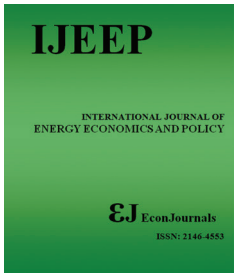

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What Drives Public Debt Growth? A Focus on Natural Resources, Sustainability and Development

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ABSTRACT

Public debt is a notable measure of economic and financial sustainability which encountered policy and scholarly interest in the international development ambients. This paper investigates the major drivers of 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, interest rate payments for foreign borrowings, and being a developing country have a 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 positive impact on the public debt rate.

Keywords: Public Debt, Natural Resources, Sustainability, Oil Rent, Mineral Rent, Defence Spending, Developing Countries
JEL Classifications: F21, F34, F36, G15, H6, N1, F3

1. INTRODUCTION

Public debt extent is a primary measure of economic and financial sustainability. The topic has often resurged in the wake of financial and economic crises, finding new fashions (Greiner and Fincke, 2016). Public budget and public debt sustainability is no news and have been attracted international financial organisations (Spaventa, 1987). They have often been referred to as the theory of intertemporal budget constraint (Baglioni and Cherubini, 1993), as part of the intertemporal viability of the economic policy (Cisco and Gatto, 2021). Public debt is often studied and considered in cases of economic, financial, and multidimensional crises. It is often referred to as a countercyclical resilience policy instrument to mitigate a system's vulnerability (Gatto and Busato, 2020; Gatto and Drago, 2020). This issue is of relevance for crises connected with resource management and energy markets (Busato and Gatto, 2019).

International development agencies are directly involved in this process, inter alia, in prescribing tailored macroeconomic recommendations to the international community (Gatto, 2020; United Nations, 2008). The latter has the objective of addressing the national development policies to ensure sustainable development to both developing and developed countries. Besides being gauged by means of intertemporal choice, public debt and budget sustainability can also refer to solvency criteria – a controversial regulatory topic within the EU budgeting and monetary policy debate (Hartwell and Signorelli, 2015; Gatto, 2019). Empirical evidence also found that public debt is negatively associated with long-run growth (Eberhardt and Presbitero, 2015).

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 the European Enlightenment of the eighteenth century

were major events that 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 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 practised in most countries around the world, whereby developing countries rely more on external than 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 detecting nexuses existing amongst public debt, sustainability, energy, and military expenditure. The analyses suggest an important role of oil embedment, mineral rent, economic growth rate, and interest rate payments for foreign borrowings in developing countries 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.

The rest of the paper is organized as follows: Section-II deals with a literature review containing studies on sources and determinants of public debt. Section-III talks about the principal hypotheses of the survey. Section-IV discusses underlying research methodology and data collection. Section-V discusses empirical results. Section-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 at 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 low-income countries, focuses on 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 the 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 and Easterly, 1990).

Despite this fact, as a short-term policy tool, this strategy could be considered as an appropriate short-term instrument for 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 the 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 inflationary pressure on the economy, nor leads to the appreciation of the 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 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 by Bua et al. (2014). The dataset shows that the substantial share of public debt in these LICs was generated through domestic borrowing. This is attributable to the result of financial liberalization that 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 in the external debt ratio over the period 1996-2008, from 72 to 23% in 2011. After 2008, this ratio did not change significantly.

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 and Le Roux, 2016).

2.2. Determinants of Public Debt

Forslund et al. (2011) identify six major categories determining the composition of 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. The 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[1] 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, the exchange rate regime, is related to the fixed or floating exchange rates. Karagol and Sezgin (2004), Sezgin (2004), Dunne et al. (2004a, b), Narayan and Narayan (2005), Ahmed (2012), Anfofum et al. (2014), Muhanji 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.

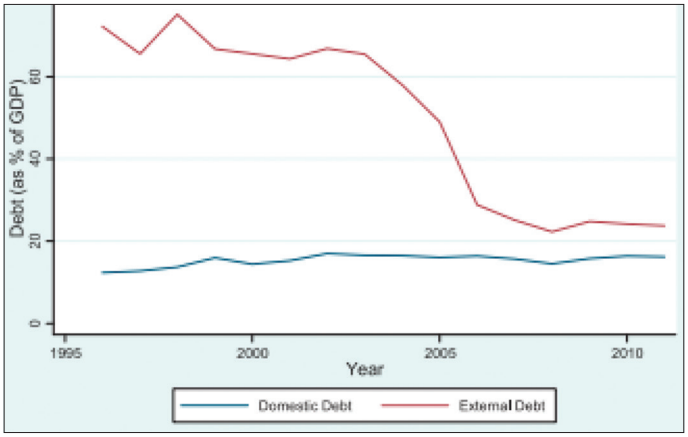
Apart from external debt, military spending is tight with economic growth and investment in the long run (Shahbaz et al., 2016), whereas negative unidirectional causality emerges investigating the relationship from defence spending to economic growth (Shahbaz and Shabbir, 2012); military spending is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

The relationship between oil abundance and public debt issues has not been yet studied exhaustively. 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 is 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.

The cross-country average public debt to GDP ratio is 50%, ranging from 8% (UAE) to 179% (Sudan). As shown in Figure 3, only 8 of 25 countries did not have default episodes (Borensztein and Panizza, 2008, Arias and Restrepo-Echavarria, 2016). The major problem in

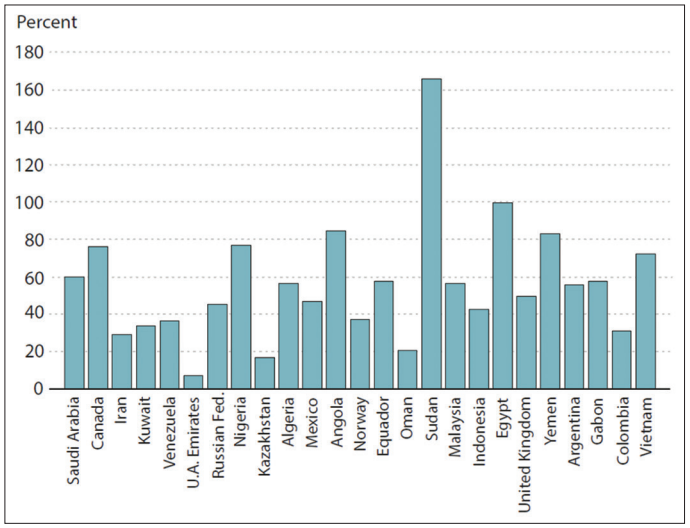
1 Money supply measure, as defined by the Federal Reserve.

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



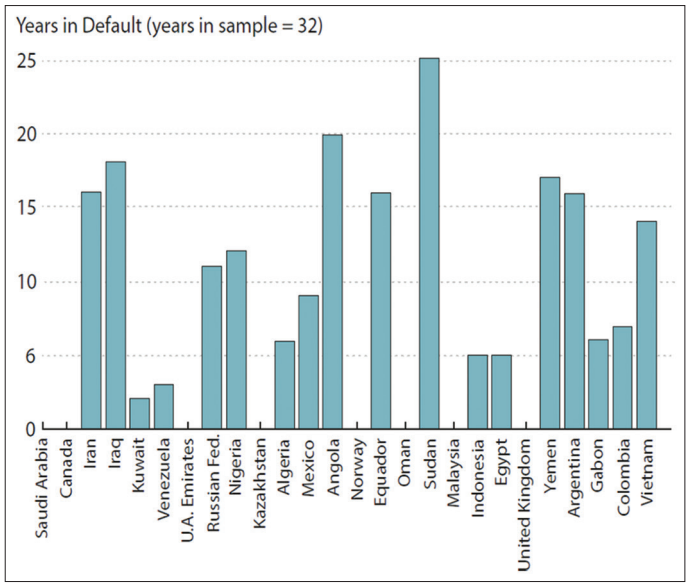
Source: Bua et al. (2014)

Figure 2: Total public debt to GDP, 1979-2010 average



Source: Arias and Restrepo-Echavarria (2016) and World Bank (2018)

Figure 3: Default Episodes, 1979-2010



Source: Arias and Restrepo-Echavarria (2016) and WB (2018)

the public finance of the oil-producing economies is the volatility of oil prices. Increasing oil prices lead to rising oil extraction and higher GDP growth rates, improvements of trade balance and current accounts, lower sovereign risk perception, and reduce default risk. In the phases of 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 6 months (Sadik-Zada, 2000 and 2016). Thus, we assume that especially in 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 the job market, governments employ public debt as a tool to compensate the recessive impulses by the positive fiscal impulses and to curb the job market.

To test for the relationship between the unemployment rate and public debt, we test the following hypothesis:

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

To combat the 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 the public debt ratio in the short run.*

Increasing defence spending, especially in 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 advanced economies. The increasing or high share of defence spending as a budget item is a sign of the existence of security risks.

In the next hypothesis, we test for the effect of defence spending on public debt.

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

Mohaddes and Raisi (2017) have shown that the existence of sovereign wealth funds (SWFs) in 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 into account 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 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 has 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 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 and treatment choices. These choices were based on methodological indications provided in Gatto et al. (2021). For the sake of completeness, we take the data of 2013. This decision 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 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 normalise 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. The test result indicates the absence of heteroscedasticity in the dataset (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 unemployment rate (*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.

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

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, a 1% increase in economic growth leads to a –3.32% decrease in 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 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 the public debt ratio.

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).

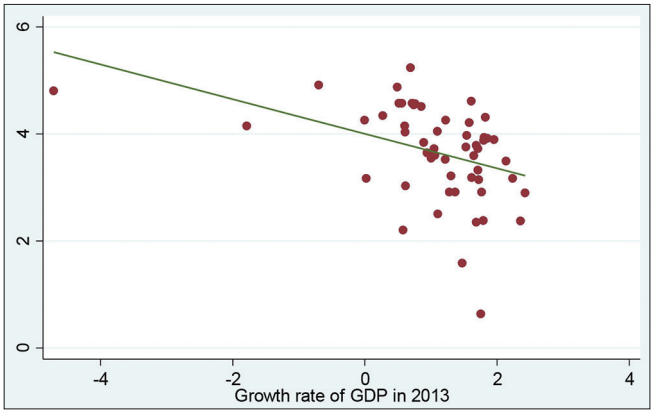
In Equation (6) we included gross capital formation as a share of GDP (*lnINV*) as a control variable to test Hypothesis 3. Estimation output rejects this hypothesis and shows that there is no statistically significant relationship between gross capital formation, which is a proxy for total investment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

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 a 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 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%.

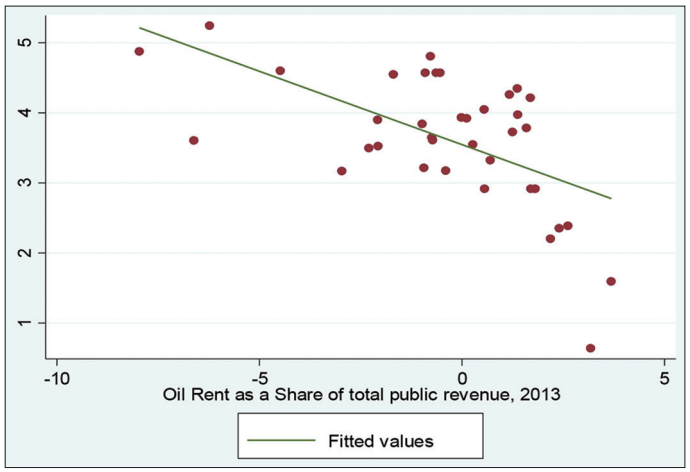
In order to control for the difference between developing and developed countries, we add a dummy variable, DEVELOPING,

Figure 4: Public debt and the growth rate of GDP, 2013



Source: Authors' illustration

Figure 5: Public debt and oil rent as a share of total public revenue, 2013



Source: Authors' illustration

Table 1: Linear regression estimations (1) - (8)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Ln_gY	-0.323***	-0.285***	-0.298***	-0.234***	-0.634**	-0.323*	-0.0791
	(0.089)	(0.102)	(0.108)	(0.0857)	(0.211)	(0.166)	(0.112)
Ln_Inflation		-0.168	-0.140	0.007			
		(0.151)	(0.165)	(0.230)			
Ln_Unemployment			0.045	0.144	-0.302	0.287	0.399**
			(0.142)	(0.188)	(0.316)	((0.188)	(0.176)
Ln_Oil Rent				-0.196**			
				(0.078)			
Ln_Defense				-0.110			
				(0.226)			
Ln_Investment					0.0744	-0.0492	-0.045
					(0.202)	(0.125)	(0.105)
Ln_Mineral					-0.068**	-0.053*	-0.018
					(0.032)	(0.110)	(0.024)
Ln_Interest						0.593***	0.698***
						(0.110)	(0.065)
Developing							-0.641***
							(0.199)
Constant	4.009***	4.163***	4.043***	3.849***	4.780***	2.338***	2.728***
	(0.139)	(0.196)	(0.376)	(0.447)	(0.764)	(0.653)	(0.463)
Observations	55	51	49	35	34	33	33

Authors' own regression estimations. Robust standard errors in parentheses. ***P<0.01, **P<0.05, *P<0.1

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 a 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 a 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

In this study, we have analysed public debt dynamics. Indeed, the public budget is a major economic and financial sustainability driver and an international development policy issue. We have also explored public debt connections with natural resources and energy, defence expenditure, unemployment rate and the country's stage of development and sustainability issues.

A cross-country regression survey shows that a greater growth rate of the aggregate GDP has a statistically negative impact on public debt as a share of GDP. This effect vanishes if we include the developing country dummy in 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 applies to 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 public debt.

Future studies might take into account further research questions arising from this work. Upcoming analyses may want to examine more closely endogeneity and eventual multicollinearity issues that have found no space in this study. These problems might be solved by corroborating the estimation results by making use of diverse techniques and tests. For this purpose, further elaboration of the econometric strategy would benefit the validity of the analyses undertaken.

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APPENDIX

Appendix 1: Heteroskedasticity and multicollinearity tests

- Breusch-Pagan/Cook-Weisberg test for heteroskedasticity Model 1

H_0: 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.

- Breusch-Pagan/Cook-Weisberg test for heteroskedasticity Model 5

H_0: 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

Variable	VIF	1/VIF
Ln_PCI	3.24	0.308
Ln_Inflation	2.67	0.374
Ln_Unemloyment	1.70	0.587
Ln_gY	1.68	0.594
Ln_Defense	1.55	0.647
Ln_Mineral	1.24	0.807
Ln_Investment	1.42	0.704
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.