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Economies

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Suggested Citation: Butkus, Mindaugas; Cibulskiene, Diana; Garsviene, Lina; Seputiene, Janina (2021) : Empirical evidence on factors conditioning the turning point of the public debt-growth relationship, Economies, ISSN 2227-7099, MDPI, Basel, Vol. 9, Iss. 4, pp. 1-22, https://doi.org/10.3390/economies9040191

This Version is available at:
https://hdl.handle.net/10419/257349

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Empirical Evidence on Factors Conditioning the Turning Point of the Public Debt–Growth Relationship

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Abstract: This paper contributes to the limited literature on the factors conditioning the turning point of the public debt–growth relationship. A decade after the global financial crisis, when the debt ratio in many countries was still above pre-crisis levels, the COVID-19 pandemic again increased the pressure on public finances. It revived the debate on the ability to promote economic recovery through debt-financed government expenditure. However, more intense government borrowing increases its costs and uncertainty about future taxation policy, thus potentially disturbing private consumption, investment, and economic growth. In this paper, we estimate the thresholds of indicators on which the expenditure multiplier depends, which may already imply a risk that public debt will dampen economic growth. We use a methodology of structural threshold regression to examine the varying effects that debt might have on growth using consumption, investment, taxes, and imports as threshold variables, as well as several other factors suggested by previous contributions. The applied methodology allows for the addressing of parameter heterogeneity and endogeneity to be accounted for at the same time. The main results suggest that a positive debt effect is more likely if the conditions for a high expenditure multiplier are met, that an increase in the public-debt-to-GDP ratio is not necessarily deleterious to growth if shares of private consumption and investment in GDP are high, while the tax-revenue-to-GDP ratio is low.

Keywords: economic growth; expenditure multiplier; heterogeneity; public debt

Citation: Butkus, Mindaugas, Diana Cibulskiene, Lina Garsviene, and Janina Seputiene. 2021. Empirical Evidence on Factors Conditioning the Turning Point of the Public Debt–Growth Relationship. *Economies* 9: 191. https://doi.org/10.3390/economies9040191

Academic Editor: Sajid Anwar

Received: 10 November 2021
Accepted: 1 December 2021
Published: 3 December 2021

1. Introduction

The Great Recession has led to an unprecedented increase in public-debt-to-GDP ratios across the world, and has prompted numerous studies on the impact of public debt on economic growth. A decade after this global crisis, when debt ratios in many countries were still above their pre-crisis levels, COVID-19 has again increased the pressure on public finances and revitalised the debate on the ability to foster economic recovery by debt-financed government expenditure. Macroeconomic theory provides arguments for both positive and negative impacts of debt on output. The arguments for positive effects are grounded in Keynesian theory, which states that an expansionary fiscal policy increases the level of debt but simultaneously accelerates domestic demand and economic growth. The magnitude of this positive effect depends entirely on the size of the fiscal multiplier. Research on the negative effects of debt points to the Ricardian equivalence hypothesis, debt overhang, the crowding-out effect, etc. Increased government borrowing leads to higher borrowing costs and higher uncertainty about taxes in the future, thus lowering private consumption, investment, and economic growth.

The literature on the public debt–economic growth nexus is extensive. Three strands of research can be distinguished. The first strand is focused mainly on the linear debt effects on growth. The second one investigates a non-linear inverted U-shaped relationship, and estimates the debt threshold level above which the growth-suppressive impact occurs. The scarcest, third strand of studies focuses on heterogeneities in the debt–growth nexus, with

the aim of identifying factors on which the effects of public debt on growth may depend. Reviews of empirical results (Rahman et al. 2019; Bentour 2021) provide broad support for the non-linear debt effect; however, they provide no consensus on the debt threshold level at which the positive effect of debt turns into a negative one. The inconsistency of the results raises the need to expand the third strand of studies and examine the factors that determine the level of public debt that still sustains growth. Studies on heterogeneities in the debt–growth relationship focus mainly on institutions, and confirm that countries with better institutions face a growth-inhibiting effect at higher debt-to-GDP ratios (see for the review Abbas et al. 2021; Law et al. 2021). The state of the financial market (Proaño et al. 2014), country risk (Chiu and Lee 2017), economic systems (Ahlborn and Schweickert 2018), trade balance (Butkus and Seputiene 2018; Liu and Lyu 2021), current account balance, and gross savings (Liu and Lyu 2021) have also been proven to be potential explanatory factors of heterogenous public debt effects on growth.

This paper contributes to the limited literature on the factors conditioning the turning point of the public debt–growth relationship. Butkus et al. (2021) relate the debt threshold with the size of the expenditure multiplier. According to Keynesian theory, a higher expenditure multiplier leads to a higher positive impact of government expenditure (an increase in public debt) on domestic demand and GDP growth. If conditions necessary for a higher multiplier value are met, namely higher propensities to consume and invest, lower propensity to import, and a lower tax rate, then countries may expect to sustain growth with higher debt-to-GDP ratios. Butkus et al. (2021) estimated higher debt threshold levels for countries with higher ratios of private consumption and investment to GDP, as well as lower ratios of imports and taxes to GDP. This paper complements the results of the aforementioned study and aims to estimate the thresholds of indicators on which the expenditure multiplier depends, which may already imply a risk that public debt will dampen economic growth.

To widen the understanding of whether the conditions that determine the size of the multiplier also determine the debt–growth nexus, we use a methodology that allows for parameter heterogeneity, which means that the growth process is not the same across all periods and countries. Since the literature suggests that, in addition to the debt-to-GDP ratio or quality of institutions, many more possible sources cause heterogeneity in the debt–growth relationship, we can use threshold variables to sort observations based on the fact that they share the same growth regime (model).

In this paper, we rely on the structural threshold regression (STR) model developed by Kourtellos et al. (2016) to model parameter heterogeneity. This class of models relies on classifying observations into regimes based on whether the value of a threshold variable we observe is above (or below) a threshold value. The main advantage of STR is that it allows both endogenous threshold variables and regressors. Our specification is based on the growth models developed in previous contributions related to the analysis of the debt–growth nexus. We augmented it with variables that proxy conditions that determine the size of the multiplier, and investigated the possibility of multiple growth regimes.

Estimation results show that the positive effect of debt on growth is more plausible in countries with favourable conditions for a high expenditure multiplier. Thus, the rising public-debt-to-GDP ratio does not necessarily harm economic growth if the shares of private consumption and investment in GDP are high, while the tax-revenue-to-GDP ratio is low. However, the weak significance of the estimated coefficients may suggest that the debt–growth relationship depends on an expenditure multiplier, and no factor determining the multiplier alone can lead to significantly different effects of debt on economic growth.

The rest of the paper is organised as follows: Section 2 provides a theoretical background of why factors determining the expenditure multiplier may lead to heterogeneous debt–growth nexuses, Section 3 presents the specification of the model, estimations strategy, and data, Section 4 discusses the main estimation results, and finally, in Section 5 we conclude by presenting policy implications.

2. Expenditure Multiplier as an Explanatory Factor of the Heterogeneity in the Debt–Growth Relationship

The growth-stimulating effect of public debt is grounded in the Keynesian theory that borrowing to finance public spending leads to higher debt together with an increase in domestic demand and economic growth. Higher government spending can become "self-financing" by boosting output and tax revenue, and can even lead to a decline in the debt-to-GDP ratio. How much domestic demand will increase and how the debt-to-GDP ratio will change after a positive government spending shock depends on the size of the fiscal (expenditure) multiplier, which is increased by growth in marginal propensities to consume and invest and reduced by increases in the tax rate and marginal propensity to import. There has been extensive debate in the literature on the question of how public debt affects the size of the fiscal multiplier. Numerous pieces of empirical evidence suggest an inverse relationship between these two variables (see, for review, Butkus et al. 2021). However, Huidrom et al. (2020) point to the lack of a systematic study on the channels through which public debt affects the fiscal multiplier. In this paper, we suggest that growing public debt may lead to lower private consumption and investment in addition to higher taxes and imports; therefore, to a lower size of the expenditure multiplier and no positive government expenditure (increasing public debt) effect on economic growth.

The negative effect of public debt on *private consumption* is based on the Ricardian equivalence hypothesis, which raises some doubts regarding the ability to stimulate economic growth by increasing public expenditure. An expansionary fiscal policy will lead to higher debt, the repayment of which will require an increase in taxes in the future. To prepare for this, households reduce consumption and increase savings (the propensity to consume declines). Sardoni (2021) criticises the idea of the Ricardian equivalence that government deficits and debt have no effect on the economy, and discusses various situations when fiscal policy neutrality can be rejected, as an example, when fiscal policy stimulates insufficient aggregate demand and increases the use of unemployed resources; when the increase in productive expenditure leads to higher productivity and allows for the stabilising of the public debt ratio while running a primary deficit.

Empirical research on the Ricardian equivalence hypothesis provides inconsistent results (Hayo and Neumeier 2017). The inconsistency of the results may be due to the non-linearity of the impact of public debt on consumer spending. The results of Nickel and Tudyka (2014) indicate that the private sector responds to a public spending shock in a Ricardian manner as the level of debt increases. Eventually, the overall effect on real GDP becomes negative. Huidrom et al. (2020) reach a similar conclusion, that public debt moderates the impulse responses of private consumption to public spending. A decrease in household consumption follows after a positive government spending shock if the debt level is high. Contrary to the Ricardian equivalence hypothesis, Checherita-Westphal and Rother (2012) found that a public-debt-to-GDP ratio beyond 82–91% has a negative effect on private saving. The authors explained the results presuming that private agents may start dissaving or transfer capital abroad as they anticipate inflation and/or troubles in the financial markets. Corsetti et al. (2012) made the distinction between countries that have public-debt-to-GDP ratios below or above 100%, and did not find significant evidence that the debt level moderates the response of private consumption to public spending shocks.

The relationship between debt level and *tax revenue* is bidirectional. Total public revenue is one of the main factors that influence the dynamics of public debt. Research estimates the impact of taxes (public revenue) on public debt. However, the direction of the relationship can be opposite, that is, from the debt to the tax burden. To ensure solvency, budget deficits and higher public debt today must be followed by budget surpluses in the future. This can be achieved through higher taxes or higher tax revenues due to economic growth, or by a reduction in government expenditure (Greiner 2014). To ensure fiscal solvency, higher debt levels require a greater increase in tax rates to follow after a positive public expenditure shock (Aloui and Eyquem 2019). Krogstrup (2002) presented a mechanism through which the level of public debt affects overall taxes and tested this

impact empirically for a panel of European Union countries. The results indicated that higher debt decreases the size of the public sector (primary-expenditure-to-GDP ratio) and increases the tax level (tax-revenue-to-GDP ratio). Srebrnik and Strawczynski (2016) found that whether the value-added tax rates change pro-cyclically or counter-cyclically depends on the level of external debt.

Traditional crowding-out models usually concentrate on the interest rate channel, where an increase in government expenditure puts upward pressure on interest rates. Increasing interest rates lead to lower *private investment* (Sánchez-Juárez and García-Almada 2016; Huang et al. 2020). Priftis and Zimic (2021) find that the direction of financing public spending defines which effect on private investment can be expected: crowding-out or crowding-in. Investments are crowded-in when government spending is financed abroad. Domestic-debt-financed spending generates a crowding-out of private investment.

Increasing government debt encourages higher demand for money and therefore increases interest rates, considering that the money supply is constant. In this case, increasing interest rates may reduce private investment and increase incentives for households to save and reduce consumption (Wang 2021). Many articles find a negative correlation between government debt, economic growth, and investment (Checherita-Westphal and Rother 2012; Huang et al. 2018; Huang et al. 2020; de Mendonça and Brito 2021).

Huang et al. (2018) analysed the correlation between public debt and private investments in countries with advanced and emerging economies. Their results show a negative correlation. The results of industry-level regressions show that a higher level of public debt is particularly damaging to industries if they need more external financial resources. These results suggest that (i) the relationships between public debt and investment are causal and (ii) by using tightening credit constraints, public debt crowds out corporate investment. The findings of de Mendonça and Brito (2021) show that a shock of 10% in the public-debt-to-GDP ratio leads to a reduction of approximately 2% in private sector investment.

From a policy-making perspective, it is also important to test the link between public debt and investment. The literature also points out that greater indebtedness reduces total factor productivity due to the decrease in capital accumulation, private savings, and investment. If a high amount of debt results in decreased investments, debt reduction might effectively aid heavily indebted countries.

Import growth is another potential explanatory factor for the heterogeneity in the debt–growth relationship. Increasing the money supply due to a higher debt leads to domestic demand growth, which affects a country's GDP and import growth. As a result of import growth, the country faces the crowding-out effect on net exports, which is accompanied by a decrease in GDP. Pyun and Rhee (2015) investigating the fiscal multipliers of 21 OECD economies, confirmed this effect through internal and external transmissions. The negative impact of public debt on economic growth originates through the crowding-out effect, while its influence depends on the marginal propensity to import and the exchange rate.

Countries with a higher marginal propensity to import will tend to import more as domestic incomes increase, which will slow economic growth. Meanwhile, in countries with a lower marginal propensity to import, rising incomes should not lead to a slowdown in economic growth. The crowding-out effect on net exports could also depend on the composition of imports. As Marks (2017) points out, the marginal propensity to import manufactured products rises more rapidly than the marginal propensity to import primary products. The growth-restricting effect of public debt is also explained by the twin deficit hypothesis. It states that the widening budget deficit increases the trade deficit, slowing the country's economic growth.

By entering world trade and liberalising some markets, countries have strengthened the relationship between the exchange rate and exports. The negative impact of public debt on economic growth depends on the sensitivity of net exports to the exchange rate. There are discussions that a country's export structure impacts the way exchange rates affect trade (see for a review Thorbecke and Salike 2020). Hong et al. (2018) also confirmed that

this effect differs according to the high costs associated with currency usage. Ojeda-Joya and Guzman (2019) confirmed that multipliers in developing economies are lower with flexible regimes, so this result suggests that a country's import and export flows may help explain the heterogeneity in the debt–growth relationship.

3. Empirical Methodology

3.1. Model

Our model aimed to examine what impact public debt, *D*, has on growth based on specifications used in the literature on the debt–growth nexus. We augmented it with variables considered as potential thresholds in addition to growth factors and the debt-to-GDP ratio: household consumption (*CON*), investment (*INV*), tax revenue (*TAX*), and import (*IMP*) shares in GDP. Following the arguments presented in Section 2, an increase in debt-financed public spending stimulates economic growth through the mechanism of the expenditure multiplier. The impact of public debt on the economy originates through its impact on private consumption, investment, tax revenue, and trade. On this basis, we assume that household consumption, investment, tax revenue, and import shares in GDP may explain the varying levels of debt thresholds between countries, since Hubbard (1954) acknowledged that, over the long term, the differences between marginal and average propensities tend to decrease.

The models on the effects of debt commonly include general government final consumption expenditure (% of GDP) to proxy the size of the public sector. Nouira and Kouni (2021) present a discussion on the effects of public spending on economic growth and estimate the inverted U-shaped relationship between the size of the public sector and the rate of growth of output. Section 2 explains that whether the effect will be positive or negative depends on household consumption and private investment responses to an increase in government spending (and public debt). To test this assumption empirically, our specification includes household consumption and private investment shares in GDP. These variables also represent the size of the public sector, as an increase in the share of the private sector in GDP is associated with a decrease in the share of the public sector. Furthermore, research includes investment and consumption shares in growth regressions to determine whether the economy is consumption- or investment-led (Kim 2017; Nouira and Kouni 2021).

The negative effect of debt on growth also originates through the tax rate channel. A higher level of debt today requires higher tax revenue in the future, as the government must repay the loans. However, higher tax revenues can be achieved as a result of economic growth without raising taxes. Following this, the tax burden (tax-income-to-GDP ratio) is a potential candidate to explain the non-linear debt–growth nexus. Vatavu et al. (2019) present a more detailed discussion on how taxes influence economic growth and present a review of the empirical literature on this topic.

The effect of debt on growth also originates through the international trade channel. Although trade openness (import- and export-to-GDP ratio) is often used as one of the growth controls examining the debt–growth nexus, we still see the point in distinguishing imports (% of GDP) and exports (% of GDP). This strategy is also widely applied. For example, Awokuse (2008); Çetintaş and Barişik (2009); Bakari and Mabrouki (2017); and Bakari et al. (2019) investigate the effects of exports and imports on economic growth separately. Trade openness shows the size of a country's trade, although, while explaining the non-linear debt–growth nexus, it is essential to assess the effects of exports and imports separately.

We assume that the relationship between economic growth in country *i* and its debt is conditional, and that this relationship is not constant across *i*. Using a pooled panel of four growth episodes, we estimate a linear specification of the average yearly growth rate of the real per capita GDP. Our examination is focused on the coefficient β_D, which

represents the impact of debt on growth while controlling other factors typically included in the specifications of the debt–growth nexus, F, and potential thresholds:

$$1/T-1ln(Y_{i,t+T}/Y_{i,t}) = \alpha' \boldsymbol{X_{i,t}} + \varepsilon_{i,t} = \beta_F' \boldsymbol{F_{i,t}} + \beta_D D_{i,t} + \beta_{CON} CON_{i,t} + \beta_{INV} INV_{i,t} + \beta_{TAX} TAX_{i,t} + \beta_{IMP} IMP_{i,t} + \theta_t + \mu_i + \varepsilon_{i,t}, \quad (1)$$

where F is a vector that includes other factors of economic growth, such as the log of per capita GDP (Y) at the beginning of each 5-year growth episode, population growth, schooling, inflation, export, and quality of institutions. The selection of factors is based on a literature review. There is no common set of control variables across studies. However, they often include population growth, the investment-to-GDP ratio, a measure representing human capital, a share of the government sector, trade openness, inflation, and a measure of institutional quality (Reinhart and Rogoff 2010; Masuch et al. 2017; Ahlborn and Schweickert 2018; Arčabić et al. 2018; Law et al. 2021; Liu and Lyu 2021). θ_t is the time trend and μ_i stands for country-specific intercept. $\varepsilon_{i,t}$ is the *iid* error term. In this research, right-hand-side variables are instrumented using their lagged values.

Our specification of structural threshold regression (STR) to examine sources of the heterogeneity of the debt–growth nexus is based on Kourtellos et al.'s (2016) developments. STR addresses the problem of parameter heterogeneity and allows for endogeneity not exclusively in the slope regressors F, but, more importantly, also in the threshold variable. It outperforms the previously widely used Caner and Hansen's (2004) threshold model, which assumes only slope regressors to be endogenous, but the threshold as strictly exogenous. We can consider Kourtellos et al.'s (2016) model as a generalisation of Hansen's (2000) and Caner and Hansen's (2004) simple threshold regression model, which allows for regime-specific heteroskedasticity and, at the same time, an endogenous threshold variable.

In our research, *CON*, *INV*, *TAX*, or *IMP* will be considered as a potential threshold variable, $\varphi_{i,t}$, which allows for assigning the observations into two regimes. We can define the following assignment rule and indicator function:

$$I(\varphi_{i,t} \leq \tau) = \begin{cases} 1 \text{ when } \varphi_{i,t} \leq \tau & : \text{Regime 1} \\ 0 \text{ when } \varphi_{i,t} > \tau & : \text{Regime 2} \end{cases}, \quad (2)$$

where $I(\varphi_{i,t} > \tau) = 1 - I(\varphi_{i,t} \leq \tau)$. In our research, we assume that $\varphi_{i,t}$ can be any factor varying over time that belongs to a vector, X. We also assume that $\varphi_{i,t}$ is endogenous, and the reduced specification of the equation that conditions which regime is present can be specified as:

$$\varphi_{i,t} = \omega_\varphi' \boldsymbol{Z_{i,t}} + v_{q,i,t}. \quad (3)$$

Equation (3) is similar to the selection equation discussed in the contributions on the models with a limited dependent variable, except for one crucial difference. While observing the assignment of observations into regimes in a sample selection model, we make an assumption about the latent threshold variable used to determine this assignment. In Equation (3), the threshold variable is observable even though we do not know which observations belong to which regime, and thus the threshold value. Based on Kourtellos et al. (2016), we can generalise Equation (1) to allow for two regimes to follow:

$$1/T-1ln(Y_{i,t+T}/Y_{i,t}) = \alpha' \boldsymbol{X_{i,t}} + \alpha_D D_{i,t} + \delta_D D_{i,t} I(\varphi_{i,t} \leq \tau) + \omega \lambda_{i,t}(\varphi_{i,t}) + \varepsilon_{i,t}, \quad (4)$$

where $\lambda_{i,t}(\varphi_{i,t})$ includes an inverse Mills ratio for both regimes to ensure the property of the error term to have a conditional mean equal to zero. The coefficient α_D is the coefficient for the *second* regime, i.e., $\alpha_D = \alpha_{D2}$, and δ_D is the gap between the coefficient of the *first* regime (α_{D1}) and the *second* regime (α_{D2}), i.e., $\delta_D = \alpha_{D1} - \alpha_{D2}$. Equation (4) converges to the specification in Equation (1), i.e., to a linear model, when $\delta = \omega = 0$.

To estimate the threshold parameter, we apply a concentrated least-squares method (CLS), and for the slope coefficients a generalised method of moments (GMM) estimator. Since the threshold parameter, $\varphi_{i,t}$, has a non-standard asymptotic distribution, we calcu-

lated the confidence intervals of the threshold estimates using an inverted likelihood ratio approach developed by Kourtellos et al. (2016).

Moreover, we test that the null model is linear against the alternative hypothesis model with a threshold for each potential threshold variable, i.e., *H0:* $\delta_D = 0$. For this test, we employ the sup Wald test developed by Kourtellos et al. (2016), which is an augmentation of one proposed by Davies (1977) for the GMM estimator. For the computation of *p*-values, we apply a bootstrap method developed by Hansen (1996) since the threshold parameter, $\varphi_{i,t}$, is not identified under the *H0:* $\delta_D = 0$, i.e., no threshold effect.

3.2. Data

We use a balanced panel data of four 5-year growth episodes (2000–2004, 2005–2009, 2010–2014, and 2015–2019), covering 42 countries. The sample countries are presented in Table 1 and the descriptive statistics of the variables described in Table A1 (see Appendix A) are shown in Table 2.

Table 1. Countries in the sample.

	High Income	**Upper Middle Income**	**Lower Middle Income**
East Asia and Pacific	Australia, Japan, Republic of Korea, New Zealand, and Singapore	Malaysia, Thailand	Indonesia, Papua New Guinea, and the Philippines
Europe and Central Asia	Hungary, Iceland, Ireland, Spain, Switzerland, and United Kingdom	Albania, Belarus, Georgia, Moldova, Russian Federation, and Turkey	Ukraine
Latin America and Caribbean	The Bahamas, Uruguay	Colombia, Guatemala, Jamaica, and Peru	El Salvador
North America	United States	–	–
Middle East and North Africa	–	Jordan	Morocco, Tunisia
South Asia	–	Maldives	Bhutan, India, Nepal, and Sri Lanka
Sub-Saharan Africa	–	Botswana, Mauritius	Zambia

The four 5-year growth episodes allow us to work with the panel data and, to some extent, remove the effects of the business cycle. The dependent variable, as well as others, are computed over the time intervals based on data sampled from World Development Indicators and Worldwide Governance Indicators databases (see Table A1 in Appendix A).

Since the applied estimator requires balanced panel data, we included all countries for which data on necessary variables were fully available. We did not intend to include a specific group of countries. As information in Table 1 shows, our sample consists of countries from different geographical regions and income groups. Unfortunately, the panel data available are limited by the fact that we have to average data over 5-year periods, as is standard for growth regressions focusing on long-run relationships and excluding business cycle effects.

Table 2. Descriptive statistics of the variables.

Variable	2000–2004				2005–2009				2010–2014				2015–2019			
	Mean	**S.D.**	**Min**	**Max**	**Mean**	**S.D.**	**Min**	**Max**	**Mean**	**S.D.**	**Min**	**Max**	**Mean**	**S.D.**	**Min**	**Max**
Growth, %	3.06	2.35	−1.58	9.50	2.44	2.51	−2.51	7.60	2.54	1.81	−2.39	5.75	2.33	1.50	−0.18	5.72
Initial income (constant 2010 USD)	13,455	17,309	455	69,583	15,054	18,824	500	72,189	15,857	19,085	592	77,117	17,514	20,856	730	79,702
Lag of initial income	11,601	14,946	400	63,361	15,346	17,309	455	69,583	15,054	18,824	500	72,189	15,857	19,085	592	77,117
Debt (% of GDP)	51.78	28.03	5.94	118.62	47.71	28.13	0.02	138.96	55.06	36.66	0.04	181.92	58.12	37.02	0.05	196.93
Lag of debt	51.82	31.31	7.59	160.63	46.24	28.03	5.94	118.62	47.71	28.13	0.02	138.96	55.06	36.66	0.04	181.92
Consumption (% of GDP)	62.25	12.52	36.70	87.55	61.83	13.98	31.45	92.74	62.05	13.42	36.74	91.56	61.66	13.10	31.45	85.70
Lag of consumption	62.79	12.55	35.97	94.90	62.28	12.52	36.70	87.55	61.83	13.98	31.45	92.74	62.05	13.42	36.74	91.56
Investment (% of GDP)	24.82	6.86	14.91	60.44	26.66	5.71	17.33	44.61	26.10	7.97	15.15	60.42	25.84	7.39	14.08	49.99
Lag of investment	24.80	4.92	15.24	35.43	25.81	6.86	14.91	60.44	26.66	5.71	17.33	44.61	26.10	7.97	15.15	60.42
Tax revenue (% of GDP)	15.55	5.22	7.92	28.82	16.97	5.44	8.73	30.72	16.52	4.72	9.16	26.46	16.59	4.82	9.60	27.51
Lag of tax revenue	15.74	5.04	7.44	27.82	89.47	5.22	7.92	28.82	16.97	5.44	8.73	30.72	16.52	4.72	9.16	26.46
Import (% of GDP)	45.27	28.28	9.87	174.06	48.68	29.90	14.30	189.96	48.48	27.19	16.59	172.09	45.60	24.83	14.95	146.04
Lag of import	42.25	25.89	8.67	156.64	47.47	28.28	9.87	174.06	48.68	29.90	14.30	189.96	48.48	27.19	16.59	172.09
Population growth, %	1.05	1.07	−2.42	2.73	1.03	1.03	−2.01	2.70	1.01	0.98	−1.61	2.65	1.00	0.95	−1.27	2.61
Lag of population growth	1.08	1.13	−2.84	2.90	1.74	1.07	−2.42	2.73	1.03	1.03	−2.01	2.70	1.01	0.98	−1.61	2.65
Schooling, %	35.70	24.88	0.20	85.75	42.70	27.80	3.48	99.81	49.21	29.29	4.14	105.75	53.52	30.34	5.14	115.13
Lag of schooling	28.38	21.60	0.20	75.75	42.42	24.88	0.20	85.75	42.70	27.80	3.48	99.81	49.21	29.29	4.14	105.75
Inflation, %	9.99	15.39	0.34	85.00	9.44	15.12	−0.28	84.57	8.45	14.01	−0.67	79.75	6.91	9.63	−0.65	51.74
Lag of inflation	11.09	14.46	0.54	70.89	10.15	15.39	0.34	85.00	9.44	15.12	−0.28	84.57	8.45	14.01	−0.67	79.75
Export (% of GDP)	41.95	32.21	9.64	194.37	42.87	34.35	11.12	217.16	43.99	32.91	9.11	197.02	41.74	30.36	8.36	173.43
Lag of export	38.70	29.07	9.90	173.92	43.31	32.21	9.64	194.37	42.87	34.35	11.12	217.16	43.99	32.91	9.11	197.02
Quality of institutions	0.28	0.96	−1.20	2.06	0.28	0.95	−1.72	2.25	0.29	0.91	−1.66	2.17	0.29	0.90	−1.71	2.22
Lag of quality of institutions	0.24	0.98	−1.62	2.07	0.44	0.96	−1.20	2.06	0.28	0.95	−1.72	2.25	0.29	0.91	−1.66	2.17

4. Results and Discussion

Here, we present our results of the STR model based on the specification augmented with debt, as shown in Equation (4). Table 3 shows the results of the test to determine whether a threshold effect is present against *H0:* $\delta_D = 0$ for each of the candidates for a threshold variable discussed in Section 3.1 plus two additional factors, debt and quality of institutions, which were previously considered, based on empirical evidence, to have an effect on the debt–growth relationship.

Table 3. Sup Wald threshold test.

Threshold Variable	Sup Wald Test Value	Bootstrap *p*-Value
Consumption (CON)	55.893	0.023 **
Investment (INV)	79.047	1.137×10^{-7} ***
Tax revenue (TAX)	37.492	0.039 **
Import (IMP)	28.140	0.078 *
Debt (D)	59.752	0.006 ***
Quality of institutions (QOI)	80.940	5.091×10^{-10} ***

Note. A low *p*-value counts against the null hypothesis that our growth model augmented by the debt-to-GDP ratio is linear, as specified in Equation (1), in favour of the alternative threshold specification in Equation (4). All tested models include constant and trend. *, **, and *** show significance at 10%, 5%, and 1%, respectively.

Of six potential candidates, in five cases, that is, for consumption, investment, tax revenue, debt, and quality of institutions, the null hypothesis was rejected. We did not find significant evidence that import is an important threshold variable for splitting a sample. A positive public expenditure shock may lead to an increase in public debt, but at the same time boost economic growth. However, due to the high propensity to import, increased imports can crowd-out the growth-enhancing effect. However, for this group of countries, there seems to be little or no evidence that imports could explain the heterogeneous debt–growth relationship. A possible explanation is that there is a close relationship between shares of imports and exports in GDP (in our sample, the correlation coefficient is 0.93). Public spending can be efficient in countries with a high propensity to import if exports go hand in hand with an increase in imports. In this case, a more appropriate candidate to explain the heterogeneous debt–growth nexus may be the import/export ratio, as it was found to influence the debt threshold level (Butkus and Seputiene 2018).

However, there is strong evidence of non-linearity in the effect of debt on growth, in line with previous findings (see, for review, Rahman et al. 2019; Bentour 2021). Moreover, we find evidence for significant threshold and parameter heterogeneity induced by the quality of institutions, as suggested by the related literature (see, for review, Abbas et al. 2021; Law et al. 2021).

Table 4 shows the estimated threshold value and its 95% confidence interval for each of the five threshold variables. By splitting the sample into two regimes according to each of these threshold variables, we assign observations to each regime. Finally, we provide *J* statistics for the estimated STR model using each threshold variable.

Therefore, each variable can potentially create an STR model for the data. According to the *J* statistics, the best-fitting model, as Table 4 shows, is when the quality of institutions is used as the threshold variable, since the *J* statistics are minimised. The second, third, and fourth best are investment, tax revenue, and consumption, which are of great interest in our research since they are related to the size of the expenditure multiplier. Although debt is also considered as a threshold variable, it is the least suitable out of the five for an STR model for our data. The assignment of countries to the regimes based on threshold variables and their threshold values are presented in Table A2 (see Appendix A).

Our findings of the model, which splits the sample into regime one and regime two (i.e., countries with "low" and "high" values of the threshold variables), are presented in Table 5.

Table 4. Estimate of the threshold parameter and its 95% confidence interval.

Threshold Variable	Threshold Estimate	95% CI	n_1 in Regime 1	n_2 in Regime 2	*J* Statistics
Consumption (CON)	56.985	[50.856, 59.029]	67	101	2.469×10^{-19}
Investment (INV)	24.306	[21.579, 25.670]	79	89	7.137×10^{-22}
Tax revenue (TAX)	16.469	[15.044, 17.895]	100	68	5.868×10^{-20}
Debt (D)	68.919	[59.074, 78.765]	128	40	1.173×10^{-19}
Quality of institutions (QOI)	−0.229	[−0.427, 0.168]	55	113	1.950×10^{-22}

Note: n_1 is the sample size in the first regime, where the values of the variable are below the threshold estimate. n_2 is the sample size in the second regime, where the values of the variable are above the threshold estimate. The *J* statistic is provided for the STR models that resulted in the rejection of the null hypothesis about linearity in Table 3.

The slope β_D shows a heterogeneous debt–growth relationship depending on consumption, investment, tax, debt, and quality of institutions in countries, and estimates vary from −0.0515 to 0.0367. Our results are in line with Arčabić et al. (2018); Bentour (2021); and Law et al. (2021), and show only a weak effect (negative or positive) of debt on growth. The abovementioned papers applied dynamic threshold panel models and estimated debt-to-GDP threshold values for a large panel of both developed and developing countries (Arčabić et al. 2018), developing countries (Law et al. 2021), and 20 advanced countries adopting individual country regression (Bentour 2021). Studies that endogenously estimate the debt threshold value reported thresholds ranging from very low to very high values (see, for review, Bentour 2021). This inconsistency of the results indicates the need to investigate more factors influencing the debt–growth relationship.

We find that in countries with a high level of consumption (above the threshold level of 57% of GDP), a 1% increase in debt (% of GDP) would result in about 0.037% of an increase in growth, the effect being just marginally significant. The low level of consumption (below the threshold) conditions a negative but insignificant debt–growth relationship. Our results support the assumption that a positive debt effect is unlikely if private consumption is low. However, if the public spending shock does not lead to reduced consumption as the Ricardian equivalence hypothesis suggests, it is not enough to ensure the growth-stimulating effect of debt.

High levels of investment (above 24.3% of GDP) are associated with a significant positive effect of debt on growth—a 1% increase in debt (% of GDP) would result in about 0.013% faster growth. On the contrary, a low investment level (below the threshold) leads to a negative debt–growth nexus. An increase in debt (% of GDP) by 1% in countries with investment levels below 24.3% of GDP would slow down economic growth by about 0.052%. This shows that an increase in government debt leads to higher demand for money and increases the interest rate, which, in turn, leads to the crowding-out effect of private investment. Our results confirm the findings of other studies suggesting a negative impact of the increase in the debt-to-GDP ratio on investment and economic growth (Checherita-Westphal and Rother 2012; Huang et al. 2018; Huang et al. 2020; de Mendonça and Brito 2021). Private debt can be an important additional variable that can influence the relationship between public debt and economic growth. Future research can also discuss the impact of private sector indebtedness on the relationship between public debt and economic growth by including private sector indebtedness indicators as an additional threshold variable.

Table 5. STR–GMM estimates.

Variable	Threshold Variable									
	Consumption		**Investment**		**Tax Revenue**		**Debt**		**Quality of Institutions**	
	Low	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Debt	−0.0248	0.0367 *	−0.0515 **	0.0132 **	0.0025	−0.0028 **	0.0075 ***	−0.0092 *	−0.0019 **	0.0046
	(0.0152)	(0.0191)	(0.0250)	(0.0065)	(0.0029)	(0.0014)	(0.0013)	(0.0052)	(0.0009)	(0.0048)
Initial income	−0.0105 ***	−0.0123 ***	−0.0122 ***	−0.0117 ***	−0.0147 ***	−0.0134 **	−0.0111 ***	−0.0139 *	−0.0123 ***	−0.0127 ***
	(0.0027)	(0.0023)	(0.0047)	(0.0024)	(0.0017)	(0.0049)	(0.0018)	(0.0080)	(0.0042)	(0.0027)
Consumption	−0.0553 **	−0.0524 **	−0.0541 **	−0.0556 **	−0.0524 **	−0.0544 **	−0.0521 **	−0.0556 **	−0.0561 **	−0.0541 **
	(0.0276)	(0.0281)	(0.0265)	(0.0262)	(0.0275)	(0.0268)	(0.0272)	(0.0259)	(0.0278)	(0.0283)
Investment	0.0426 ***	0.0428 ***	0.0425 ***	0.0428 ***	0.0412 ***	0.0442 ***	0.0411 ***	0.0434 ***	0.0413 ***	0.0443 ***
	(0.0124)	(0.013)	(0.0122)	(0.0129)	(0.0131)	(0.0132)	(0.0127)	(0.0129)	(0.0123)	(0.0123)
Tax revenue	−0.0267 **	−0.0273 **	−0.0251 **	−0.0263 **	−0.0252 **	−0.0256 **	−0.0266 **	−0.025 **	−0.0249 **	−0.0249 **
	(0.0104)	(0.0107)	(0.01)	(0.0106)	(0.0105)	(0.0101)	(0.0099)	(0.0101)	(0.0102)	(0.0099)
Import	−0.0379 **	−0.0385 **	−0.0375 **	−0.036 **	−0.0351 **	−0.0374 **	−0.0358 **	−0.037 **	−0.0375 **	−0.0373 **
	(0.0151)	(0.015)	(0.0147)	(0.0153)	(0.0147)	(0.0143)	(0.014)	(0.015)	(0.0151)	(0.0149)
Quality of institutions	0.0062 **	0.0064 **	0.0063 **	0.0063 **	0.0062 **	0.0067 **	0.0062 **	0.0062 **	0.0064 **	0.0063 **
	(0.0032)	(0.0029)	(0.003)	(0.003)	(0.0032)	(0.0031)	(0.0030)	(0.0032)	(0.0030)	(0.0032)
Population growth	−0.7708 ***	−0.8222 ***	−0.7891 ***	−0.747 ***	−0.8091 ***	−0.7904 ***	−0.7515 ***	−0.7983 ***	−0.8126 ***	−0.7765 ***
	(0.1786)	(0.181)	(0.1956)	(0.1947)	(0.1915)	(0.1899)	(0.1838)	(0.1844)	(0.1829)	(0.1801)
Schooling	0.0016	0.0015	0.0015	0.0015	0.0015	0.0015	0.0016	0.0015	0.0015	0.0015
	(0.0036)	(0.0036)	(0.0036)	(0.0036)	(0.0036)	(0.0034)	(0.0035)	(0.0036)	(0.0037)	(0.0034)
Inflation	−0.0313 *	−0.0293 *	−0.0298 *	−0.0307 *	−0.0314 *	−0.0293 *	−0.0297 *	−0.0299 *	−0.03 *	−0.0313 *
	(0.0166)	(0.0162)	(0.0159)	(0.0164)	(0.0161)	(0.0172)	(0.0165)	(0.0171)	(0.0157)	(0.0166)
Export	0.026 **	0.0237 **	0.0254 **	0.0238 **	0.0237 **	0.0245 **	0.0244 **	0.0244 **	0.0259 **	0.0243 **
	(0.0123)	(0.0113)	(0.0114)	(0.0117)	(0.0113)	(0.0117)	(0.0117)	(0.0113)	(0.0123)	(0.0117)
Number of observations	67	101	79	89	100	68	128	40	55	113

Table 5. *Cont.*

Variable	Threshold Variable									
	Consumption		Investment		Tax Revenue		Debt		Quality of Institutions	
	Low	High	Low	High	Low	High	Low	High	Low	High
Averages										
Growth	2.7	2.5	2.3	2.9	2.6	2.6	2.8	2.1	2.7	2.6
Debt	49.3	55.7	58.6	48.3	54.1	51.9	38.6	99.7	40.4	57.5
Initial income, 000	21.9	11.2	14.6	16.2	14.9	16.3	13.2	22.8	10.1	17.4
Consumption	49.8	70.0	65.5	58.8	61.1	63.2	62.2	61.0	65.5	60.0
Investment	28.2	24.3	20.9	30.3	26.4	25.1	26.1	25.0	25.6	26.0
Tax revenue	16.2	16.5	17.0	15.9	12.8	21.4	16.2	17.2	14.5	17.3
Import	59.2	38.9	41.0	52.3	45.7	48.8	44.1	56.5	43.5	47.9
Quality of institutions	0.54	0.12	0.31	0.27	0.15	0.48	0.14	0.74	−0.69	0.78
Population growth	1.2	0.9	0.8	1.2	1.17	0.8	1.1	0.8	1.1	1.0
Schooling	52.1	40.8	47.2	43.5	42.2	49.5	42.4	54.6	30.3	49.0
Inflation	10.5	7.5	7.3	9.9	7.6	10.2	9.8	5.2	10.3	8.2
Export	63.9	30.0	38.0	48.4	44.0	42.9	40.2	54.2	37.6	46.0

Note: Here, we present estimations of the STR model developed by Kourtellos et al. (2016). Values that lagged by one period are used as the instruments for all variables. All estimations include trend- and country-specific constants. The averages of the variables are presented for each regime. "Low" corresponds to the first regime where values of the variable are below the threshold estimate, "High" corresponds to the second regime where values of the variable are above the threshold estimate. *, **, and *** show significance at 10%, 5%, and 1%, respectively.

Low taxes (below the threshold level of taxes revenue of 16.5% of GDP) are associated with a positive but insignificant effect of debt on growth. Meanwhile, high tax rates condition negative growth outcomes of debt—an increase in debt (% of GDP) by 1% in countries with tax revenue above 16.5% of GDP would statistically significantly damp economic growth by about 0.003%. Based on the expenditure multiplier effect, we relate a low tax-to-GDP ratio to a positive public debt effect on aggregated demand. On the other hand, it can be related to the shadow economy, which reduces tax revenues and increases public debt (Cooray et al. 2017).

Our results are in line with a strand of research supporting an inverted U-shaped debt–growth relationship (see for review Rahman et al. 2019; Bentour 2021). We find that debt above 69% (of GDP) starts to hinder economic growth. Although we find just marginally statistically significant negative growth outcomes of debt above the threshold level, its effect is significantly different from that when debt levels are low.

Our estimates also suggest that the relatively low quality of institutions is related to a negative effect of debt on growth, while relatively good institutions seem to have an insignificant effect on the debt–growth nexus. Studies on the intermediation role of institutions in the debt–growth relationship commonly include the interaction of the institutional quality variable with debt in the growth regression or split the sample of countries according to the quality of their institutions. The results are far from consistent. However, in line with Masuch et al. (2017); Turan and Yanıkkaya (2021); Abbas et al. (2021); and Law et al. (2021), among others, our results support the conclusion that sound institutions eliminate or at least suppress the negative effect of debt on growth.

To test the robustness of our estimates, we alternatively used the threshold sup test developed by Hansen (2000). Despite the fact that this test ignores the endogeneity of the threshold, our findings are similar (see results in Table 5, Table A3, and Appendix A for comparison).

5. Conclusions

Our results show that a positive debt effect is more likely to occur if conditions associated with a high expenditure multiplier value are met, i.e., an increase in the public-debt-to-GDP ratio is not necessarily deleterious to growth if shares of private consumption and investment in GDP are high, while the tax-revenue-to-GDP ratio is low. However, the significance of the estimated coefficients is weak. The explanation may be that the debt–growth relationship depends on a multiplier (Butkus et al. 2021), but no single factor determining the multiplier can lead to significantly different effects of debt on economic growth.

This implies the need for further research on factors related to the expenditure multiplier and their interactions as a potential candidate with which to explain the varying impact of public debt on economic growth. It is well-acknowledged in the literature that there is no single debt-to-GDP ratio that holds for all countries when the debt effect on growth changes from positive to negative. The same is true for consumption, investment, and tax shares in GDP. For fiscal policy implementation, our results suggest that the growth-stimulating effect of public debt is more likely if consumption and investment shares in GDP are above 57% and 24%, respectively, while the tax revenue to GDP ratio is below 16%.

However, we stress that these results need to be interpreted with caution, as threshold values were estimated for a sample of countries that includes both developed and developing ones. Another limitation is that we do not estimate the joint effect of consumption, investment, tax revenue, and imports on the debt–growth relationship. For example, if two factors are favourable for a higher expenditure multiplier value, e.g., both investment and consumption shares in GDP are high, then one can expect a higher taxes-to-GDP threshold value. Despite these limitations, we recommend that fiscal policymakers at least monitor the dynamics of consumption, investment, and taxes as a share of GDP, aiming to forecast the effectiveness of expansionary public spending using borrowed funds.

Author Contributions: Conceptualisation, D.C., L.G. and J.S.; methodology, M.B.; validation, M.B.; formal analysis, M.B.; data curation, M.B.; writing—original draft preparation, M.B., D.C., L.G. and J.S.; writing—review and editing, M.B., D.C., L.G. and J.S.; visualisation, J.S.; supervision, D.C.; project administration, D.C.; funding acquisition, D.C. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Research Council of Lithuania, grant number S-MIP-19-65.

Data Availability Statement: Publicly available datasets were analysed in this study. These data can be found here: The World Bank's World Development Indicator's database. Available online: https://databank.worldbank.org/source/world-development-indicators (accessed on 10 May 2021); The International Monetary Fund's World Economic Outlook's database. Available online: https://www.imf.org/en/Data (accessed on 10 May 2021); and The World Bank's World Governance Indicator's database. Available online: https://info.worldbank.org/governance/wgi/ (accessed on 10 May 2021).

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

Appendix A

Table A1. Description of the variables.

Variable	Abbreviation	Description
Growth	$1/T-1ln(Y_{i,t+T}/Y_{i,t})$	The average growth rate of logged per capita GDP (constant 2010 USD) for the periods 2000–2004, 2005–2009, 2010–2014, and 2015–2019. Source: own calculations based on per capita GDP (constant 2010 USD).
Initial income	Y	The logarithm of per capita GDP (constant 2010 USD) in 2000, 2005, 2010, and 2015. Lagged values correspond to 1995, 2000, 2005, and 2010. Source: World Development Indicators NY.GDP.PCAP.KD.
Debt	D	The logarithm of average central government total debt (% of GDP) for 2000–2004, 2005–2009, 2010–2014, and 2015–2019. Lagged values correspond to 1995–1999, 2000–2004, 2005–2009, and 2010–2014. Source: World Development Indicators GC.DOD.TOTL.GD.ZS.
Consumption	CON	The logarithm of average households' and NPISHs' final consumption expenditure (% of GDP) for 2000–2004, 2005–2009, 2010–2014, and 2015–2019. Lagged values correspond to 1995–1999, 2000–2004, 2005–2009, and 2010–2014. Source: World Development Indicators NE.CON.PRVT.ZS.
Investment	INV	The logarithm of average gross capital formation (% of GDP) for 2000–2004, 2005–2009, 2010–2014, and 2015–2019. Lagged values correspond to 1995–1999, 2000–2004, 2005–2009, and 2010–2014. Source: World Development Indicators NE.GDI.TOTL.ZS.
Tax revenue	TAX	The logarithm of average tax revenue (% of GDP) for 2000–2004, 2005–2009, 2010–2014, and 2015–2019. Lagged values correspond to 1995–1999, 2000–2004, 2005–2009, and 2010–2014. Source: World Development Indicators GC.TAX.TOTL.GD.ZS.
Import	IMP	The logarithm of average imports of goods and services (% of GDP) for 2000–2004, 2005–2009, 2010–2014, and 2015–2019. Lagged values correspond to 1995–1999, 2000–2004, 2005–2009, and 2010–2014. Source: World Development Indicators NE.IMP.GNFS.ZS.
Population growth	PGR	The average growth rate of logged population for the periods 2000–2004, 2005–2009, 2010–2014, and 2015–2019. Lagged values correspond to 1995–1999, 2000–2004, 2005–2009, and 2010–2014. Source: World Development Indicators SP.POP.TOTL.

Table A1. *Cont.*

Variable	Abbreviation	Description
Schooling	SCH	The logarithm of average tertiary school enrolment (% gross) for 2000–2004, 2005–2009, 2010–2014, and 2015–2019. Lagged values correspond to 1995–1999, 2000–2004, 2005–2009, and 2010–2014. Source: World Development Indicators SE.TER.ENRR.
Inflation	INF	The average growth rate of a logged consumer price index (2010 = 100) for the periods 2000–2004, 2005–2009, 2010–2014, and 2015–2019. Source: own calculations based on per capita GDP (constant 2010 USD). Source: World Development Indicators FP.CPI.TOTL.
Export	EXP	The logarithm of average exports of goods and services (% of GDP) for 2000–2004, 2005–2009, 2010–2014, and 2015–2019. Lagged values correspond to 1995–1999, 2000–2004, 2005–2009, and 2010–2014. Source: World Development Indicators NE.EXP.GNFS.ZS.
Quality of institutions	QOI	Average of government effectiveness estimate for the periods 2005–2009, 2010–2014, and 2015–2019. Lagged values correspond to 1995–1999, 2000–2004, 2005–2009, and 2010–2014. Source: Worldwide Governance Indicators GE.EST.

Table A2. Assignment of countries to the regimes based on threshold variables under consideration and estimated threshold.

Country	Period	Assignment to the Regime Based on Threshold Variable				
		CON	INV	TAX	D	QOI
Albania	2000–2004	H	H	L/H	L	L
	2005–2009	H	H	L/H	L/H	L
	2010–2014	H	H	L/H	L/H	L/H
	2015–2019	H	L/H	H	H	L/H
Australia	2000–2004	L/H	L/H	H	L	H
	2005–2009	L/H	H	H	L	H
	2010–2014	L/H	H	H	L	H
	2015–2019	L/H	L/H	H	L	H
The Bahamas	2000–2004	L/H	H	L	L	L
	2005–2009	H	H	L	L	L
	2010–2014	H	H	L	L	L
	2015–2019	H	H	L	L	L/H
Belarus	2000–2004	L/H	L/H	L/H	L	H
	2005–2009	L/H	H	H	L	H
	2010–2014	L/H	H	L	L	H
	2015–2019	L/H	H	L	L	H
Bhutan	2000–2004	L	H	L	L/H	H
	2005–2009	L	H	L	L/H	H
	2010–2014	L	H	L	L/H	H
	2015–2019	L/H	H	L	H	H
Botswana	2000–2004	L	H	H	L	L
	2005–2009	L	H	H	L	L
	2010–2014	L	H	H	L	L
	2015–2019	L	H	H	L	L
Colombia	2000–2004	H	L	L	L	L
	2005–2009	H	L/H	L	L/H	L
	2010–2014	H	L/H	L	L/H	L
	2015–2019	H	L/H	L	L/H	L

Table A2. *Cont.*

Country	Period	Assignment to the Regime Based on Threshold Variable				
		CON	**INV**	**TAX**	**D**	**QOI**
El Salvador	2000–2004	H	L	L	L	L
	2005–2009	H	L	L/H	L	L/H
	2010–2014	H	L	L/H	L	L/H
	2015–2019	H	L	L/H	L	L/H
Georgia	2000–2004	H	H	L	L/H	L
	2005–2009	H	H	H	L	L/H
	2010–2014	H	L/H	H	L	H
	2015–2019	H	H	H	L	H
Guatemala	2000–2004	H	L	L	L	L
	2005–2009	H	L	L	L	L
	2010–2014	H	L	L	L	L
	2015–2019	H	L	L	L	L
Hungary	2000–2004	L/H	H	H	L/H	H
	2005–2009	L/H	L/H	H	L/H	H
	2010–2014	L/H	L	H	H	H
	2015–2019	L	L/H	H	H	H
Iceland	2000–2004	L/H	L/H	H	L	H
	2005–2009	L/H	H	H	L	H
	2010–2014	L/H	L	H	H	H
	2015–2019	L	L	H	L/H	H
India	2000–2004	H	H	L	L/H	L/H
	2005–2009	L/H	H	L	L	L/H
	2010–2014	L/H	H	L	L	L/H
	2015–2019	H	H	L	L	L/H
Indonesia	2000–2004	H	L/H	L	L	L/H
	2005–2009	H	H	L	L	L/H
	2010–2014	L/H	H	L	L	L/H
	2015–2019	L/H	H	L	L	L/H
Ireland	2000–2004	L	L/H	H	L	H
	2005–2009	L	H	H	L	H
	2010–2014	L	L	H	H	H
	2015–2019	L	H	H	H	H
Jamaica	2000–2004	H	H	H	H	L/H
	2005–2009	H	L/H	H	H	H
	2010–2014	H	L	H	H	L/H
	2015–2019	H	L/H	H	H	H
Japan	2000–2004	L/H	L/H	L	H	H
	2005–2009	L/H	L/H	L/H	H	H
	2010–2014	L/H	L/H	L/H	H	H
	2015–2019	L/H	L/H	L	H	H
Jordan	2000–2004	H	L/H	H	H	L/H
	2005–2009	H	H	H	L	H
	2010–2014	H	L/H	L/H	L	L/H
	2015–2019	H	L	L	L	L/H
Republic of Korea	2000–2004	L/H	H	L	L	H
	2005–2009	L/H	H	L	L	H
	2010–2014	L	H	L	L	H
	2015–2019	L	H	L	L	H

Table A2. *Cont.*

Country	Period	Assignment to the Regime Based on Threshold Variable				
		CON	**INV**	**TAX**	**D**	**QOI**
Malaysia	2000–2004	L	L/H	L/H	L	H
	2005–2009	L	L	L	L	H
	2010–2014	L	L/H	L	L	H
	2015–2019	L/H	L/H	L	L	H
Maldives	2000–2004	L	L/H	L	L	H
	2005–2009	L	L/H	L	L	L/H
	2010–2014	L	H	L	L	L/H
	2015–2019	L	H	L	L/H	L/H
Mauritius	2000–2004	H	L/H	L/H	L	H
	2005–2009	H	L/H	L/H	L	H
	2010–2014	H	L/H	H	L	H
	2015–2019	H	L	L/H	L	H
Moldova	2000–2004	H	L/H	L	L/H	L
	2005–2009	H	H	H	L	L
	2010–2014	H	L/H	L/H	L	L
	2015–2019	H	L/H	L/H	L	L
Morocco	2000–2004	L/H	H	H	L	L/H
	2005–2009	L/H	H	H	L	L/H
	2010–2014	H	H	H	L	L/H
	2015–2019	L/H	H	H	L	L/H
Nepal	2000–2004	H	L/H	L	L/H	L
	2005–2009	H	H	L	L	L
	2010–2014	H	H	L	L	L
	2015–2019	H	H	L/H	L	L
New Zealand	2000–2004	L/H	L/H	H	L	H
	2005–2009	L/H	L/H	H	L	H
	2010–2014	L/H	L	H	L	H
	2015–2019	L/H	L/H	H	L	H
Papua New Guinea	2000–2004	L	L	H	L/H	L
	2005–2009	L	L/H	H	L	L
	2010–2014	L/H	L	H	L	L
	2015–2019	L/H	L/H	L	L	L
Peru	2000–2004	H	L	L	L	L/H
	2005–2009	H	L	H	L	L
	2010–2014	H	L/H	H	L	L/H
	2015–2019	H	L/H	L	L	L/H
The Philippines	2000–2004	H	L	L	L/H	L/H
	2005–2009	H	L	L	L	L/H
	2010–2014	H	L	L	L	L/H
	2015–2019	H	L/H	L	L	L/H
Russian Federation	2000–2004	L	L	L	L	L
	2005–2009	L	L/H	H	L	L/H
	2010–2014	L/H	L/H	L	L	L/H
	2015–2019	L/H	L/H	L	L	L/H
Singapore	2000–2004	L	L/H	L	H	H
	2005–2009	L	L/H	L	H	H
	2010–2014	L	H	L	H	H
	2015–2019	L	H	L	H	H

Table A2. *Cont.*

Country	Period	Assignment to the Regime Based on Threshold Variable				
		CON	**INV**	**TAX**	**D**	**QOI**
Spain	2000–2004	L	H	L	L	H
	2005–2009	L	H	L	L	H
	2010–2014	L	L	L	H	H
	2015–2019	L	L	L	H	H
Sri Lanka	2000–2004	H	L/H	L	H	L/H
	2005–2009	H	H	L	H	L/H
	2010–2014	H	H	L	L/H	L/H
	2015–2019	H	H	L	L/H	L/H
Switzerland	2000–2004	L/H	H	L	L	L
	2005–2009	L/H	H	L	L	L
	2010–2014	L/H	L/H	L	L	L
	2015–2019	L/H	L/H	L	L	L
Thailand	2000–2004	L/H	L/H	L	L	H
	2005–2009	L/H	H	L/H	L	H
	2010–2014	L/H	H	L/H	L	H
	2015–2019	L	L/H	L/H	L	H
Tunisia	2000–2004	H	L/H	H	L	H
	2005–2009	H	L/H	H	L	H
	2010–2014	H	L/H	H	L	L/H
	2015–2019	H	L	H	L	L/H
Turkey	2000–2004	H	L/H	L/H	L	L/H
	2005–2009	H	H	L/H	L	H
	2010–2014	H	H	H	L	H
	2015–2019	L/H	H	L/H	L	L/H
Ukraine	2000–2004	L/H	L/H	L	L	L
	2005–2009	H	H	L/H	L	L
	2010–2014	H	L	L/H	L	L
	2015–2019	H	L	H	L/H	L
United Kingdom	2000–2004	H	L	H	L	H
	2005–2009	H	L	H	L	H
	2010–2014	H	L	H	H	H
	2015–2019	H	L	H	H	H
United States	2000–2004	H	L/H	L	L	H
	2005–2009	H	L/H	L	L/H	H
	2010–2014	H	L	L	H	H
	2015–2019	H	L	L	H	H
Uruguay	2000–2004	H	L	L/H	H	H
	2005–2009	H	L	H	L/H	H
	2010–2014	H	L	H	L	H
	2015–2019	H	L	H	L	H
Zambia	2000–2004	L/H	L/H	L/H	H	L
	2005–2009	L/H	H	L	L/H	L
	2010–2014	L/H	H	L	L	L
	2015–2019	L	H	L/H	L	L

Note: *L* indicates that the value of a variable in the country is *low*, i.e., it falls below the lower bound of the 95% confidence interval of the threshold value. *H* indicates that the value of a variable in the country is *high*, i.e., it falls above the upper bound of the 95% confidence interval of the threshold value. *L/H* indicates that country falls within the lower and upper bounds of the 95% confidence interval of the threshold value.

Table A3. TR–LS and linear–GMM estimates.

Variable	TR–LS Estimates with a Threshold Variable										Linear–GMM Estimates
	Consumption		Investment		Tax Revenue		Debt		Quality of Institutions		
	Low	High	Low	High	Low	High	Low	High	Low	High	
Threshold Estimate	**58.306**		**23.018**		**15.900**		**70.872**		**−0.206**		
95% Confidence Interval	**[49.560, 67.052]**		**[19.653, 26.471]**		**[13.515, 18.285]**		**[60.241, 81503]**		**[−0.337, 0.175]**		
Debt	−0.0199	0.0432 *	−0.0449 *	0.0126 **	0.0026	−0.0033 **	0.0064 ***	−0.0104 **	−0.0022 **	0.0054	−0.0199
	(0.0168)	(0.0254)	(0.0225)	(0.0068)	(0.0034)	(0.0015)	(0.0015)	(0.0045)	(0.0010)	(0.0039)	(0.0168)
Initial income	−0.0112 ***	−0.0113 ***	−0.0134 ***	−0.0111 ***	−0.0127 ***	−0.0113 ***	−0.0127 ***	−0.0161 ***	−0.0139 ***	−0.0117 ***	−0.0112 ***
	(0.0032)	(0.0027)	(0.0055)	(0.0025)	(0.0016)	(0.0053)	(0.0021)	(0.0086)	(0.0039)	(0.0032)	(0.0032)
Consumption	−0.0463 **	−0.0430 **	−0.0550 **	−0.0586 **	−0.0584 **	−0.0565 **	−0.0571 **	−0.0591 **	−0.0546 **	−0.0444 **	−0.0463 **
	(0.0305)	(0.0322)	(0.0272)	(0.0281)	(0.0317)	(0.0264)	(0.0231)	(0.0300)	(0.0236)	(0.0324)	(0.0305)
Investment	0.0471 ***	0.0483 ***	0.0434 ***	0.0356 ***	0.0332 ***	0.0403 ***	0.0484 ***	0.0365 ***	0.0355 ***	0.05 ***	0.0471 ***
	(0.0121)	(0.0145)	(0.0112)	(0.0131)	(0.0131)	(0.0147)	(0.0104)	(0.0146)	(0.0143)	(0.0137)	(0.0121)
Tax revenue	−0.0251 **	−0.0275 **	−0.0262 **	−0.0292 **	−0.0278 **	−0.0232 **	−0.0309 **	−0.0279 **	−0.0208 **	−0.0251 **	−0.0251 **
	(0.0101)	(0.0096)	(0.0081)	(0.0087)	(0.0121)	(0.0110)	(0.0092)	(0.0105)	(0.0118)	(0.0089)	(0.0101)
Import	−0.0411 **	−0.0319 **	−0.0405 **	−0.0334 **	−0.0407 **	−0.0335 **	−0.0428 **	−0.0314 **	−0.0404 **	−0.0309 **	−0.0411 **
	(0.0150)	(0.0178)	(0.0139)	(0.0183)	(0.0164)	(0.0157)	(0.0114)	(0.0143)	(0.0168)	(0.0177)	(0.0150)
Quality of institutions	0.0071 **	0.0065 **	0.0072 **	0.0062 **	0.0064 **	0.0071 **	0.0053 **	0.0071 **	0.0053 **	0.0064 **	0.0071 **
	(0.0038)	(0.0024)	(0.0027)	(0.0031)	(0.0031)	(0.0030)	(0.0029)	(0.0035)	(0.0030)	(0.0027)	(0.0038)
Population growth	−0.6514 ***	−0.699 ***	−0.8157 ***	−0.7365 ***	−0.9566 ***	−0.8512 ***	−0.7775 ***	−0.7362 ***	−0.8592 ***	−0.6602 ***	−0.6514 ***
	(0.2005)	(0.1449)	(0.1645)	(0.2265)	(0.1698)	(0.1739)	(0.1505)	(0.1550)	(0.1875)	(0.1442)	(0.2005)

Table A3. *Cont.*

Variable	TR–LS Estimates with a Threshold Variable										Linear–GMM Estimates
	Consumption		Investment		Tax Revenue		Debt		Quality of Institutions		
	Low	High	Low	High	Low	High	Low	High	Low	High	
Threshold Estimate	**58.306**		**23.018**		**15.900**		**70.872**		**−0.206**		
95% Confidence Interval	**[49.560, 67.052]**		**[19.653, 26.471]**		**[13.515, 18.285]**		**[60.241, 81503]**		**[−0.337, 0.175]**		
Schooling	0.0016	0.0012	0.0014	0.0017	0.0014	0.0014	0.0016	0.0013	0.0014	0.0012	0.0016
	(0.0041)	(0.0031)	(0.003)	(0.0032)	(0.0037)	(0.004)	(0.0028)	(0.0036)	(0.0038)	(0.0029)	(0.0041)
Inflation	−0.0290 *	−0.0239 *	−0.0307 *	−0.0274 *	−0.0286 *	−0.0334 *	−0.0328 *	−0.0257 *	−0.0273 *	−0.0255 *	−0.0290 *
	(0.0146)	(0.0154)	(0.0140)	(0.0144)	(0.0160)	(0.0168)	(0.0171)	(0.0138)	(0.0156)	(0.0158)	(0.0146)
Export	0.0308 **	0.0248 **	0.0261 **	0.0199 **	0.0254 **	0.0231 **	0.0242 **	0.0205 **	0.0277 **	0.0255 **	0.0308 **
	(0.0108)	(0.0114)	(0.0097)	(0.0131)	(0.0120)	(0.0131)	(0.0115)	(0.0113)	(0.0130)	(0.0119)	(0.0108)
Number of observations	69	99	75	93	95	73	130	38	59	109	168

Note: Here, we present estimations of the TR model developed by Hansen (2000) and baseline linear–GMM estimates. All estimations include trend- and country-specific constants. "Low" corresponds to the first regime, where values of the variable are below the threshold estimate, and "High" corresponds to the second regime, where values of the variable are above the threshold estimate. *, **, and *** show significance at 10%, 5%, and 1%, respectively.

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