An empirical note on causality between government spending and debt in South Africa

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Abstract

The causal relationship between government spending and debt is richly debated theoretically, but empirical examination of the causal relationship between them has received little attention. Understanding the debt-spending relationship is important for reforming debt contraction and management strategies. Using quarterly data for the 1965-2019 period for South Africa, the paper tests the causal relationship within the Toda-Yamamoto granger non-causality and non-linear autoregressive distributed lag frameworks. The paper finds that debt granger causes spending and, thus, confirms the public choice hypothesis, while it fails to find evidence in support of the neoclassical and modern monetary theory views. The results suggest that there is no evidence of asymmetrical effects of changes in debt on spending. A long run relationship between debt and spending is found in the context of non-linear autoregressive distributed lag model, but not in the context of the linear autoregressive distributed lag model. This suggests the existence of hidden cointegration between the variables.

Introduction

Although literature is replete with tests of the causality between government spending and tax revenue, little by way of empirical evidence exists on the relationship between government spending and debt. The faint voice in empirical literature not only is surprising given the rich theoretical debates about the relationship between the two, but also points towards a research issue that demands closer empirical examination. Theoretically, public choice theorists have shown that democracies tend to experience high levels of government spending co-existing with high levels of debt, especially because of pork-barrel public expenditure programs (Alesina & Tabellini, 1990; Battaglini & Coate, 2008; Buchanan, 1958; Buchanan, 2014; Salsman, 2017). In essence, they assume that since it is electorally less costly to finance higher spending by debt than by raising tax rates, debt tends to cause government spending (Battaglini & Coate, 2008). There is much less democratic accountability concerning debt than there is with respect to taxation (Eusepi & Wagner, 2017; Wagner, 2019). This ties in well with the problem of fiscal illusion as expounded by Buchanan and Tullock (1962).
The neoclassical view is that debt is raised to fill in the excess of expenditure over tax-

ation. In that sense, revenue, spending or both causally explain debt levels (Bernheim, 1989). From a heterodox standpoint, Abba Lerner's laws of functional finance postulate that debt is not a financial resource-raising tool primarily, but rather a liquidity and interest rate management tool (Forstater, 1999; Lerner, 1943; Lerner, 1944; Wray, 2018). Secondarily, the resources so mobilized in the processes of managing liquidity and interest rates can always be spent when the economy falls below its full employment level of performance. The laws of functional finance suggest that causality runs from spending to debt, but the difference with the neoclassical view lies in the causal chain and the purpose of debt. Modern Monetary Theory scholarship strongly supports the functional finance theoretical view (Corbin, 2012; Kelton, 2011; Kelton, 2019; Kelton, 2020; Mitchell, Wray, & Watts, 2016; Wray, 2018).

The differences amongst the few schools touched on here can be clarified by two contrary understandings of fiscal processes. The neoclassical view, like many other mainstream views, assumes that government taxes first and then spends (Ho & Huang, 2009; Jaén-García, 2020; Payne, 1998; Phiri, 2019; Young, 2009), and subsequently borrows to cover any fiscal deficits. In fact, a variant of the neoclassical view is that government taxes and borrows first, before it can spend (Kelton, 2020). The heterodox view is that government spends first and then deploys taxation and debt to counteract the overheating of the economy from early doses of government spending (Bell, 2000; Cesaratto, 2016; Kelton, 2020; Lerner, 1943).

The disagreements in theory equally deserve considerable effort aimed at empirical falsification of the theories. The present paper takes up this challenge by examining the causal relationship between government spending and debt using South African data. One of four possibilities might be established: bidirectional causality, unidirectional causality from debt to spending, unidirectional causality from spending to debt or no causal relationship, each with important implications for fiscal policy. From a policy standpoint, South Africa has been struggling with ever-growing levels of debt to GDP ratio posing threats to fiscal sustainability and scholars blame the ever-rising government spending for the unsustainable debt path (Burger, Stuart, Jooste, & Cuevas, 2012; Burger, Siebrits, & Calitz, 2016; Burger & Calitz, 2020). Figure 1 shows that debt in general fell, with occasional setbacks, between the mid-1960s and the late 1980s. According to Browne (1983), the years 1968-1975 were characterised by significant fiscal expansion, while the 1976-1983 period was one of fiscal restraint – these switches explain the behaviour of the debt-gdp ratio, as well as upward trending government spending to GDP ratio. The earlier part of the 1990s before transition to democracy exhibited rising debt-GDP and spending-GDP ratios as the apartheid government spend more on defence because of its expanding presence in Namibia and Angola. However, the adoption of the Medium Term Expenditure framework in 1998 and the fiscal consolidation process that ensued resulted in the debt ratio declining sharply between 1998 and 2008 (Burger et al., 2016; Burger & Calitz, 2020). After the global financial crisis, the ratio just escalated. A number of operative forces can be identified. First, the downgrading of South African bonds by credit rating agencies, which raised the cost of servicing debt. Second, the heightened pace of state capture since the entrance of former President Jacob Zuma into power between 2009 and 2018. Third, rising levels of government debt guarantees to state-owned enterprises

between 2009 and 2019, many of which ended up being on national treasury's books. A bird's eye view of Figure 1 suggests that the two variables have a relationship, even though it is hard to tell its strength.
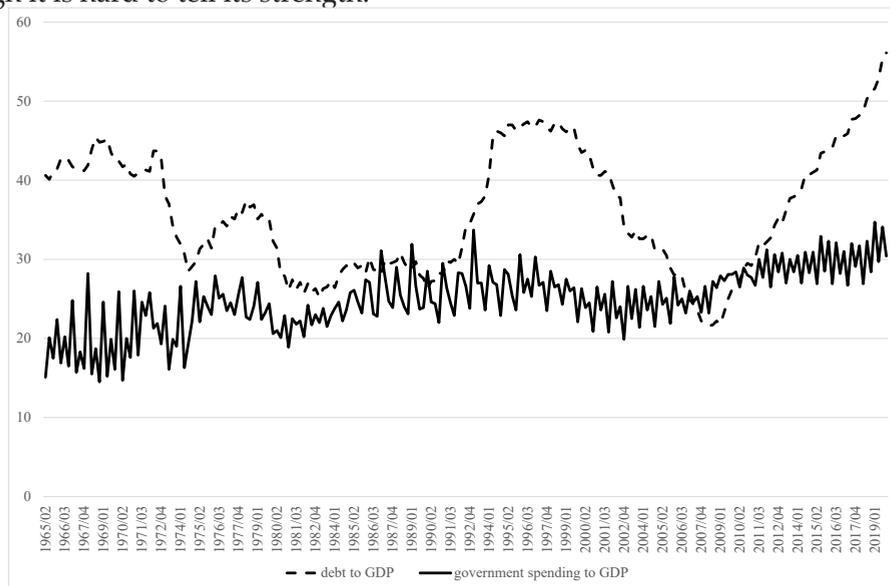

Figure 1: Evolution of South African government debt and spending
Plotted from the South African Reserve Bank data

Literature

The neoclassical and heterodox perspectives are that government spending causally explains government debt despite differing on the purpose of debt and its influence on spending. Based on GMM regression application to OECD data, Del Monte and Pennacchio (2020) found that government expenditure causally explains government debt. Odo, Igberi, and Anoke (2016), using a vector error correction modelling framework, also found that causality ran from government current and capital spending to debt in the case of Nigeria. The Nigerian case demonstrated that debt was used to finance deficits. However, Onyango (2019) established bi-directional causality between government development spending and debt, but uni-directional causality from debt to government current spending. In this sense, it appears as though the lack of democratic accountability on how debt finance is spend tends to cause governments to allocate debt to consumption spending. Iiyambo and Kaulihowa (2020) found public spending to Granger-cause debt in the case of Namibia, although it is not clear why they used the Engle-Granger error correction framework even if they had carried out a Johansen cointegration test. Like Iiyambo and Kaulihowa (2020), Mah, Mukkudem-Petersen, Miruka, and Petersen (2013) found government spending to granger-cause the net present value of government debt. As Hadi and Hashim (2021) have shown, government revenue explains the evolution debt. This is because debt is an accumulation of fiscal deficits, which evidently are determined by the evolution of tax

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revenue. To reduce debt, in most cases, is to work on increasing tax capacity and effort. Introducing some nuances, Mahdavi (2004) found external public debt to affect public capital spending negatively, while increasing deficit bias in favour of wage goods that enhance vote-maximisation for the ruling elite.

Some studies have attempted to focus on a specific category of government spending and its relationship with either public debt or public external debt. Karagol (2005) has examined the relationship at the level of defence spending and external debt and found that defence spending granger-causes external debt both in the short run and the long run, but Sezgin (2004) found no causal relationship between the two. Sezgin (2004) used a much simpler Engle-Granger causality analysis framework, while Karagol (2005) used the vector error correction framework. The former method might have failed to control for reverse causality. Dunne, Perlo-Freeman, and Soydan (2004) and Kollias, Manolas, and Paleologouc (2004) have also established that defence spending has a positive causal influence on the debt to GDP ratio for a panel of small developing economies.

From the short survey of literature, it is evident the causal relationship between government spending and debt is ambiguous. In some instances, government spending in general and for some specific categories has a causal influence on both domestic and foreign debt. In some cases, there is bi-directional causality between government spending and debt. Yet, others have found no causal relationship between the two variables. Given the debate about fiscal sustainability, the link between government spending and debt in South Africa is a critical policy and intellectual issue that deserves attention presently. The next section presents the methods and data.

Methods and Data

Since the various strands of economic thought on the relationship between government debt and spending suggest either a reverse causal or a one-way causal process, the research note adopts a two stage approach. A vector autoregressive model is developed and granger causality tests carried out. If one way causality is established, a non-linear autoregressive distributed lag (NARDL) model is estimated. The choice of the NARDL stems from the possibility of non-linearities in the relationship and the possibility of hidden cointegration (Schleer-van Gellecom, 2013). The theoretical links justify the use of the vector autoregressive regression (VAR) framework and the Toda-Yamamoto modification to the standard VAR, which the paper employ. The Granger non-causality testing framework proposed by Toda-Yamamoto requires the lag structure to be modified such that the optimal lag length is augmented by the maximum order of integration (Toda & Yamamoto, 1995). The Granger non-causality test focuses on the optimal lag length, while the augmented lag structure whitens the error term. The Toda-Yamamoto VAR model is specified:

$$debt2gdp_t = \beta_{10} + \sum_{i=1}^{p,d} \beta_{1i} debt2gdp_{t-j} + \sum_{j=1}^{q,d} \gamma_{1j} spend2gdp_{t-i} + \varepsilon_{1t} \quad (1)$$

$$spend2gdp_t = \beta_{20} + \sum_{i=1}^{p,d} \beta_{2i} debt2gdp_{t-j} + \sum_{j=1}^{q,d} \gamma_{2j} spend2gdp_{t-i} + \varepsilon_{2t} \quad (2)$$

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The error terms and are assumed to follow a normal distribution. is the maximum order of integration, which is determined by using the standard Augmented Dickey-Fuller (ADF) test and the Kwiakowski, Phillips, Schmidt and Shin (KPSS) test that structure their null hypothesis differently. The test for Granger non-causality tests the null hypotheses that and , for i = 1, …, p; j = 1, …, q and excluding the augmenting lag, (p + d) or (q + d), whichever is greater. If the lag augmented lag is dropped the standard VAR is retained.

After testing for causality and establishing that it is unidirectional, a NARDL model is estimated to overcome the overly restrictive assumption that decreases and increases in the explanatory variable have an identical effect on the dependent variable. A better assumption is to say positive and negative changes in the explanatory variables have asymmetric effects on the depended variable. The Toda-Yamamoto granger non-causality test showed that debt causes spending. Thus, the assumption of asymmetric effects of changes in debt on spending leads to the specification of non-linear ARDL (NARDL) model, as follows:

$$spend2gdp_t = \beta_0 + \sum_{i=1}^{p} \rho_{1i} spend2gdp_{t-i} + \sum_{j=0}^{q} \beta_{2j}^{+} debt2gdp_{t-j}^{+} + \sum_{j=0}^{q} \beta_{2j}^{-} debt2gdp_{t-j}^{-} + +\mu_t \qquad (3)$$

In equation (3), each explanatory variable is decomposed into positive and negative changes so that a test of asymmetric effects can be carried out. In general, therefore, the optimal lags for each decomposed variable do not necessarily have to be the same for positive and negative changes even though in the representation in (3) they might appear to be. The test for asymmetric effects is carried out on the hypotheses that

$$-\frac{\beta_{2j}^{+}}{\rho_{11}} = -\frac{\beta_{2j}^{-}}{\rho_{11}}; \; \forall j = 0, ..., q \qquad (4)$$

The test in (4) is an F-test based on the linear restrictions imposed on coefficients in (3).

Further, an F-bounds test can be carried out to examine the existence of a long run relationship between spending and debt, finding which paves way for an error correction representation. The error correction mechanism can be expressed as (5), following Schleer-van Gellecom (2013):

$$\Delta spend2gdp_t = \alpha_0 + \sum_{i=1}^{p} \alpha_{1i} \Delta spend2gdp_{t-i} + \sum_{j=0}^{q} \alpha_{2j}^{+} \Delta debt2gdp_{t-j}^{+} + \sum_{j=0}^{q} \alpha_{2j}^{-} \Delta debt2gdp_{t-j}^{-} + \theta ECT_{t-1} + \varepsilon_t \qquad (5)$$

The coefficient of the error correction term (ECT), for convergence to occur. If statistically significant, it also indicates that the decomposed debt variables granger-cause spending. Further, short run dynamics can also have asymmetric effects on change in spending, which can be tested in much the same way as in equation (3).

The data used in the model was obtained from the South African Reserve Bank. Central government total spending is used to measure government spending and central government debt excluding interest payments is used to measure debt. Both variables are expressed as a percentage of GDP. The period of study is 1965-second quarter to 2019-fourth quarter.

Results

Table 1: Unit root tests for government spending and debt

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	Level		First difference		Order of integration
	Drift	Drift & trend	Drift	Drift & trend	
ADF:					
Debt-2GDP	-1.484	-1.509	-4.356***	-4.645***	One
Spend-2GDP	-1.027	-2.370	-10.970***	-10.949***	One
KPSS:					
Debt-2GDP	0.148***	0.135***			Zero
Spend-2GDP	1.425	0.143***§	0.066***		One

Note: §trend is significant; ***means significant at 1%

The ADF test shows that debt and spending are cointegrated, while the KPSS shows that debt and spending are integrated of different orders (Table 1). The KPSS points to the need to use the Toda-Yamamoto causality testing framework.

Table 2: Vector Autoregressive, Toda-Yamamoto and NARDL estimates

	VAR		Toda-Yamamoto		NARDL (4, 1, 1)	NARDL-ECM (4,1,1)
	Debt-2GDP	Spend-2GDP	Debt2GDP	Spend-2GDP	Spend2GDP	ΔSpend2GDP
Debt2GDP$_{-1}$	1.129***	-0.019	0.976***	-0.209		
	(0.068)	(0.125)	(0.066)	(0.127)		
Debt2GDP$_{-2}$	0.046	0.186	0.002	0.170		
	(0.099)	(0.182)	(0.092)	(0.177)		
Debt2GDP$_{-3}$	-0.350***	-0.117	-0.295***	-0.046		
	(0.096)	(0.176)	(0.087)	(0.167)		
Debt2GDP$_{-4}$	0.581	-0.298	0.559***	-0.332**		
	(0.099)	(0.182)	(0.091)	(-1.911)		
Debt2GDP$_{-5}$	-0.422***	0.222*	-0.357***	0.278**		
	(0.067)	(0.122)	(0.061)	(0.117)		
Spend2GDP$_{-1}$	0.130***	0.178**	0.078**	0.098		
	(0.040)	(0.074)	(0.038)	(0.072)		
Spend2GDP$_{-2}$	-0.022	0.112**	-0.002	0.060		
	(0.026)	(0.047)	(0.032)	(0.062)		
Spend2GDP$_{-3}$	-0.030	-0.008	-0.040	-0.022		
	(0.026)	(0.048)	(0.024)	(0.046)		

Spend2GDP$_{-4}$	0.038	0.818***	0.028	0.793***		
	(0.026)	(0.047)	(0.023)	(0.045)		
Spend2GDP$_{-5}$	-0.068*	-0.134*	-0.030	-0.078		
	(0.039)	(0.072)	(0.036)	(0.070)		
Constant	-0.627	1.904	0.255	3.069**	5.377***	5.378***
	(0.699)	(1.282	(0.703)	(1.347)	(1.516)	(1.234)
Debt2GDP$_{-6}$			0.114***	0.127***		
			(0.017)	(0.032)		
Spend2GDP$_{-6}$			-0.043	0.047		
			(0.030)	(0.058)		
Spend2GDP$_{-1}$					-0.068	
					(0.045)	
Spend2GDP$_{-2}$					-0.089**	
					(0.042)	
Spend2GDP$_{-3}$					0.008	
					(0.043)	
Spend2GDP$_{-4}$					0.725***	
					(0.043)	
Debt2GDP^{+}					0.496***	
					(0.175)	
Debt2GDP$_{-1}^{+}$					-0.505***	
					(0.174)	
Debt2GDP^{-}					0.764***	
					(0.178)	
Debt2GDP$_{-1}^{-}$					-0.793***	
					(0.179)	
ΔSpend2GDP$_{-1}$						-0.822***
						(0.057)
ΔSpend2GDP$_{-2}$						-0.733***
						(0.057)
ΔSpend2GDP$_{-3}$						-0.725***
						(0.041)
ΔDebt2GDP^{+}						0.496***
						(0.173)

ΔDebt2GDP⁻					0.764***
					(0.175)
ECT$_{-1}$					-0.246***
					(0.059)
Lag order: SIC/ HQ	5	5	5	5	5	
F-bounds test					5.688
					3.79† 4.85§
VAR stability	Stable	Stable	Stable	Stable	

Note: ***means p<0.01; **means p<0.05; *means p < 0.10; † means lower bound and § means upper bound for the F-bounds test

Table 3: Block Exogeneity Wald tests of causality

Dependent	Excluded	χ^2	df	Prob
Standard VAR:				
Debt/GDP	Spending/GDP	15.505	5	0.008
Spending/GDP	Debt/GDP	7.290	5	0.200
Toda-Yamamoto:				
Debt/GDP	Spending/GDP	8.189	5	0.146
Spending/GDP	Debt/GDP	24.810		0.000

The results in Tables 2 and 3 show that, based on the standard VAR, spending granger-causes debt. However, the unreliability of the granger causality test when variables are cointegrated or are of mixed orders of integration implies that the Toda-Yamamoto granger non-causality test provides reliable results. Tables 2 and 3 show that, based on the Toda-Yamamoto framework, causality runs from government debt to spending. This finding contradicts both the Neoclassical and Modern Monetary Theory and/or Functional Finance perspectives, which postulate that causality runs from government spending to debt. Rather, the findings confirm the public choice perspective that in democracies and other political arrangements, debt is the most preferred means of financing government spending. This is because fiscal illusion lessens the effectiveness of democratic accountability on how debt is spend, leading to rent seeking and vote maximising debt financing strategies.

Table 2 reports results of the non-linear ARDL regression model. While we have not reported results for the linear ARDL, which showed that there was no long run relationship between government spending and debt, the NARDL estimates clearly show that the two variables have a very significant long run relationship. The error correction term is significant and suggests that 24.6% of the equilibrium error in the previous period is corrected in the current period. This is a small speed of adjust-

ment, which suggests persistence of the shock in the relationship between government spending and debt. This is a case of hidden cointegration established through the NARDL test. Table 4 reports hypotheses tests of asymmetric effects of changes in debt on spending. The results show that the effects of debt are symmetrical. Figure 2 confirms the results in Table 4. In general the effect of positive and negative changes in debt cancel out each other so that the effect nets out to be symmetrical. However, the joint effect of positive and negative changes in debt are significant.

Table 4: Tests of non-linear effects in the NARDL model and overall significance

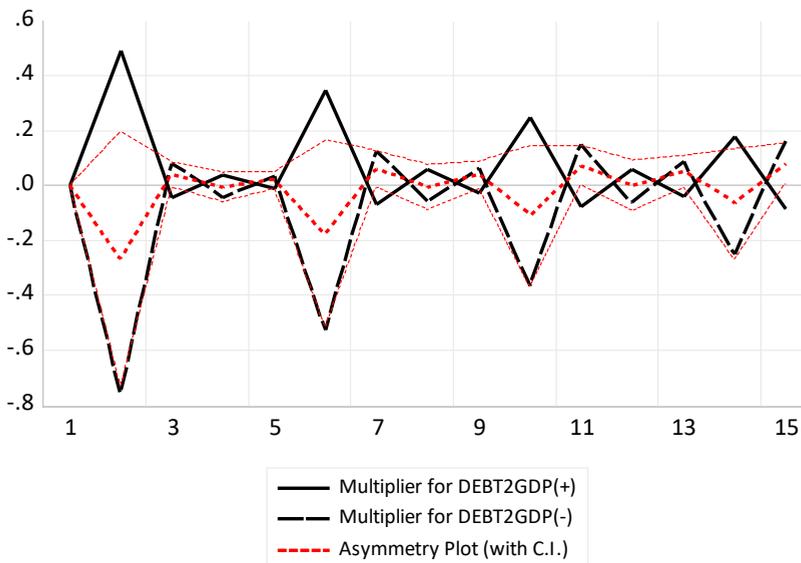| Hypothesis	Test statistic, [prob]	Conclusion
$-(\text{Debt/GDP}^+)/(\text{spending/GDP})_{-1} =$ $-(\text{Debt/GDP}^{-+})/(\text{spending/GDP})_{-1}$	-0.792 [0.429]	No asymmetric effects
$-(\text{Debt/GDP})_{-1}{}^+/(\text{spending/GDP})_{-1} = -(\text{Debt/GDP})_{-1}{}^-/(\text{spending/GDP})_{-1}$	0.836 [0.404]	No asymmetric effects
$\text{Debt/GDP}^+ = \text{Debt/GDP}_{-1}{}^+ = \text{Debt/GDP}^- = \text{Debt/GDP}_{-1}{}^- = 0$	10.807 [0.000]	Jointly significant

Figure 2: Multiplier analysis for the NARDL regression of spending on debt
Source: Author's analysis

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Conclusion and discussion

The purpose of the research note was to test empirically the competing views on the causal relationship between government spending and debt. The neoclassical and functional finance/modern monetary theory views agree that spending causes debt, although they differ on how the causal chain plays out. The public choice view is that debt causes spending. The findings confirm the public choice view. The implications of this finding are immense and potentially help explain why emerging economy democracies tend to have a positive debt bias in their fiscal plans. When availability of debt drives spending, it points towards a failing democracy in which corrupted political incentives increase the appetite for debt-financed spending. The corrupted political incentives perpetually reproduce because they ride on the wave of fiscal illusion of the electorate.

First, given the history of repressive and extractive economic institutions of apartheid in South Africa, the democratic government finds it hard to innovate on the revenue front because an increase in tax burden can result in a tax revolt or raises electoral cost for the ruling party. In an environment of a narrowing tax base and ever-increasing social pressure for more government spending, debt is the only means of achieving the spending at levels that the electorate demands but also availability of debt tends to create the appetite to spend on programmes that may be more consumptive than they are productivity.

Second, because of fiscal illusion, the majority of citizens who are low-income earners prefer government to supply public goods and other social services financed by debt, which they interpret as having no immediate or future effect on the tax burden. This observation implies that citizens do not behave in the way predicted by the Ricardian Equivalence theorem. This is the only reason why debt keeps rising as government seeks to provide social services such as social security grants, roads, electricity and housing among other things.

Third, it therefore appears that the ratchet effect is as much a fact on the spending side as it is on the debt side of the fiscal process (Feld & Kirchgässner, 2001). The ability of government to access international capital markets has made it a preferable option to resort to debt to raise finances for both recurrent and capital spending. Although credit rating agencies have managed to instil some fiscal discipline through punitive ratings, South Africa has continued to create a fiscal environment that makes borrowing internationally possible and cheap.

Overall, the empirical note established that debt granger causes spending, a finding that defies conventional logic and requires government to rethink institutions for debt contraction and management. Institutional changes that enhance political commitment to credible and productive debt would need to be instituted. The recent discourse on achieving fiscal sustainability in South Africa will have to consider the possibility of twisted political incentives and the need to institute statutory fiscal rules like debt rules, debt ceiling or some statutory rules on the process of government debt contraction. This will ensure that spending does not increase because of easy availability of debt finance.

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