growth both in the short-run and the long-run.

Among the research that examine debt to GDP growth effect in Sri Lanka, Madhuhansi and Shantha [18] analyze the relationship between public debt and economic growth and find that an increase in debt reduces economic growth. Further, they find that the negative effect of external debt is stronger than domestic debt in the short run. Ushanthiny et al. [30], in a neo-classical growth model, reveal a negative relationship between internal debt and economic growth while external debt fail to report a significant impact both in short-run and long-run. Munasinghe et al. [31] using Johansen cointegration method conclude that both domestic debt and external debt significantly affect economic growth in long run. Kumarasinghe and Purankumbura [32] evaluate the impact of debt stock on the Sri Lankan economy. The study, in a non-linear model, finds a negative effect of debt on economic growth. The study therefore recommends importance of lowering debt stock for long-term economic wellbeing. Atapattu, and Padmasiri [33], in an ARDL model, find that external debt reports a negative impact on economic growth while the effect of domestic debt is insignificant. Kumara and Cooray [34] examine the debt to GDP effect and the threshold level of public debt for Sri Lanka. The study finds the threshold level of debt as 59.42 percent of GDP. The accumulation of public debt beyond this threshold level negatively affect the country's economic growth rate.

These studies reveal that the effect of public debt on economic growth is inconclusive as both negative and positive effects are reported irrespective of the duration of time. In the case of Sri Lanka, debt seems to be having a negative impact or no impact on economic growth in general. However, as there are model specification issues and data and time period issues, it is not advisable to take the results of prior studies as conclusive and final. Further research is required to verify debt to GDP effect in terms of more accurate modelling framework, different debt components and different debt episodes.

3. MODELLING FRAMEWORK

In order to accommodate debt effect on economic growth, the paper uses the Keynesian demand model as the basis. The Keynesian economics began to supersede classical economic theory in policy dialogue in 1930s with its successful intervention in recovering from the Great Economic Depression in late 1930s and until 1970s. Monetarists, a branch of Keynesian economics, argue that careful use of monetary policy tools such as interest rate with appropriate money supply decisions will make the demand management easier than the fiscal policy. According to the monetarists, money supply is reckoned as the primary driver of economic growth. Higher money growth will increase aggregate demand for goods and services which encourages job creation, reduces unemployment and stimulate economic growth. Yet, the failure of Keynesianism to provide an answer to the simultaneous presence of both high inflation and slow growth in many advanced economies, known as stagflation, brought the popularity of Keynesian economic theory down and government's ability to control output fluctuations with government tax and spending policies was questioned by the new classical growth theorists in mid 1970s. With the assumption of quickly adjusting markets to any shocks in competitive market structure, new classical growth theory asserted that policy makers are ineffective as individuals adjust their behavior in response to policy changes. Later, this new classical growth theory was also questioned heavily in the presence of imperfect market structures and policy interventions become unsuccessful.

In light of the failure of new classical growth theory, new Keynesians highlight that aggregate markets may not clear and adjust quickly allowing for fiscal policy and monetary policy to effect on output and other macro variables, especially in the short-run. As prices and wages are somewhat rigid in the market, Keynesians show that fluctuations in components of aggregate demand such as consumption, investment and government spending cause changes in output. The size or magnitude of the output change depends on the multiplier effect of each spending component. The Keynesian economic theory as an alternative growth theory was received attention during the global financial crisis, 2007-2008. Many Eastern and Western country governments adopted Keynesian theoretical insights in responding to economic crisis situations.

Thus, this paper adopts the Keynesian aggregate demand theory as a succinct way of modeling short-term and long-term fluctuations in economic growth. In this framework, the aggregate demand of the economy is given as:

$$Y_t = C_t + I_t + G_t + NX_t \quad (1)$$

where Y is output, C is private consumption spending, I is private investment, G is government spending and NX is net exports at time t.

As our objective is to examine the growth effects of public debt, we alter Eq. (1) to specify the debt effect on investment expenditure. The inclusion of debt stock, whether total debt stock or local and foreign debt stocks separately, in growth

equation, should be justified both through supply-side effect and the demand-side effect. Public debt affects output and economic growth by enhancing production capacity through new investment and creation of capital stock, both physical and human capital. If government borrowings are spent/ invested on physical assets such as ports, airports, dams, powerhouses, new agricultural lands, roads, livelihood opportunities, etc. and/or human capital such as training of employees, educational opportunities, promotion of health facilities, etc., the debt stocks are expected generate more output and enhance output growth. Further, if the government borrowing leads to more demand in the economy through high government purchases and more public demand made through fiscal transfers, it may affect the level of output or output growth positively. On the other hand, if public borrowings are used for unproductive means, it crowds out private economy significantly, and then public debt are expected to have a negative effect on output growth.

But adding debt stocks directly into Eq. (1) creates collinearity issues in variables. The collinearity emerges between debt stock variable/s and investment variable and demand side variables such as money supply (MS - through money printing to purchase government securities) and government expenditure (GE) as more debt will lead to more government expenditure. The link between investment (gross fixed capital formation in practical application) is direct as a part of public debt stock is expected to use for investment and creation of capital. In order to accommodate debt stocks in growth equation without having a shared impact through investment, we follow the following two stage method of specification.

In this specification, we assume that gross fixed capital formation (FCF) includes both private and public investments and therefore FCF depends positively on public debt. As investment variable bearing the effect of public debt and public debt variables cannot be included in output growth equation together, we use the following two stage method of specification and estimation to remove public debt effect on FCF:

$FCF2_t = FCF_t - \widehat{FCF_t} + \hat{\kappa}$ (2)

where $\widehat{FCF_t}$ is defined as

$\widehat{FCF_t} = \hat{\kappa} + \hat{\varphi} DD_t + \hat{\phi} ED_t$ (3)

where DD is domestic public debt stock, ED is external public debt stock and $\hat{\kappa}$, $\hat{\varphi}$ and $\hat{\phi}$ are estimated long-term parameters. We derive Eq. (3) from the following ARDL model of FCF:

$FCF1_t = \eta + \sum_{i=0}^{n} a_i DD_{t-i} + \sum_{i=0}^{n} b_i ED_{t-i} + \sum_{i=1}^{n} c_i FCF1_{t-i} + \vartheta_t$ (4)

where $\hat{a}, \hat{b}$ and $\hat{c}$are estimated parameters that measure contemporaneous and lagged effects of domestic and external debt on FCF. In this framework, FCF2 variable, as given in Eq. (2) represents FCF without investment effects of domestic and external debt. In Eq. (4) contemporaneous and lagged effects of DD and ED on FCF are modeled as per the perpetual inventory accumulation. The lags of FCF are included to cater to missing variables and endogeneity in investment function. Though Eq. (4) is a dynamic model, we compute FCF2 variable by removing only the long-term effects of DD and ED on FCF as given in Eq. (3). Since model stability of Eq. (3) it is not necessary to restrict Eq. (3) to be a cointegrating relationship.

In order to represent all variables given in Eq. (1), a general to specific modelling approach is used by incorporating variables to represent all variables in Eq. (1). In addition to debt stocks, we may include FCF2 (FCF after removing debt effects), GE, MS, LFP (labour force), INF (general price level) and OPN (trade openness) in output equation. Though variables such as FCF2, GE, MS, INF are expected to be correlated, we proceed with all variables in estimating the model with a view to eliminate such colinear variables later. Thus, a testable static equation of Eq. (1) is given as follows:

$GDP_t = \gamma + \mu' \boldsymbol{X}_t + \varepsilon_t$ (5)

where matrix X includes variables DD, ED, FCF2, LF, GE, MS, IFN and OPN and ε is an iid disturbance term with zero mean and constant variance. OPN is measured as export + imports as a % of GDP. All macroeconomic variables except OPN in Eq. (5) are in constant prices converted based on GDP deflator. Since variables in concern are non-stationary, e.g. I(1) or above, Eq. (5) needs to be a cointegrating relationship. Since OLS estimates of Eq. (5) do not follow standard t and F distributions (see Enders, 2004:342; Sims et al. 1990), [35,36] we derive parameters of Eq. (5) from a fully specified dynamic model. The parameters of static model of Eq. (5) is obtained using the following auto-regressive distributed lag model (ARDL):

$GDP_t = \alpha_0 + \sum_{i=0}^{n} \boldsymbol{\beta}_i \boldsymbol{X}_{t-i} + \sum_{j=1}^{m} \gamma_j GDP_{t-j} + u_t$ (6)

where **X** is a matrix of variables given in RHS of Eq. (5), $\boldsymbol{\beta}$ is a vector of parameters and *u* is an *iid* random error term with zero mean and constant variance. In order to have a stable model, these long-term parameters in Eq. (5) should be cointegrating parameters, thus long-term solution of Eq. (5) is required to satisfy cointegrating requirements. As Pesaran and Shin (1998) [37] note, t and F statistics of Eq. (6) follow standard distributions even if variables in concern are non-stationary. The ARDL model given in Eq. (6) is estimated using natural logarithmic values and thus Eq. (5) generates long-term elasticity parameters of variables.

4. RESULTS AND DISCUSSION

In order to generate FCF2 variable, public debt effect netted out fixed capital formation, we estimated Eq. (4) and generated its long-term solution. Table 1 provides the long-term solution to the estimated Eq. (4). We found a positive and significant effect of domestic debt on gross capital formation with a domestic debt investment elasticity of 0.44. However, in this modelling framework, foreign debt has failed to generate long-term significant effect on gross fixed capital formation while short-term parameters in ARDL model demonstrate marginally significant effects. We, however, found that dropping LED variable from Eq. (4) reduced its predictive power significantly. Thus, we use $\hat{\kappa}$ = 5.6224, $\hat{\varphi}$ = 0.4383 and $\hat{\phi}$ = 0.0712 in Eq. (3) and derive FCF2 as given in Eq. (2).

Table 1. Results of static investment equation
Dep. var: LFCF

Variables	Coefficient	Prob.
LDD	0.4383**	0.0352
LED	0.0712	0.7081
C	5.6214***	0.0002

Note: *** significant at 1% level and ** significant at 5% level
Source: Authors' calculations.

We estimate Eq. (6) to find the parameters associated with variables in RHS of Eq. (5). First, we test the stationarity of all variables involved in Eq. (5) to assess the suitability of OLS method in estimation. The Phillips Perron (PP) test confirms that all variables in Eq. (5) are non-stationary in their levels and stationary in their first differences at 1% level of significance. Thus, variables in Eq (5) are I(1) and a regression of Eq. (5) should generate cointegrating parameters for the model to be stable and to use standard testing procedure.

We estimate a variant of models of Eq. (6), starting from the inclusion of all set of variables and then eliminating insignificant variables. Table 3 provides results of such 3 variant of models. In Model 1, we include all variables that previously discussed as important for explaining GDP in a Keynesian macro model. These includes, DD, ED, FCF2, LFP, OPN, INF, MS and GE variables. Results show that almost all variables and their lags become insignificant though R^2 of the regression is high. This indicates that the model suffers from the issue of multicollinearity. We re-specified the model by dropping most insignificant variables. First, we dropped GE and MS variables and re-estimate the model. The results are given in Model 2. The model 2 generates better predictive power but all most all variables and their lag variables become insignificant, e.g., LFP and INF variables are also highly insignificant. The model fails to ensure that the model is free from auto-correlation issue. In this exercise, we demonstrate that Keynesian demand side variables such as GE, MS, INF and LFP are not useful in predicting GDP of Sri Lanka. The presence of contemporaneous and lag effects of FCF, DD, ED and lag effects of GDP may have captured the most of demand-side and supply-side effects of GDP.

The ARDL model is estimated without GE, MS, INF and LFP. Results are listed under Model 3 in Table 2. While retaining R^2 almost unchanged, model 3 generates more significant parameters and better diagnostic test statistics. Model 3 passes all diagnostic tests such as AR, ARCH, Normality, Hetero and RESET test and indicates a better overall significance of the model. Unit Root t-test statistic also suggests that there is high chance of generating stable long-run solution by the model. More importantly, the model selection criteria such as AIC and SC criteria suggest that the model 3 is the most suitable model among the three models reported. As given in Figure 1, the fitted values of model 3 closely follow the actual quarterly GDP and satisfy model normality and stability conditions.

Table 2. ARDL Estimation of Eq. (6): Dep. var: LGDP

Variable	Model 1		Model 2		Model 3	
	Est. coef.	SE	Est. coef.	SE	Est. coef.	SE

LGDP(-1)	0.152)	0.303	0.080	0.206	0.083	0.177
LGDP(-2)	-0.245	0.317	-0.195	0.270	-0.239	0.192
LGDP(-3)	-0.071	0.401	0.164	0.271	0.081	0.200
Constant	-6.792	15.57	3.709	9.058	5.776**	2.054
LDD	0.181	0.471	0.105	0.304	0.068	0.223
LDD(-1)	0.344	0.425	0.636*	0.274	0.611**	0.212
LDD(-2)	0.292	0.401	-0.302	0.227	-0.206	0.152
LDD(-3)	0.387	0.308	0.101	0.195	0.158	0.144
LED	-0.082	0.194	-0.049	0.130	-0.100	0.093
LED(-1)	-0.059	0.209	-0.056	0.154	-0.045	0.102
LED(-2)	0.350	0.379	0.340	0.271	0.268	0.178
LED(-3)	-0.258	0.330	-0.414	0.211	-0.396**	0.131
LFCF2	0.246	0.158	0.305*	0.111	0.324**	0.090
LFCF2(-1)	0.124	0.150	0.076	0.116	0.078	0.102
LFCF2(-2)	-0.091	0.181	-0.122	0.128	-0.104	0.105
LFCF2(-3)	0.304	0.167	0.262*	0.125	0.285**	0.096
LOPN	-0.214	0.199	-0.172	0.119	-0.203*	0.092
LOPN(-1)	-0.016	0.186	0.205	0.125	0.199	0.100
LOPN(-2)	-0.075	0.271	-0.039	0.204	-0.007	0.132
LOPN(-3)	0.230	0.191	0.200	0.157	0.226*	0.100
LLFP	0.550	0.898	0.702	0.630		
LLFP(-1)	0.302	1.016	0.224	0.798		
LLFP(-2)	-0.212	0.997	-0.751	0.769		
LLFP(-3)	0.421	0.997	-0.034	0.743		
LINF	-0.102	0.930	-0.127	0.735		
LINF(-1)	-1.029	1.425	-0.473	1.156		
LINF(-2)	1.824	1.858	0.930	1.221		
LINF(-3)	-1.874	1.378	-0.461	0.661		
LMS	-0.649	1.104				
LMS(-1)	-1.102	1.566				
LMS(-2)	2.388	1.695				
LMS(-3)	-0.329	0.159				
LGE	1.427	0.106				
LGE(-1)	-0.033	0.117				
LGE(-2)	-0.056	0.094				
LGE(-3)	-0.072	0.088				
R^2	0.973		0.964		0.958	
Sig. F test	14.46 [0.00]		22.31 [0.00]		36.41 [0.00]	
UR t-test stat	-1.588		-2.109		-3.126	
AR F test	3.137 [0.07]		3.046 [0.04]		1.139 [0.36]	
ARCH F test	0.137 [0.94]		1.391 [0.25]		0.430 [0.09]	
Normality Chi^2	7.528 [0.23]		4.050 [0.13]		4.289 [0.11]	
Hetero F test	Not enough obs.		Not enough obs.		1.695 [0.17]	
RESET F test	0.104 [0.90]		1.554 [0.23]		1.725 [0.20]	
AIC	-2.913		-2.964		-3.119	
SC	-1.537		-1.893		-2.354	
No. of obs.	50		50		50	

Note: ** significant at 1% level and * significant at 5% level.
Source: Authors' calculations.

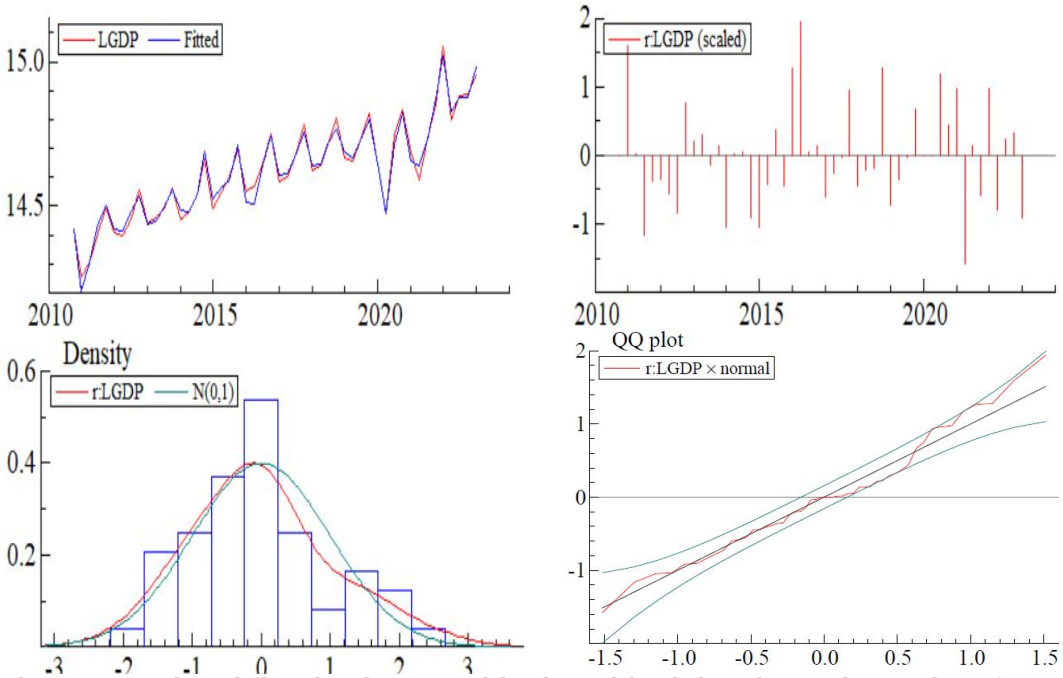

Fig. 1. Actual and fitted values, residual, residual density and QQ plot of ARDL Model 3
Source : Based on Authors' calculations.

Given the suitability and accuracy of the estimated model, we selected ARDL Model 3 to generate the long-term solution as given in Eq. 5. Table 3 provides the static long-term solution from Model 3. We report the estimated coefficients of long-term solution, their standard errors; sum of the contemporaneous and lagged effects of variables and their standard errors; and F test statistics values of significance of each variable and their probability values. The long-run coefficients give the static long run effect while sum of effects gives the short-term (within 4 quarters) impact of variables. In this specification, we use DD, ED, FCF2 and OPN variables as the fundamental variables explaining GDP. The long-term output elasticity of LFCF2 is 0.544 which is highly significant by both t test and F test statistics while the short-term impact (sum of the effects of 4 quarters) is slightly higher (0.584) than the long-term coefficient and significant. These numbers indicate that 1% increase in debt-impact netted out investment generate 0.54% GDP in the long-run and 0.58% GDP in the short-run. We found that 1% increase in trade openness (OPN) results in 0.2% increase in GDP in the long-run as well as in the short-run. Though the impact is not significant at standard probability levels by the t-test, F test indicates significance of the variable at 1% probability level.

Table 3. Long-run static solution from ARDL models
Dep. var: LGDP

Variable	From ARDL Model 3 (LFCF2 is used)			From Alternative ARDL Model (LFCF is used)		
	LR coefficients and SE	Sum of effects and SE (sum)	F test on significance of each variable	LR coefficients and SE	Sum of effects and SE (sum)	F test on significance of each variable
Constant	5.378**	5.78	7.91**	5.274**	5.85	7.74**
	(1.322)	(2.05)	[0.009]	(1.34)	(0.37)	[0.009]
LDD	0.588**	0.631	10.43**	0.274**	0.304	5.34**
	(0.083)	(0.20)	[0.000]	(0.080)	(0.114)	[0.002]
LED	-0.254*	-0.273	3.66* [0.015]	-0.170	-0.189	2.11
	(0.103)	(0.116)		(0.115)	(0.113)	[0.105]
LFCF2/LFCF	0.544**	0.584	5.43**	0.529**	5.87	5.23**
	(0.079)	(0.225)	[0.002]	(0.093)	(0.229)	[0.003]
LOPN	0.200	0.215	6.02**	0.187	0.207	5.79**
	(0.121)	(0.143)	[0.001]	(0.128)	(0.148)	[0.001]
LGDP		-1.07	0.59		-1.11	0.59

	(0.344)	[0.626]		(0.37)	[0.624]
LR Sigma	0.041		0.040		
Wald Chi^2	307.51**		289.16**		
UR t-test	-3.126		-3.001		
Observations	50		50		

Note: Standard errors are given in (.) and probability values are given in [.]. ** significant at 1% level and * significant at 5% level.
Source: Authors' calculations.

Addressing the objectives of this paper, we find the long-term and short-term impacts of domestic debt and external debt on GDP of Sri Lanka. The long-term domestic debt elasticity of output (GDP) is 0.588, which means that 1% increase in DD will result in about 0.6% of increase in GDP. The sum of the lag effects in four quarters is 0.63 and it indicates that 1% increase in DD increases GDP by 0.63% in the short-run. These results are significant at 1% probability level both by standard t and F tests. In this case, we found that domestic debt is having a strong positive impact on output growth both in the short-run and the long-run. Panel (a) of Figure 2 gives the lag structure analysis of DD. The contemporaneous effect is 0.068, lag 1 effect is 0.611, lag 2 effect is -0.206 and lag 3 effect is 0.158. The cumulative effects is 0.068, 0.679, 0.473 and 0.626 in lag 0, 1, 2 and 3 respectively. It seems that the cumulative effect of DD on GDP tappers off to 0.60 in the long-run.

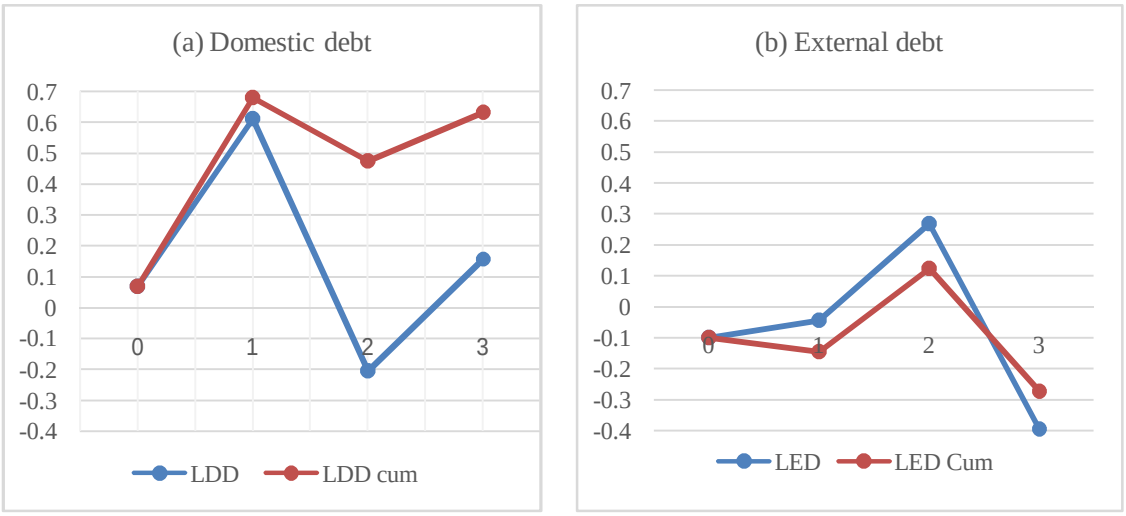

Fig. 2. Lag structure analysis of debt effects on GDP
Source: Based on authors' calculation.

The long-term impact of external debt is negative (-0.254) as is given Table 2 and the sum of contemporaneous and lag effects is -0.273, which are significant at 5% by the t-test and at less than 2% by the F test. It means that 1% increase in external debt reduces GDP of the country by 0.27% in the short-run and 0.25% in the long-run. The result suggests a negative impact of external debt on the economic growth. As panel (b) of Figure 2 demonstrates, contemporaneous effect of ED is -0.1, lag 1 effect is -0.045, lag 2 effect is 0.27 and lag 3 effect is -0.40. These short-term effects will be settled around -0.254 in the long-run. This outcome is strange to some extent as external debts are expected to contribute to economic growth more than the expected effect of domestic debt since external debt are targeted more on investment. Further, in absolute terms, the effects of ED on GDP is very small compared to the impact of DD on GDP. The ineffectiveness of external debt on economic growth need further analysis by exploring how these debts have been utilized. If recent external borrowings have been used to repay loans taken previously to finance war and unproductive project loans in foreign currencies, then ED effect on GDP will be minimum or become negative, as operations of projects on foreign funds are restricted.

In this analysis, we included DD and ED together with FCF2 variable in GDP equation by netting out DD and ED effects from FCF. In order to justify what have been done, we estimate the ARDL regression using DD, ED, FCF (without netting out debt effects) and other variables to see what happen to the effects of DD and ED on GDP. The results are given in Table 2 under the Alternative ARDL model. The inclusion of FCF instead of FCF2 does not change the ARDL model outcome and static long-run solution significantly. However, it has significantly affected short-term and long-term effects of DD and ED. In the presence of FCF variable, the long-term and short-term GDP effects of DD have been reduced by 50% to 0.274 (from 0.588) and to 0.304 (from 0.631) respectively. However, effects of DD on GDP remain significant at 1%

level of probability. The short-term and long-term effects of ED have also changed significantly and become insignificant both by t-test and F test. The significant change in effects of DD and ED in the presence of FCF indicate that FCF and debt variables are highly correlated. When FCF2 variable is included in ARDL model, DD and ED variables hold both demand-side and supply-side (through investment) effects of debt variables on GDP. With FCF variable, the effects of DD and ED on GDP reflect only the demand-side effects of debt on GDP.

5. CONCLUSION

This paper aims at analyzing short-term and long-term public debt effects on GDP of Sri Lanka by separating debt into domestic and external debt and using quarterly data from Q1 2010 to Q1 2023. The paper adopts the Keynesian demand-side model to estimate GDP on various demand-side and supply-side factors such as domestic debt, external debt, gross fixed capital formation (investment), labour force participation, general price level (CPI), money supply, government spending and trade openness. Given that debt variables cause investment, we netted out public debt effects of investment variable by estimating investment on domestic and external debt. In order to derive both short-term and long-term effects of variables on GDP, the ARDL method of estimation is used with a 3-lags balance model. The natural logarithmic real values of variables except trade openness are used in the estimation so that parameters indicate output elasticities of independent variables. We follow a general to specific modelling framework by accommodating all theoretically and empirically relevant variables and then eliminating variables based on model selection criteria. The ARDL model estimates were subjected to a battery of tests to ensure that the model and its parameter estimates do not violate any conditions required. We found that variables such as government spending, money supply, general price level and labour force are not relevant while domestic debt, external debt, gross fixed capital formation (debt effects netted out) and trade openness are significant in our modelling framework to describe GDP of Sri Lanka.

We found that the long-term domestic debt elasticity of GDP is 0.588 while short-term domestic debt elasticity (sum of contemporaneous and lag effects) is about 0.63. These results are significant at 1% probability level both by standard t and F tests. Thus, domestic debt has a strong positive impact on output growth both in the short-run and the long-run. As given by the lag structure analysis of domestic debt effect, the cumulative effects of domestic debt is 0.068, 0.679, 0.473 and 0.626 in lag 0, 1, 2 and 3 respectively. The cumulative effect of domestic debt on GDP tappers off to 0.60 in the long-run. The long-term impact of external debt is negative (-0.254) and the sum of contemporaneous and lag effects is -0.273, which are significant at standard probability levels. The result suggests a negative impact of external debt on the economic growth both in short-term and long-term. Though quarter 3 effect is a relatively large positive value, the impact of external debt on GDP within a year become negative. This negative effect of external debt is difficult to justify as external debts are expected to contribute to economic growth more than domestic debt. This unexpected nature of external debt effect on economic growth need further analysis by exploring how these debts have been utilized. The negative effect can be justified if recent external borrowings have been used to repay loans taken previously to finance war and unproductive project loans in foreign currencies. Further we found that debt effects on GDP has significantly reduced when investment variable without netting out the debt effect, is included in the regression. This justify our decision to include debt variables in GDP equation together with investment variable free from public debt effect.

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