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Summary

This paper investigates the major drivers of the public debt growth in 184 countries. The underlying cross-country survey is conducted on the basis of the improved compilation of datasets on the central government debt for 2013. The study finds that oil abundance, economic growth rate, the share of mineral rent in the total revenue and interest rate payments for foreign borrowings have statistically significant impact on the growth of the public debt. In contrast, defence spending, unemployment rate, and inflation rate do not have a statistically significant impact on the public debt rate. Being a developing country has a statistically significant negative impact on the level of the central government debt.

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JEL Classification: F21, F34, F36, G15, H6, N1, F3

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Determinants of the Public Debt and the Role of the Natural Resources: A Cross-Country Analysis

Elkhan Richard Sadik-Zada[1] *Andrea Gatto*[2]

Abstract:

This paper investigates the major drivers of the public debt growth in 184 countries. The underlying cross-country survey is conducted on the basis of the improved compilation of datasets on the central government debt for 2013. The study finds that oil abundance, economic growth rate, the share of mineral rent in the total revenue and interest rate payments for foreign borrowings have statistically significant impact on the growth of the public debt. In contrast, defence spending, unemployment rate, and inflation rate do not have a statistically significant impact on the public debt rate. Being a developing country has a statistically significant negative impact on the level of the central government debt.

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1. Introduction

Sovereign borrowing as a tool of public finance emerged first in the UK after Britain's Glorious Revolution in 1688 (Pincus and Robinson, 2011). Adding to this, America's Revolution in 1776 and European Enlightenment of the eighteenth century were major events which led to a strengthening of the rule of law, sanctity of contract and parliamentary checks on the power of the heads of the states (Brautigam, 1992; Ferguson, 2014). This, in combination with the incessant money shortage of the state led to the emergence of the central banking. The money shortage and the rise of the division of powers were the results of the permanent wars taking place between European states inside Europe and outside Europe over the colonies (Kennedy, 2010).

To assist governments in financing the war with France, Britain established 1694 Britain's Bank of England. In a similar manner, Denmark (1773), France (1800), Austria (1816), Norway (1816), Belgium (1850), Netherlands (1864), Germany (1875), Japan (1882), Italy (1893), Switzerland (1905), the United States (1913), and Canada (1933) established their central banks (Salsman, 2017); this fact produced an impetus for the emergence of public debt as a central instrument of fiscal policy.

Today, public debt is a global phenomenon practiced in most of the countries around the world, whereby developing countries rely more on the external than on the domestic borrowing. This is the result of the underdevelopment of the financial sector in a number of developing and transition economies.

This work aims at proposing a contribution to detect nexuses existing amongst public debt, energy, and military expenditure. The analyses suggest an important role of oil embedment, mineral rent, economic growth rate, interest rate payments for foreign borrowings in developing country in public debt increase. On the other hand, we discover that defence spending, unemployment rate, and inflation rate do not play a major role in augmenting public debt rates.

Rest of paper is organized as follows: **Section-II** deals with literature review containing studies on sources and determinants of public debt. **Section-III** talks about major hypotheses of the survey. **Section-IV** discusses underlying research methodology and data collection.

Section-V discusses empirical results. **Subsection-VI** presents concluding remarks with policy implications.

2. Literature review

2.1 Sources of Public Debt

The International Monetary Fund (IMF) defines debt "*as all liabilities that require payments of interest and/or principal by the debtor to the creditor at a date or dates in the future. Thus, all liabilities in the Government Finance Statistics system are debt except for shares and other equity and financial derivatives*" (IMF, 2001). Printing money, running down foreign exchange reserves, borrowing abroad, and borrowing domestically are four major forms of fiscal deficit financing (Fischer and Easterly, 1990). Printing money fuels inflation and the seigniorage revenue enabled by such a policy is non-linear inflation. Empirical surveys show that printing money has a very limited leeway for combating the budget deficit and in the same time is very costly for macroeconomic stability and economic growth (Easterly and Schmidt-Hebbel, 1991; Bua et al. 2014).

The literature on public debt, especially for the low-income countries, focuses on the external debt data (Panizza, 2008; Jaimovich and Panizza, 2010). Two factors arise: not only the data availability issue holds, but also the fact that government borrowing in most developing countries was made possible mainly over foreign debt sources. The role of the local debt market to finance budget deficits started to increase in last decade, especially in 2008, during the financial crisis (Bua et al., 2014). Running down the foreign exchange reserves has no inflationary effects. Hence, this policy seems to be more advantageous than increasing the stock of money in the economy. Nevertheless, this policy has its limits and cannot be employed for a substantially long time due to the limits of foreign exchange reserves (Krugman, 1979; Fischer & Easterly, 1990).

Despite this fact, as a short-term policy tool, this strategy could be considered as an appropriate short-term instrument for the emergency and crisis situations. Foreign lending does not create an inflationary pressure on the domestic economy nor leads to crowding out of domestic lending to private sector. This could eventually lead to the appreciation of domestic currency over the increasing demand for the local currency and harm domestic exports (Sachs and Werner, 1995; Rordrik, 2008). Foreign debt financing scales up the pressure on solvency and complicates the exchange rate management (Bua et al., 2014).

Domestic borrowing does not have the inflationary pressure on the economy, nor leads to the appreciation of local currency. The major concerns of domestic borrowing result to be the crowding out effects of private investments by public investments and increasing domestic interest rates. Domestic borrowing is more common in the countries with developed financial institutions. Thus, for a long time domestic borrowing was latently assumed to be more widespread in the advanced and emerging economies, and much less in the low intensity conflicts (LICs). This opinion was backed by the absence of empirical data on the LICs. This paradigm has changed with the new data on domestic public debt for 36 LICs compiled in Bua et al. (2014). The dataset shows that the substantial share of public debt in these LICs were generated through domestic borrowing. This is attributable to the result of financial liberalization commenced in the late 1980s and early 1990s (Presbitero, 2012). Based on the dataset built by Bua et al. (2014), it is appreciable as well a slight increase of the already substantial domestic borrowing as the source of public debt (**Figure-1**). Domestic debt has increased from 12.3% in 1996 to 16.2% in 2011. The dataset presented in Presbitero (2012) yields the same result.

In addition, **Figure-1** also shows the evolution of external debt in the LICs. There has been a steady decline of external debt ratio over the period 1996-2008, from 72 to 23% in 2011. After 2008, this ratio did not change significantly.

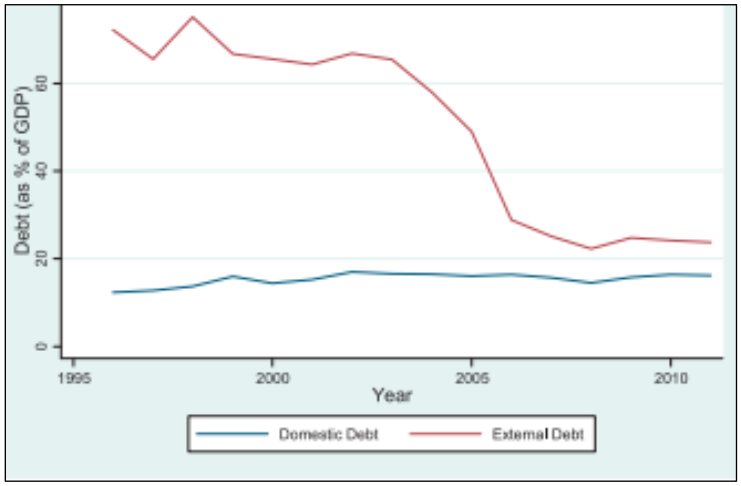

Figure-1. Domestic and External Public Debt (as % of GDP), 1996-2011

Source: Bua et al. (2014)

It must be mentioned that domestic debt, especially in developing countries with high inflation rates, is mostly issued in foreign currencies. A textbook case is Zimbabwe during hyperinflation. During the years of hyperinflation, Zimbabwe issued the majority of debt obligations in foreign currencies. However, this is not a problem happening solely to countries experiencing hyperinflation: the overwhelming majority of the LICs issue their public obligations in the currencies which dominate in the international financial and trade relations – i.e. US Dollars, Euro, and Yuan. This is an additional burden

on the sovereign default risk, because the local governments are not able to control the factors determining the volatility of foreign currency (Mupunga & Le Roux, 2016).

2.2 Determinants of the Public Debt

Forslund et al. (2011) identify six major categories determining the composition of the public debt in developing countries. These are: (1) macroeconomic imbalances; (2) country size and the level of development; (3) crises and external shocks; (4) openness; (5) exchange rate regime. Macroeconomic imbalances category encompasses inflation, current account balance, level of total public debt and exchange rate misalignment. The second category, country size and level of development is related to indicators such as GDP, per capita income, M2[3] over GDP, and institutional quality. The third category, crises and external shocks, captures the crisis situations related to a sovereign default and other impulsive changes in the current macroeconomic situation. The fourth category sketches trade and capital account openness. The last category, exchange rate regime, is related to the fixed or loating exchange rates. Karagol and Sezgin (2004), Sezgin (2004), Dunne et al. (2004a, b), Narayan and Narayan (2005), Ahmed (2012), Anfofum et al. (2014), Muhanyi and Ojah (2014), Azam and Feng (2015), Karagöz (2018) detect a positive causal relationship between defence expenditure as an important driver of the public debt.

Apart from external debt, military spending is tight in the long-run with economic growth and investment (Shahbaz et al., 2016), whereas negative unidirectional causality emerges investigating the relationship from defence spending to economic growth (Shahbaz and Shabbir, 2012); military spending is connected with investment and trade openness, whereas it is negatively correlated with interest rate (Tiwari and Shahbaz, 2013). It is also reputed that increases in defence spending reduces the pace of economic growth, while current economic growth is connected with growth of previous periods, and that non-military expenditures rises can boost economic growth (Shahbaz et al., 2013).

[3] Money supply measure, as defined by the Federal Reserve

The relationship between oil abundance and public debt issues has not been yet studied exhaustibly. Despite the intuition that the economies with substantial petroleum revenues should have a lower public debt share, and consequently a lower sovereign default risk (Sadik-Zada, 2016), this ascertainment not generally valid. Hamann et al. (2016) and Arias and Restrepo-Echavarria (2016) show that this is by far not the case. **Figure-2** depicts the average public debt for 25 net oil exporters between 1979 and 2010.

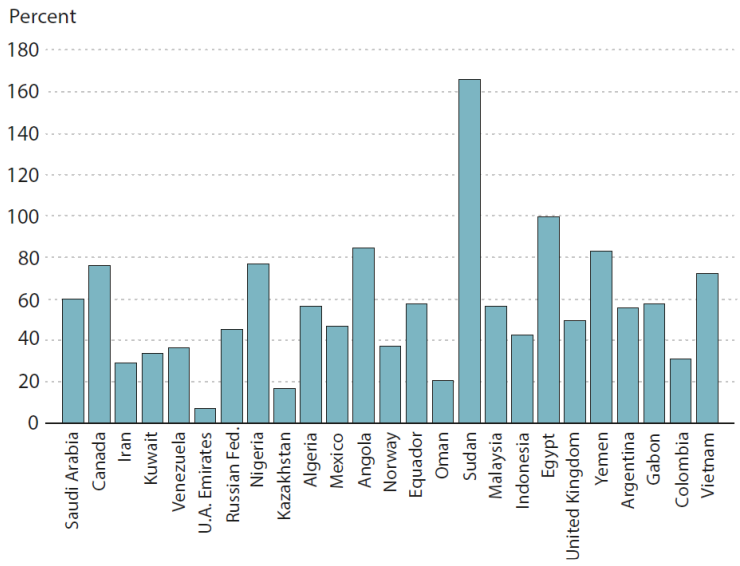

Figure-2. Total Public Debt to GDP, 1979-2010 Average
Source: Arias and Restrepo-Echavarria (2016) and WB (2018).

The cross-country average public debt to GDP ratio is 50%, ranging from 8% (UAE) to 179% (Sudan). As shown on **Figure-3**, only 8 of 25 countries did not have default episodes (Borzenstein and Panizza, 2008, Arias and Restrepo-Echavarria, 2016). The major problem in the public finance of the oil-producing economies is the volatility of oil prices. Increasing oil prices lead to the rising oil extraction and higher GDP growth rates, improvements of trade balance and current accounts, lower sovereign risk perception, and reduce the default risk. In the phases of

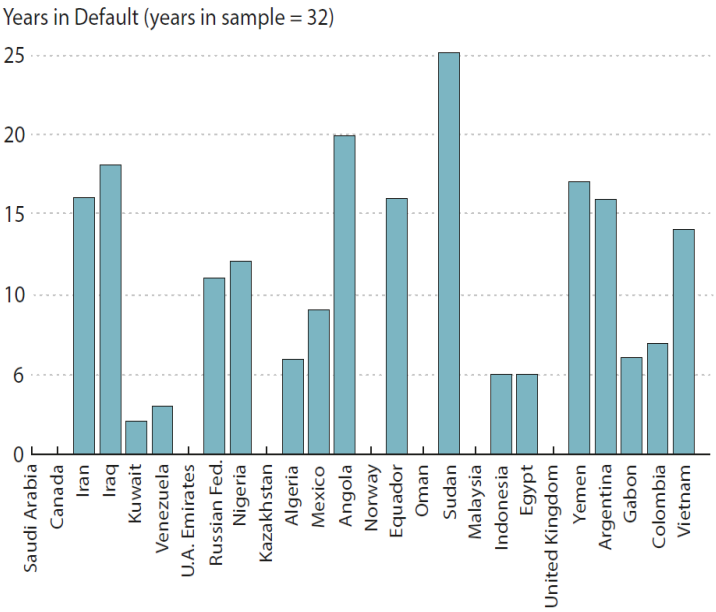

Figure-3. Default Episodes, 1979-2010
Source: Arias and Restrepo-Echavarria (2016) and WB (2018).

shrinking oil prices, the opposite happens, and the default risk increases substantially (Arias and Restrepo-Echavarria, 2016).

3. Theoretical Framework and Hypotheses

Fiscal policy targets do stimulate the economy especially during or before a recession. The constitutive feature of the recession is the negative growth rate at least for six months (Sadik-Zada, 2000 and 2016). Thus, we assume that especially in the times of very low or negative growth rates the governments employ public debt as an anticyclical stimulation instrument. Based on this assumption, we test the following hypothesis:

Hypothesis 1: *Economic growth has a negative growth effect on public debt.*

Armed with the same logic, we assume that especially in the recession phases with high pressure on job market, governments employ public debt as a tool to compensate the recessive impulses by the positive fiscal impulses and to curb job market.
To test for the relationship between unemployment rate and public debt, we test the following hypothesis:

Hypothesis 2: *There is a positive relationship between unemployment rate and public debt.*

To combat recession, governments increase public investments mainly financed over public debt. This is especially the case of recession phases due to decreasing tax revenues.
To assess the relationship between public debt and gross capital formation, we test the following hypothesis:

Hypothesis 3: *There is a positive relationship between gross capital formation (GCF) and public debt ratio in the short run.*

Increasing defence spending, especially in the developing countries, does not have strong positive effects on economic growth and is not considered as an anticyclical instrument. In fact, the majority of developing countries import most armament from the advanced

economies. Increasing or high share of the defence spending as a budget item is a sign for the existence of the security risks.
In the next hypothesis, we test for the effect of the defence spending on public debt.

Hypothesis 4: *There is positive relationship between defence spending and public debt ratio.*

Mohaddes and Raisi (2017) have shown that the existence of the sovereign wealth funds (SWFs) in the petroleum rich countries also serve actively as an anticyclical tool. The availability of the transfers from these SWFs to the state budgets could lead to fungibility between these transfers and the public debt.
Thus, we test this in the following hypothesis:

Hypothesis 5: *Petroleum (mineral) abundance has a negative impact on the public debt ratio.*

In order to take account for the structural differences between advanced and developing/transition economies, we include a dummy variable, which takes the value 1 for all developing and transition economies and 0 for the advanced economies. This variable captures also partly the diverging effect of the defence sector on the rest of the economy in these two groups.

Hypothesis 6: *There is a difference between developing/transition and advanced economies in public debt levels.*

The countries with a high level of public debt have a higher share of the interest rate as a share of public debt than the countries with a moderate public debt. We also want to assess the impact of the indebtedness on the level of additional indebtedness and employ the interest rate payments as an independent variable.

Hypothesis 7: *There is a positive relationship between interest rate payments and the public debt share.*

4. Research Design

4.1 Data

The data on public debt have become more comprehensive, more accurate, and more readily available in recent years due to the efforts of Abbas et al. (2011), Jaimovich and Panizza (2010), and Bova et al (2014). Bua et al. (2014), introduced a new dataset on the stock and structure of domestic public debt in 36 Low-Income Countries over the period 1971-2011. This dataset provides not only the information on the stock of public debt and interest payments, but also encompasses the information on maturity, currency composition, creditor base, and type of the financial instruments. For our analysis, we employ the data compilation provided by the last version of the World Development Indicators (2018) which incorporates the data sources mentioned above. We should stress our data collection choice. For the sake of completeness, we take the data of 2013. This choice is driven by data availability, and to avoid data loss or imputation: we chose the most recent, standard, and representative year in terms of data, 2014, presenting 2017 a lot of missing values. The years 2013 to 2015 are more complete. Nevertheless, to avoid a structural break, we take the observations for 184 countries before the dramatic shrinkage of the oil prices in November 2014.

4.2 Methodology

For the assessment of the major determinants of the public debt, this study applies a cross-country linear regression approach with data for 184 countries. To interpret the regression coefficients as elasticities, i.e. in percentages and to normalize the data, the natural logarithm of the dependent and all the independent variables are taken. To test for the existence of heteroscedasticity *Breush-Pagan test* was applied.[4] The test result indicates the absence of heteroscedasticity in the dataset (see **Appendix 1**). To assess the differences in the level of public debt between the advanced and developing economies, we employ a dummy-variable strategy. We classify all the EU-member states and all the high-income countries with a per capita income over 30000 in constant 2010 US Dollars as developed countries. Except for the UAE and Qatar, all the Gulf States are classified as developing countries.

The natural logarithm (ln) of the share of the central government debt in GDP *(lngY)* is the dependent variable; ln of the inflation rate *(lnINFLAT)*, ln of the unemployment rate projected by the International Labour Organization (ILO), ln of the unemploymenr rate

[4] Heteroscedasticity refers to the circumstance in which the variability of a variable is unequal across the range of values of a second variable that predicts it (*cf.* Wooldridge, 2013).

(*lnUEMP*), ln of the share of the oil rents as a share of GDP *(lnOilRent)*, ln of the share of the defence spending as a share of GDP *(lnDEFENCE)*, gross capital formation as a share of GDP *(lnINV)*, ln of the mineral rent as a share of GDP *(lnMINERAL)* and ln of the interest payment for the public debt *(lnINTEREST)* are the independent variables.

$$Y_i = \beta_0 + \beta_1 lngY + \beta_2 lnINFLAT + \beta_3 lnUEMP + \beta_4 lnOilRent + \beta_5 lnDEFENCE + \\ + \beta_6 lnINV + \beta_7 lnMINERAL + \beta_8 lnINTEREST + \varepsilon_i \qquad (1)$$

The log-log character of the regression model enables the interpretation of the coefficients in percentages.

5. Results

In the framework of the regression analysis, seven regression equations were conducted. The first estimation is a bivariate regression with only GDP growth ($lngY$) as the explanatory variable. Based on the regression output, 1% increase of economic growth leads to -3,32% decrease on public debt. In all the 7 estimations *lngY* has a statistically negative impact on the public debt. The coefficient of lngY, β_1, varies between -2,85% and -6,34%. This indicates the negative nexus between the GDP growth and the level of public debt and corroborates the Hypothesis 1 *(Economic growth has a negative growth effect on public debt).* **Figure-4** and the fitted linear regression line (fitted values) also indicate a negative relationship between the growth rate of GDP and public debt ratio.

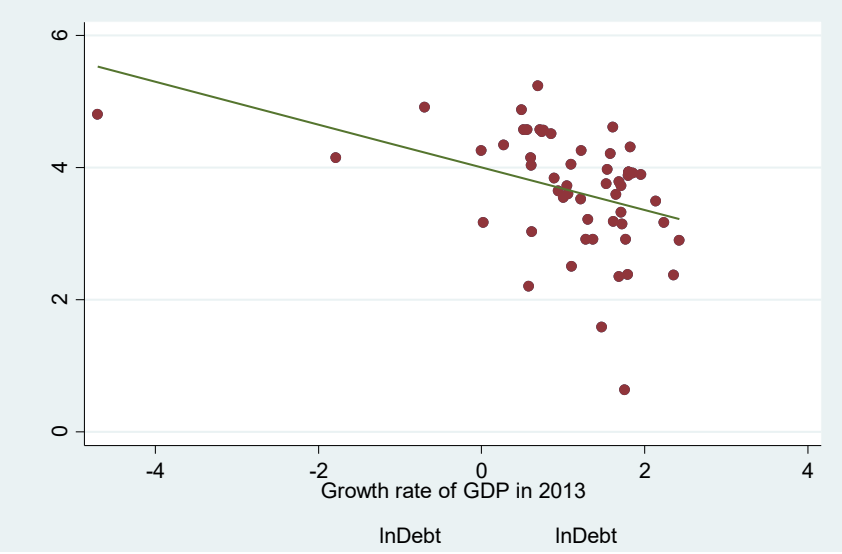

Figure-4. Public debt and the growth rate of GDP, 2013.
Source: Authors' illustration.

Inflation rate (*lnINFLAT)*, unemployment rate *(lnUEMP)*, and defence spending (lnDEFENCE) have no statistically significant impact on the public debt. This result rejects Hypothesis 2 and shows that there is no statistically significant relationship between unemployment (inflation) and the level of public debt. The share of oil rent *(lnOILRent)* and mineral rent as a share of GDP *(lnMINERAL)* has a statistically significant negative impact on the dependent variable (equations (4) and (5) for oil and equation (6) for mineral rent).

In Equation (6) we included gross capital formation as a share of GDP ($lnINV$) as a control variable to test Hypothesis 3. Estimation output rejects this hypothesis and shows that there is no statistically significant relationship between gross capital formation, which is a proxy for total investment share in GDP), and public debt.

The coefficient of $lnOilRent$ varies between (-0,177) and (-0,196). This implies that an increase of the oil revenues by 1% leads to a decrease of the public debt by 1,77 (1,96%) (Equations (4) and (5)). **Figure-5** also indicates the negative relationship between oil rent as a share in total public revenue and the public debt.

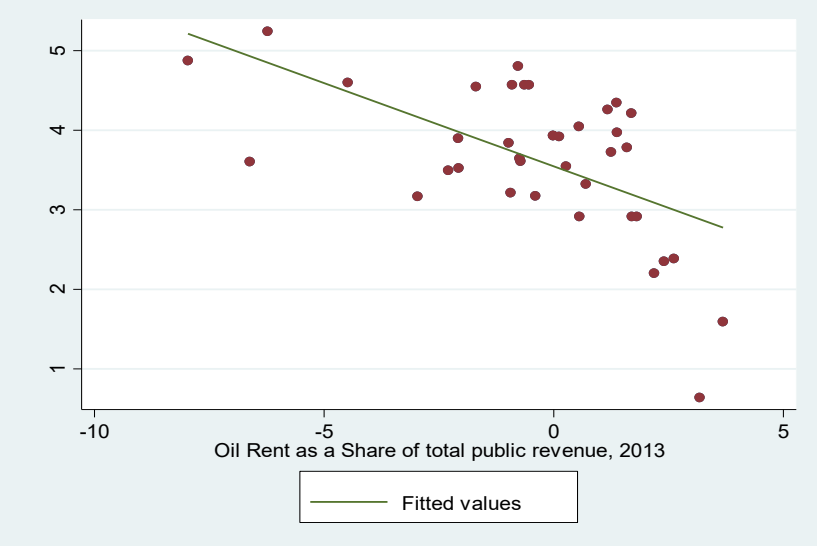

Figure-5. Public debt and oil rent as a share of total public revenue, 2013.
Source: Authors' illustration.

lnMINERAL, another proxy for the natural resource abundance, also has a statistically significant negative impact on the level of public debt: 1% increase of the mineral rent as a share of GDP leads to 0.05-0,06% decrease of public debt. We can observe that oil abundance has a much stronger impact on public debt than mineral rent. These results corroborate the Hypothesis 4. This implies a positive relationship between resource

abundance and fiscal stability. Interest payments (public debt related) as a share of total revenue have a statistically significant positive impact on the level of public debt: An increase of the interest payments by 1% lead to an increase of the public debt by 0,593%.

DEPENDENT VARIABLE: *Central government debt as a share of GDP in 2013*								
VARIABLES	1	2	3	4	5	6	7	8
lngY	-0.323***	-0.285***	-0.298***	-0.234**	-0.446	-0.634***	-0.323*	-0.0791
	(0.0892)	(0.102)	(0.108)	(0.0857)	(0.268)	(0.211)	(0.166)	(0.112)
lnINFLAT		-0.168	-0.140	0.00729	0.0383			
		(0.151)	(0.165)	(0.230)	(0.245)			
lnUEMP			0.0459	0.144	0.164	-0.302	0.287	0.399**
			(0.142)	(0.188)	(0.197)	(0.316)	(0.188)	(0.176)
lnOilRent				-0.196**	-0.177**			
				(0.0788)	(0.0725)			
lnDEFENCE					-0.110			
					(0.226)			
lnINV						0.0744	-0.0492	-0.0453
						(0.202)	(0.125)	(0.105)
lnMINERAL						-0.0684**	-0.0532*	-0.0180
						(0.0328)	(0.0263)	(0.0247)
lnINTEREST							0.593***	0.698***
							(0.110)	(0.0655)
DEVELOPING								-0.641***
								(0.199)
Constant	4.009***	4.163***	4.043***	3.575***	3.849***	4.780***	2.338***	2.728***
	(0.139)	(0.196)	(0.376)	(0.514)	(0.447)	(0.764)	(0.653)	(0.463)
Observations	55	51	49	35	34	33	33	33
R-squared	0.163	0.198	0.209	0.434	0.433	0.343	0.684	0.757

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table-1. Linear Regression Estimations (1) - (8).
Authors' own regression estimations.

In order to control for the difference between developing and developed countries we add a dummy variable, DEVELOPING, which take the value 1 if the country in the dataset is a developing or transition economy, and 0 if the country is a developed country with high income level or an EU-member country. We find that being a developing country has a statistically significant negative impact on public debt. Being a developing country leads on average to 6,5% decrease of public debt as a share of GDP.

As shown in the estimation output sketched in **Table-1**, the coefficients of determination in the estimations range between 16,3 and 75,5%. This implies that all the regression models explain a substantial share (at least 16,3% and at utmost 75,5%) of the variations of the dependent variable, i.e. $lnDebt$.

6. Concluding remarks

Cross-country regression survey shows that a greater growth rate of the aggregate GDP has a statistically negative impact on the public debt as a share of GDP. This effect vanishes if we include the developing country dummy in the Equation (8). Unemployment has a statistically significant impact on the level of public debt only in the last regression Equation (8). Interest payments also have a statistically significant positive impact on the level of public debt (Equations (7) and (8)). Oil rent as a share of total revenue (Equations (4) and (5)) has a statistically significant negative impact on public debt. The same is true for the mineral rent as a share of total revenue (Equations (6) and (7)). Defence spending does not have a statistically significant impact on the level of the public debt (see **Appendix-2**). Future studies might take into account further research questions arising from this study. Upcoming research may want to examine more closely the endogeneity problem and eventual multicollinearity issues. These problems might be solved by making use of the panel analysis. For this purpose, further elaboration of the econometric strategy would benefit the validity of the analyses undertaken.

References

Abbas, S. A., Belhocine, N., El-Ganainy, A., & Horton, M. (2011). Historical patterns and dynamics of public debt—evidence from a new database. IMF Economic Review, 59(4), 717-742.

Ahmed, A. D. (2012). Debt burden, military spending and growth in Sub-Saharan Africa: a dynamic panel data analysis. Defence and Peace Economics, 23(5), 485-506.

Anfofum, A. A., Andow, H. A., & Mohammed, A. N. (2014). Military spending and external debt burden in Nigeria. International Journal of Education and Research, 2(7), 611-626.

Arias, M. A., & Restrepo-Echavarria, P. (2016). Demographics Help Explain the Fall in the Labor Force Participation Rate. The Regional Economist, 24(4), 16-18.

Azam, M. and Feng, Y. (2015), Does military expenditure increase external debt? Evidence from Asia. Defence and Peace Economics, 28(5): 1-18.

Barro, R. (1979), On the determination of public debt. Journal of Political Economy, 87(5): 940-971.

Bender, D., Loewenstein, W. (2014), Immiserizing capital flows to developing countries. IEE Working Papers 201. Ruhr-Universität Bochum: Bochum.

Borensztein, M. E., & Panizza, U. (2008). The costs of sovereign default (No. 8-238). International Monetary Fund.

Bova, M. E., Carcenac, N., & Guerguil, M. M. (2014). Fiscal rules and the procyclicality of fiscal policy in the developing world (No. 14-122). International Monetary Fund.

Brautigam, D. (1992). Governance, economy, and foreign aid. Studies in comparative international development, 27(3), 3-25.

Bua, G., Pradelli, J., Presbitero, A.F. (2014), Domestic public debt in low-income countries: Trends and structure. Review of Development Finance. 4(2014): 1-19.

Dunne, J.P., Perlo-Freeman, S., Soydan, A. (2004a), Military expenditure and debt in South America. Defence and Peace Economics, 15(2): 173-187.

Dunne, J.P., Perlo-Freeman, S., Soydan, A. (2004b), Military expenditure and debt in small industrialized economies: A panel analysis. Defence and Peace Economics, 15(2): 125-132.

Easterly, W., Schmidt-Hebbel, K. (1991), The macroeconomics of public sector deficits. A synthesis. The World bank, Washington, DC.

Ferguson, E. J. (2014). The power of the purse: A history of American public finance, 1776-1790. UNC Press Books.

Fischer, S., & Easterly, W. (1990). The economics of the government budget constraint. The World Bank Research Observer, 5(2), 127-142.

Forslund, K., Lima, L., & Panizza, U. (2011). The determinants of the composition of public debt in developing and emerging market countries. Review of Development Finance, 1(3-4), 207-222.

Hamann, F., Mendoza, E.G., Restepo-Echavarria, P. (2016), Commodity prises and sovereign default: A new perspective on the Harberger-Laursen-Metzler effect. Unpublished manuscript.

International Monetary Fund (2001), Global Financial Statistics Manual. International Monetary Fund, Washington DC.

Jaimovich, D., Panizza, U. (2010), Public debt around the world: A new dataset. Applied Economic Letters, 17: 19-24. IMF Working Paper No. 14/122.

Karagol, E., & Sezgin, S. (2004). Do defence expenditures increase debt rescheduling in Turkey? Probit model approach. Defence and Peace Economics, 15(5), 471-480.
Karagöz, K. (2018), Impact of defence expenditure on external debt: An econometric analysis of Turkey and Turkic republics. Theoretical and Applied Economics, XXV(1): 183-192.
Kennedy, P. (2010). The rise and fall of the great powers. Vintage.
Krugman, P. (1979). A model of balance-of-payments crises. Journal of money, credit and banking, 11(3), 311-325.
Mupunga, N., & Le Roux, P. (2016). Analysing the theoretical and empirical foundations of public debt dynamics in Zimbabwe. Studies in Economics and Econometrics, 40(1), 95-118.Melina, G., Yang, S-C.S., Zanna, L-F. (2016), Debt sustainability, public investment, and natural resources in developing countries: The DIGNAR model. Economic Modelling, 52(2016): 630-649.
Mohaddes, K., Raisi, M. (2017), Do Sovereign Wealth Funds Dampen the Negative Effects of Commodity Price Volatility? IMF WP 304. Available from: https://www.dallasfed.org/-/media/documents/institute/wpapers/2017/0304.pdf Last retrieved on 2018 April 19].
Muhanji, S., & Ojah, K. (2014). External debt and military spending: the case of Africa's conflict countries.
Narayan, P. K., & Narayan, S. (2008). Does military expenditure determine Fiji's exploding debt levels?. Defence and Peace Economics, 19(1), 77-87.
Neck, R., Getzner, M. (2001), Political-economic determinants of public debt growth: A case study for Austria. Public Choice, 109: 243-268.
Overton, M., Nukperzah, J.A., Ismayilov, O. (2017), Prepayments, late payments, and sales tax revenue volatility in Texas cities. Public Money and Management, 37(7): 469-476.
Panizza, U. (2008, March). Domestic and external public debt in developing countries. In United Nations Conference on Trade and Development Discussion Paper (No. 188).
Pincus, S. C., & Robinson, J. A. (2011). What really happened during the Glorious Revolution? (No. w17206). National Bureau of Economic Research.
Presbitero, A. (2012), Domestic debt in low-income countries. Economic Bulletin, 32(2): 1099-1112.
Rodrik, D. (2008), The real exchange rate and economic growth. Brookings Papers on Economic Activity, 39(2): 365-439.
Sachs, J., Warner, A.M. (1995), Natural resource Abundance and Economic Growth. NBER WP No. 5398, Cambridge, MA.
Sadik-Zada, E. R. (2016). Oil Abundance and Economic Growth (Vol. 70). Logos Verlag Berlin GmbH.
Sadik-Zada, E. R. (2000), Oil Strategy of Azerbaijan and Socio-Economic Development Problems, Oil and Development, 93-105.
Salsman, R. (2017), The political economy of public debt. New thinking in political economy series. Edward Elgar Pub: Cheltenham.
Sezgin, S. (2004), An empirical note on external debt and defence expenditures in Turkey. Defence and Peace Economics, 27(5): 718-741.
Shahbaz, M., Shabbir, M. S., & Butt, M. S. (2016). Does military spending explode external debt in Pakistan?. Defence and Peace Economics, 27(5), 718-741.

Shahbaz, M., Afza, T., & Shabbir, M. S. (2013). Does defence spending impede economic growth? Cointegration and causality analysis for Pakistan. Defence and Peace Economics, 24(2), 105-120.

Shahbaz, M., & Shabbir, M. S. (2012). Military spending and economic growth in Pakistan: New evidence from rolling window approach. Economic research-Ekonomska istraživanja, 25(1), 119-131.

Tiwari, A. K., & Shahbaz, M. (2013). Does defence spending stimulate economic growth in India? A revisit. Defence and Peace Economics, 24(4), 371-395.

Wooldridge, J. (2013), Introductory econometrics: A modern approach. South-Western Cengage Learning.

World Bank (2018). World Development Indicators.

APPENDIX-1: Heteroskedasticity and Multicollinearity Tests

- Heteroskedasticity Test

```
. estat hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of lnDebt

         chi2(1)      =     1.17
         Prob > chi2  =   0.2786
```

The heteroscedasticity test shows that there is no heteroscedasticity because the P-value 0.2786 is greater than 0.005.

- Heteroskedasticity Test Model 5

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of lnDebt

         chi2(1)      =     3.91
         Prob > chi2  =   0.0480
```

The heteroscedasticity test for model 5 shows that there exists heteroscedasticity for model 5.

- Multicollinearity Test

```
. vif
```

Variable	VIF	1/VIF
lnPCI	3.24	0.308761
lnINFLAT	2.67	0.374333
lnUEMP	1.70	0.587419
lngY	1.68	0.594168
lnDEFENCE	1.55	0.647016
lnINV	1.42	0.704009
lnMINERAL	1.24	0.807020
Mean VIF	1.93	

The rule of thumb: If all vif-values are less than 10 then it can be concluded that there is no multicollinearity in the dataset.

APPENDIX-2: Regression Estimations with *lnDEFENCE*

```
Linear regression                               Number of obs =      33
                                                F(  7,    25) =   31.08
                                                Prob > F      =  0.0000
                                                R-squared     =  0.7656
                                                Root MSE      =  .46123

------------------------------------------------------------------------------
             |               Robust
      lnDebt |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        lngY |  -.0905965    .141691    -0.64   0.528    -.3824146    .2012216
       lnINV |  -.0007423    .113095    -0.01   0.995    -.2336657    .2321811
   lnMINERAL |  -.0158622   .0277523    -0.57   0.573    -.0730191    .0412948
      lnUEMP |   .3358068   .1913663     1.75   0.092    -.0583196    .7299331
  lnINTEREST |    .725654    .068402    10.61   0.000     .5847775    .8665305
       Devel |  -.6297367   .2142159    -2.94   0.007    -1.070923   -.1885508
   lnDEFENCE |   .1392224   .1691691     0.82   0.418    -.2091879    .4876326
       _cons |   2.636197   .4896482     5.38   0.000     1.627747    3.644646
------------------------------------------------------------------------------
```

```
. regress lnDebt lngY lnMINERAL lnUEMP lnINTEREST  Devel lnDEFENCE , vce(robust)

Linear regression                               Number of obs =      38
                                                F(  6,    31) =   26.57
                                                Prob > F      =  0.0000
                                                R-squared     =  0.7492
                                                Root MSE      =  .44879

------------------------------------------------------------------------------
             |               Robust
      lnDebt |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        lngY |  -.2231513   .1386878    -1.61   0.118     -.506007    .0597044
   lnMINERAL |  -.0289094   .0253788    -1.14   0.263    -.0806697    .0228509
      lnUEMP |   .1445688   .1318217     1.10   0.281    -.1242833    .4134209
  lnINTEREST |   .6381418   .0823463     7.75   0.000     .4701953    .8060883
       Devel |  -.5087088   .1889063    -2.69   0.011    -.8939858   -.1234318
   lnDEFENCE |   .1269872   .1495183     0.85   0.402    -.1779573    .4319318
       _cons |   3.144059   .4727041     6.65   0.000     2.179973    4.108145
------------------------------------------------------------------------------
```

```
. regress lnDebt lngY lnMINERAL lnINTEREST  Devel lnDEFENCE , vce(robust)

Linear regression                               Number of obs =      38
                                                F(  5,    32) =   21.51
                                                Prob > F      =  0.0000
                                                R-squared     =  0.7368
                                                Root MSE      =  .45249

------------------------------------------------------------------------------
             |               Robust
      lnDebt |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        lngY |  -.2692371    .127021    -2.12   0.042    -.5279704   -.0105037
   lnMINERAL |  -.0255204   .0247525    -1.03   0.310    -.0759397    .0248988
  lnINTEREST |   .6141596   .0785581     7.82   0.000     .4541419    .7741773
       Devel |  -.5064927   .1855837    -2.73   0.010    -.8845144    -.128471
   lnDEFENCE |   .1496637    .149986     1.00   0.326    -.1558477    .4551752
       _cons |   3.500219   .3466033    10.10   0.000     2.794212    4.206227
------------------------------------------------------------------------------
```

In all three estimations the natural defence spending as a share of GDP is not statistically significant (p-values are greater than 0,005, i.e. 5%). Thus, the positive coefficient values do not lead to the conclusion that the effect is positive.

APPENDIX-3: Description of the Dataset

```
  obs:           269
 vars:            38                          25 Apr 2018 12:54
 size:        79,624
```

variable name	storage type	display format	value label	variable label
CountryName	str52	%52s		Country Name
CountryCode	str3	%9s		Country Code
Developing	byte	%10.0g		Country Code
YR2013Central~e	double	%10.0g		2013 [YR2013] - Central government debt, total (% of GDP) [GC.DOD.TOTL.GD.ZS]
D	double	%10.0g		2013 [YR2013] - Central government debt, total (current LCU) [GC.DOD.TOTL.CN]
YR2013Oilrent~f	double	%10.0g		2013 [YR2013] - Oil rents (% of GDP) [NY.GDP.PETR.RT.ZS]
YR2013Officia~g	double	%10.0g		2013 [YR2013] - Official exchange rate (LCU per US$, period average) [PA.NUS.FCR
YR2013GDPgrow~u	double	%10.0g		2013 [YR2013] - GDP growth (annual %) [NY.GDP.MKTP.KD.ZG]
YR2013GDPperc~a	double	%10.0g		2013 [YR2013] - GDP per capita (constant 2010 US$) [NY.GDP.PCAP.KD]
I	double	%10.0g		2013 [YR2013] - GDP per capita (constant LCU) [NY.GDP.PCAP.KN]
YR2013Grossfi~i	double	%10.0g		2013 [YR2013] - Gross fixed capital formation (annual % growth) [NE.GDI.FTOT.KD.
K	double	%10.0g		2013 [YR2013] - Gross fixed capital formation (% of GDP) [NE.GDI.FTOT.ZS]
YR2013Grosssa~s	double	%10.0g		2013 [YR2013] - Gross savings (% of GDP) [NY.GNS.ICTR.ZS]
YR2013Undisbu~e	double	%10.0g		2013 [YR2013] - Undisbursed external debt, official creditors (UND, current US$)
N	double	%10.0g		2013 [YR2013] - Undisbursed external debt, private creditors (UND, current US$)
O	double	%10.0g		2013 [YR2013] - Undisbursed external debt, total (UND, current US$) [DT.UND.DPPG
YR2013Unemplo~o	double	%10.0g		2013 [YR2013] - Unemployment, total (% of total labor force) (modeled ILO estima
Q	double	%10.0g		2013 [YR2013] - Unemployment, total (% of total labor force) (national estimate)
YR2013Inflati~u	double	%10.0g		2013 [YR2013] - Inflation, consumer prices (annual %)

APPENDIX-3: continued

YR2013Inflati~d	double	%10.0g	2013 [YR2013] - Inflation, GDP deflator (annual %) [NY.GDP.DEFL.KD.ZG]
YR2013Informa~m	double	%10.0g	2013 [YR2013] - Informal employment (% of total non-agricultural employment) [SL
U	double	%10.0g	2013 [YR2013] - Inflation, GDP deflator: linked series (annual %) [NY.GDP.DEFL.K
YR2013Interes~t	double	%10.0g	2013 [YR2013] - Interest payments on external debt, public and publicly guarante
W	double	%10.0g	2013 [YR2013] - Interest payments (% of revenue) [GC.XPN.INTP.RV.ZS]
X	double	%10.0g	2013 [YR2013] - Interest payments on external debt, total (INT, current US$) [DT
Y	double	%10.0g	2013 [YR2013] - Interest payments on external debt (% of exports of goods, servi
YR2013Militar~i	double	%10.0g	2013 [YR2013] - Military expenditure (% of GDP) [MS.MIL.XPND.GD.ZS]
YR2013Mineral~s	double	%10.0g	2013 [YR2013] - Mineral rents (% of GDP) [NY.GDP.MINR.RT.ZS]
lnDebt	float	%9.0g	
lnOilRent	float	%9.0g	
lngY	float	%9.0g	
lnPCI	float	%9.0g	
lnINV	float	%9.0g	
lnUEMP	float	%9.0g	
lnDEFENCE	float	%9.0g	
lnINTEREST	float	%9.0g	
lnMINERAL	float	%9.0g	
lnINFLAT	float	%9.0g	

Sorted by:
     Note: dataset has changed since last saved

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