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# **Does the composition of government spending matter for government bond spreads?**

J-L. Combes, A. Minea, P.N. Sawadogo

**Abstract:** This paper contributes to the literature on fiscal policy as a determinant of government bond spreads. We analyze the effect of government spending on government bond spreads using a panel of 30 emerging countries during the period 2000-2013. Based on system-GMM estimations, we find that total public spending does not affect government bond spreads. Instead, we reveal a composition effect: higher current spending (public investment) increase (decrease) government bond spreads. This result may arise due to the fact that current (less productive) spending may be associated with lower growth prospects, making investors to require higher premia. Finally, we unveil nonlinearities driven by the quality of institutions: in particular, good institutions support a more favourable impact of current spending on government bond spreads. Our findings suggest that governments of emerging countries can improve their international financing conditions by reducing current spending and supporting public investment.

**JEL Classification:** E62, H50, H63, G12.

**Keywords:** government bond spreads; government current spending; public investment.

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## I. Introduction

Access to capital on international financial markets is necessary for developing countries from the perspective of achieving the Sustainable Development Goals. Indeed, raising such resources may provide a solution against poor infrastructures, inequalities, natural disasters, food security, and so forth, in line with the current commitment to achieve the 2030 sustainable development agenda by reducing poverty, increasing prosperity, and promoting sustainable development. However, following the sovereign debt crises that occurred in the 1980s, investors reduced their demand of securities issued by developing countries due to their high risks, and in particular required higher yields for holding their bonds. Despite a downward trend prior to the 2008-9 crisis, spreads continue to remain important nowadays.

A large and extending literature analyzing the determinants of sovereign bond spreads insists on country-specific factors. In a seminal contribution, [Edwards \(1984\)](#) finds that external debt, the debt service, the current account, international reserves, and the investment ratio are first-order determinants of government bond spreads. Subsequent studies underscored the importance of other macroeconomic variables in the determination of spreads, such as e.g. inflation, the real exchange rate, the terms of trade, and foreign assets ([Min, 1998](#)), creditworthiness ([Rowland and Torres, 2004](#)), political risks ([Bellas et al., 2010](#)), and the presence of an inflation targeting framework ([Fouejieu and Roger, 2013](#); [Balima et al., 2017](#)). While this list of government bond spreads determinants is far from being exhaustive, [Packer and Borio \(2004\)](#) emphasize that good domestic macroeconomic and structural policies are essential for country risk management.<sup>1</sup>

Despite this large literature, the contributions on the effects of fiscal policy on government bond spreads are rather rare, probably because the seminal analysis of [Edwards \(1984\)](#) fails to establish a significant effect of the government expenditure/GNP ratio. However, one must go beyond an aggregated measure of government spending, and investigate the impact of disaggregated public spending on spreads. Disentangling government spending into current spending and public investment to evaluate their respective effect on government bond spreads is supported by several arguments. First, following the seminal work of [Aschauer \(1989\)](#) and [Barro \(1990\)](#) an important strand of literature opposes productive (i.e. growth-enhancing) public investment and unproductive current spending.<sup>2</sup>

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<sup>1</sup> Other studies complement country-specific factors with e.g. global factors (see [Baldacci et al., 2011](#), for an excellent discussion), and even non-fundamental factors, e.g. market sentiments ([Eichengreen and Mody, 1998](#)).

<sup>2</sup> In addition to its growth effects (see e.g. [Mallick, 2001, 2006](#); [Minea and Villieu, 2009, 2012, 2013](#); [Menuet et al., 2018](#)), an important literature discusses the degree of productivity of public investment—see the early contribution of e.g. [Sturm and de Haan \(1995\)](#) and [Hurlin and Minea \(2013\)](#) for a more recent reappraisal.

Such differences in their respective effect on economic growth may be echoed by investors into differences in the reaction of spreads. Second, some studies support that public investment is reduced during fiscal consolidations (see e.g. [Alesina and Perotti, 1995](#)), above the contraction of current spending ([Bamba et al., 2019](#)); in turn, fiscal consolidations are found to narrow spreads ([Baldacci et al., 2011](#)). Third, the composition of public spending better captures government's fiscal policy decisions, and particularly the existence of political budget cycles (see e.g. [Shi and Svensson, 2006](#)) that may affect investors' evaluation of risk.

In light of these arguments, the goal of this paper is to re-assess the potential influence of government spending, as one of the most important components of fiscal policy, on government bond spreads. We draw upon a panel of 30 emerging countries that are part of the JP Morgan Emerging Market Bond Index Global (EMBIG). Estimations from a System-GMM model augmented with external instrumental variables (IV) that allow capturing a causal effect show the following.

First, while we find that total spending in % of GDP do not significantly affect government bond spreads (i.e. similar to [Edwards, 1984](#), we fail to illustrate a *level* effect), disaggregating public spending between current government spending and public investment shows a fairly different picture according to which spending are not neutral for spreads. An increase in current spending in ratio of total spending is found to significantly increase government bond spreads, as opposed to the negative effect of public investment in ratio of total spending on spreads. This *composition* effect holds when controlling for the level effect captured by total spending in % of GDP (whose effect remains not significant), and is unaffected by the definition of current spending, namely with or without interest payments.

Second, some prominent existing studies that are close to our analysis find a level effect of current spending and public investment expressed in % of GDP: the former increases spreads according to [Akitoby and Stratmann \(2008\)](#), and the latter decreases them as shown by [Baldacci et al. \(2008\)](#) provided that the fiscal deficit does not increase.<sup>3</sup> Our additional estimations reveal that when considering both the level and the composition effect, only the *composition* effect is significant: in the presence of current spending (public investment) measured in % of GDP, only the ratio of current spending (public investment) in total spending significantly affects government bond spreads.

Third, subsequent estimations confirm that our findings are robust. Performing estimations with the panel-IV method, considering additional variables that can influence

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<sup>3</sup> [Baldacci et al. \(2011\)](#) suggest that the favorable effect of public investment in reducing spreads may be affected when considering different models.

government resources and other domestic and structural economic conditions, or looking at different subsamples leaves unaffected the positive (negative) effect of current spending (public investment) on government bond spreads.

Finally, motivated by differences in the sign of the effect of different types of functional government spending on spreads, we look for nonlinearities. Following the related literature that outlines the key role of institutions for spreads (e.g. [Martinez et al., 2013](#); [Eichler, 2014](#)),<sup>4</sup> we draw upon panel techniques that allow identifying potential endogenous thresholds driven by the quality of institutions in the relationship between government spending and spreads. While they confirm the presence of a composition effect, estimations reveal that this effect may indeed be subject to thresholds. In particular, although they are not found to affect the negative impact of public investment, good institutions support a more favourable impact of current government spending on government bond spreads.

From a policy perspective, the financial reliability of states, measured by interest rate spreads, depends mainly on their growth prospects. Consequently, on the one hand, the lack of a significant effect of the level of public spending on government interest rate spreads may illustrate the fact that their expected effects on growth are uncertain, since they depend on multiple factors including the way they are financed, the type of public spending, and so forth. However, on the other hand and in accordance with the theoretical literature, the composition of public expenditure matters. Our analysis shows that the (least productive) public expenditure, namely current expenditure, significantly increases borrowing costs, while the effect is opposite for public investment. Therefore, promoting public investment and reducing current spending may be a virtuous way to allow emerging markets to raise international funding at lower costs.

The paper is organized as follows. Section 2 discusses the model and the data, section 3 is devoted to our main results by emphasizing the composition effect in the relationship between disaggregated public spending and government bond spreads, section 4 assesses the robustness of this result, section 5 explores possible heterogeneities and nonlinearities, and section 6 concludes the paper.

## **II. Model and data**

To estimate the effect of public spending on government bond spreads and allow our results to be compared with the related literature, we start with a panel data model

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<sup>4</sup> By driving growth (see e.g. [Acemoglu et al., 2001](#); [Rodrik et al., 2004](#)), good institutions may favorably act on investors' perception of risk, and, possibly, on government bond spreads.

$$y_{it} = \mu_i + \lambda_t + \beta_x x_{it} + \gamma Q_{it} + \varepsilon_{it}, \quad (1)$$

in which  $y$  represents government bond spreads,  $x$  is the variable of public spending (with  $\beta_x$  the coefficient of interest), and  $\mu_i$ ,  $\lambda_t$ ,  $Q$ , and  $\varepsilon$  are country and time fixed effects, the vector of control variables, and the error term, respectively.

We use a homogenous panel of 30 emerging countries that are part of the JP Morgan Emerging Market Bond Index Global (EMBIG). The choice of this sample of emerging countries is dictated by the availability of data on both spreads and various independent variables. Our data are in annual frequency, and span from 2000 to 2013.

Data on sovereign bond spreads come from the JP Morgan EMBIG (*EMBIG*), which includes all sovereign foreign debt instruments issued by emerging countries. These instruments include international borrowings denominated in US dollars, such as Brady bonds, loans, and Eurobonds with a face value of at least US\$ 500 million and a maturity of 12 years. The government bond spread is calculated with respect to the US government bonds, which are considered as risk-free, and is taken in log to reduce potential heteroscedasticity issues.

Data on government spending comes from the International Monetary Fund (IMF) World Economic Outlook database. We use three measures of government spending in our analysis. On the one hand, an aggregated measure, which includes all government spending, expressed in % of GDP (*Expenditure*). On the other hand, we disentangle government spending into current spending and public investment. The former (*Current*) includes the final consumption expenditure, property income paid, subsidies, and other current transfers, e.g., social security, social assistance, pensions, and other welfare benefits. The latter (*Public investment*) is related to “productive” government spending, and measured by government gross fixed capital formation, where the general government comprises central and subnational governments but excludes other public entities such as state-owned enterprises and public-private partnership arrangements. To seize a *composition effect*, both variables are expressed as a share of total government spending.

Finally, based on the literature on the determinants of government bond spreads, we selected the following vector of control variables. To control for real conditions, we include the (i) growth rate of the gross domestic product (*GDP growth*), which is assumed to negatively affect spreads; indeed, higher GDP growth rates may provide higher public resources to repay public borrowing. To control for monetary conditions, we include the (ii) inflation rate computed as  $\log(1+\text{inflation})$  (*Inflation*), which is assumed to positively affect

spreads; indeed, high inflation rates may signal monetary instability, which may be translated into higher spreads. To control for fiscal conditions, we include two variables, namely the (iii) ratio of debt to GDP (*Debt*) and the (iv) payment defaults (*Debt default*) measured by a dummy equal to 1 if a country has failed or restructured its debt and to 0 otherwise, which are assumed to positively affect spreads. Indeed, a high debt ratio, by raising the debt burden, may foster the risk of default and therefore the spreads, while a defaulting country may be victim of “debt intolerance” (Reinhart et al., 2003) that results in higher spreads. To control for international conditions, we include three variables, namely the (v) *Terms of trade*, measured by the ratio between export prices and import prices, the (vi) total currency reserves in months of imports (*Reserves months*) that measure a country’s ability to repay foreign debt denominated in foreign currencies (for example, the IMF uses it as an appropriate indicator for reserves needs for countries with limited access to capital markets), and the (vii) Foreign Direct Investment (FDI) net inflows in ratio of GDP (*FDI inflows*) as a measure of a country’s capacity to attract foreign investors. These three variables are expected to negatively affect spreads; indeed, an increase in the terms of trade provides foreign currency that may be used to pay the debt service thus reducing the risk of default, while a higher ratio of reserves in months of imports and higher FDI may signal better macroeconomic conditions that may translate into lower spreads. Finally, to control for the quality of institutions, we include a composite index that captures the governance quality (*Index*), which is computed as the average of seven International Country Risk Guide (ICRG) indicators;<sup>5</sup> this variable is likely to negatively affect spreads since sound institutions may enforce investors’ confidence towards a given country. Some of these control variables (growth of the GDP, the inflation rate, debt, and the terms of trade) come from the IMF’s World Economic Outlook database, sovereign default data is from Reinhart and Rogoff (2008) revised database, and data for remaining control variables come from World Development Indicators, Worldwide Governance Indicators, ICRG, and the World Bank Database of Political Institutions.

Appendices A1-A3 present the definitions and sources of the variables, and some descriptive statistics. Moreover, Appendix A4 shows that all variables used in our analysis are stationary in level. Finally, Appendix A5 reveals that the unconditional correlation between the EMBIG index (in log) and total expenditure (in % of GDP) is positive, while positive (negative) with current spending (public investment) in ratio of total expenditure. Starting

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<sup>5</sup> These indicators are: government stability, internal & external conflict, corruption, military in politics, religious tensions, ethnic tensions, and democratic accountability.

from these simple correlations, the next section provides an econometric assessment of the effect of public spending on government bond spreads.

### **III. Government spending and government bond spreads: level and composition effects**

We first detail how we achieve identification of a causal effect in the relationship between public spending and government bond spreads, and then we present our main results.

#### *3.1. Identification*

The identification of a causal effect of public spending on government bond spreads is a difficult task. In particular, simple OLS estimations of the model (1) may be polluted by the presence of potential endogeneity. Reversed causality is a primary source of endogeneity; for example, a country may change its public spending behavior following an increase in risk premia on the issued bonds. Also, some factors that are not taken into account (such as agents' expectations) can affect both public spending and spreads.

To address these endogeneity issues, the traditional solution is to draw upon instrumental variables (IV). However, finding time-varying IV that fulfill the usual econometric restrictions is challenging with macroeconomic series. Consequently, we draw upon a combination between internal and external IVs, through augmenting the System-GMM model of [Blundell and Bond \(1998\)](#), which uses lagged variables as instruments and is particularly appropriate to deal with inertia in spreads, with additional IVs. Following the related literature (see e.g. [Fatás and Mihov, 2003](#); [Akitoby and Stratmann, 2008](#)), we include two external instruments for government spending, namely the urbanization rate and the age dependency ratio, which are expected to affect public spending (but not spreads) directly.<sup>6</sup>

#### *3.2. Results*

Table 1 presents the estimations. Following the literature on fiscal policy (see e.g. [Combes et al., 2018](#), for a recent contribution), we restricted and collapsed the instrument set to avoid the proliferation of instruments (see [Roodman, 2009](#)), and corrected standard errors for the finite sample bias (see [Windmeijer, 2005](#)). Before discussing the main results, observe that usual diagnostic tests support the quality of our fitting: the Hansen J-test does not reject the null

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<sup>6</sup> For instance, [Pearson et al. \(1989\)](#) suggest that a rise in the proportion of old people could increase pensions, health, and social services spending (see also [Busemeyer et al., 2009](#)), while a higher urbanization rate may be associated with the need of additional public infrastructures. 2SLS estimations available upon request show that these external instruments are valid.



hypothesis that our instruments are valid (i.e. uncorrelated with the error term), and the AR(2) test suggests the absence of second-order autocorrelation of the error term. In addition, the high coefficient of the lagged EMBIG confirms the important persistence in the dynamic of spreads, and, therefore, the appropriateness of drawing upon the System-GMM model. Finally, whenever significant, control variables present the expected sign: higher GDP growth and reserves (inflation and debt default probability) decrease (increase) government bond spreads.

Table 1: The effect of public spending on government bond spreads: level and composition effects

Bond spreads (embig)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lag embig	0.530*** (0.0856)	0.494*** (0.0910)	0.602*** (0.0827)	0.604*** (0.0745)	0.551*** (0.0773)	0.680*** (0.0917)	0.739*** (0.141)	0.608*** (0.0760)
GDP growth	-0.0744*** (0.0129)	-0.0878*** (0.0145)	-0.0576*** (0.0134)	-0.0528*** (0.0127)	-0.0848*** (0.0213)	-0.0546*** (0.0107)	-0.0568*** (0.00788)	-0.0681*** (0.0140)
Inflation	3.306*** (0.882)	2.646*** (0.997)	2.973*** (0.942)	2.948*** (0.971)	1.928* (1.155)	3.995*** (1.063)	3.473*** (1.006)	3.334*** (1.233)
Reserves months	-0.0371* (0.0195)	-0.0230 (0.0188)	-0.0564* (0.0333)	-0.0572*** (0.0218)	-0.0396** (0.0193)	-0.0339* (0.0198)	-0.0421** (0.0208)	-0.0264* (0.0147)
Debt default	0.854*** (0.267)	0.792*** (0.220)	0.702** (0.301)	0.674** (0.280)	0.857*** (0.221)	0.590* (0.312)	0.602** (0.260)	0.773*** (0.221)
Debt	-0.000628 (0.00263)	0.000723 (0.00265)	0.00982 (0.00641)	0.00101 (0.00480)	-0.000701 (0.00273)	0.00263 (0.00367)	-0.00184 (0.00446)	-0.00184 (0.00604)
FDI inflows	0.00275 (0.00495)	0.00245 (0.00461)	0.00361 (0.00602)	0.00360 (0.00624)	0.00425 (0.00472)	0.00620 (0.00456)	0.00679 (0.00662)	0.00557 (0.00372)
Terms of trade	-0.000258 (0.000630)	0.000579 (0.00100)	0.000417 (0.00240)	0.000141 (0.00203)	0.000139 (0.000978)	-0.00124 (0.000828)	-0.00142* (0.000846)	-0.000444 (0.00124)
Index	-0.115* (0.0590)	-0.131** (0.0625)	-0.106 (0.120)	-0.0829 (0.130)	-0.117 (0.122)	-0.0551 (0.0635)	0.00322 (0.127)	-0.103 (0.0824)
<b>Expenditure</b>	<b>0.00645</b> <b>(0.0102)</b>		<b>-0.0325</b> <b>(0.0239)</b>	<b>-0.00774</b> <b>(0.0204)</b>	<b>-0.0127</b> <b>(0.0115)</b>			
<b>Net Expenditure</b>		<b>-0.00183</b> <b>(0.00845)</b>						
<b>Net Current/Total</b>			<b>0.0345**</b> <b>(0.0141)</b>			<b>0.0245*</b> <b>(0.0147)</b>		
<b>Current/Total</b>				<b>0.0370**</b> <b>(0.0152)</b>			<b>0.0475*</b> <b>(0.0268)</b>	
<b>Public Investment/Total</b>					<b>-0.0280**</b> <b>(0.0134)</b>			<b>-0.0388*</b> <b>(0.0222)</b>
<b>Net Current/GDP</b>						<b>-0.0136</b> <b>(0.0187)</b>		
<b>Current/GDP</b>							<b>-0.00256</b> <b>(0.0168)</b>	
<b>Public Investment/GDP</b>								<b>0.0792</b> <b>(0.0628)</b>
Constant	3.370*** (0.670)	3.767*** (0.725)	1.002 (1.210)	-0.0378 (1.670)	4.311*** (0.882)	0.670 (1.156)	-2.153 (2.362)	3.272*** (0.536)
Observations	326	326	326	326	325	326	326	325
Groups/instruments	28/22	28/23	28/23	28/23	28/22	28/25	28/24	28/27
AR1 p-value	0.008	0.008	0.037	0.074	0.007	0.014	0.055	0.004
AR2 p-value	0.225	0.295	0.274	0.538	0.171	0.101	0.502	0.124
Hansen p-value	0.133	0.146	0.202	0.180	0.136	0.152	0.326	0.339

Note: Robust standard errors in brackets. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Column (1) of Table 1 shows that total government expenditure, expressed in % of GDP, does not significantly affect government bond spreads. The absence of a significant effect is confirmed by column (2), in which our main variable is net expenditure, namely government expenditure minus interest payment (again in % of GDP). Consequently, we fail to exert a *level effect* of government spending on spreads in our sample of emerging countries, i.e. government spending is neutral for spreads, similar to [Edwards \(1984\)](#).<sup>7</sup>

However, the lack of a significant effect of aggregated public spending covers important effects when disaggregating them in search for a *composition effect*. Indeed, according to columns (3)-(4)-(5), government spending is not neutral: higher government current spending (without or with interest payments), expressed in ratio of total government spending, significantly increase spreads, contrary to public investment, expressed in ratio of total government spending, which significantly reduces them. The latter result can be explained by a favorable effect of higher public investment on economic activity, which increases public resources available to pay the service of the debt, thereby reducing spreads. The former result may arise due to the fact that current (unproductive) spending can be considered as a sign of a poor growth prospects in the future, making investors to require higher premia.

The presence of a composition effect in our sample of emerging countries calls for two remarks. First, notice that this effect is established when controlling for a potential level effect by the inclusion of total government spending—such a level effect is, yet again, not at work in columns (3)-(4)-(5). Second, the related literature emphasized significant level effects of disaggregated government spending. Notably, [Akitoby and Stratmann \(2008\)](#) and [Baldacci et al. \(2008; 2011\)](#) found a positive (negative) effect of government current (public investment) spending expressed in % of GDP on government bond spreads. Consequently, we introduce in column (6) government net current spending (with interest payments in column (7)) and in column (8) public investment, expressed in ratio of both total expenditure and GDP. Results show that, contrary to the lack of significant effect of variables computed in % GDP (i.e. level effect), variables expressed in ratio of total expenditure continue to significantly affect government bond spreads, thus supporting the presence of a composition effect.

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<sup>7</sup> Additional panel IV-based estimates, in which we employ different combinations of control variables, confirm the neutrality of government expenditure (with or without interest payments) in ratio of GDP for government bond spreads (results are available upon request).

#### IV. Robustness

The previous section emphasized a composition effect of public spending on government bond spreads: government current (investment) spending significantly increase (reduce) spreads. The goal of this section is to explore the robustness of this finding in several ways. To save space, we focus on the specification with government net current spending (results are comparable when adding interest payments, and are available upon request), and we report only the coefficients of interest (full tables are available upon request).<sup>8</sup>

First, we augment the model with variables that may influence government resources.<sup>9</sup> For example, to account for the fact that the tax policy could affect spread (see e.g. [Ji and Qian, 2015](#)), we augment our specification with the variable government revenue. Relatedly, we consider the net official development assistance received, and two measures of seigniorage, namely money growth and the monetary ratio. Columns (1)-(8) of Table 2 show that, irrespective of the retained specification, higher government current (investment) spending significantly increase (decrease) government bond spreads, consistent with our main findings.<sup>10</sup>

Table 2. Robustness—government resources

Bond spreads (embig)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lag embig	0.612*** (0.182)	0.533*** (0.129)	0.561*** (0.107)	0.604*** (0.128)	0.597*** (0.0930)	0.579*** (0.0955)	0.667*** (0.108)	0.593*** (0.0705)
Expenditure	-0.0646 (0.0563)	-0.0779 (0.0525)	0.000359 (0.0151)	-0.00962 (0.0118)	-0.0255 (0.0242)	-0.00337 (0.0117)	-0.0161 (0.0159)	-0.00720 (0.0208)
Net Current	0.0259*** (0.00915)		0.0131* (0.00789)		0.0297** (0.0141)		0.0261** (0.0121)	
Public Investment		-0.0372* (0.0193)		-0.0227** (0.0107)		-0.0301** (0.0144)		-0.0274** (0.0137)
Includes as control	Government revenue		Net official assistance		Money growth		Monetary ratio	
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	284	283	283	282	326	325	326	325
Groups/instruments	28/23	28/24	25/24	25/23	28/24	28/25	28/24	28/27
AR2 p-value	0.738	0.204	0.514	0.512	0.239	0.183	0.260	0.148
Hansen p-value	0.316	0.328	0.132	0.145	0.127	0.184	0.243	0.269

Note: Robust standard errors in brackets. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

<sup>8</sup> Prior to performing these regressions, we conduct two sets of robustness checks. First, we reproduce the system-GMM estimations of Table 1 only with internal instruments (we drop the external instruments). Second, we perform a wide set of panel IV-based estimations with different combinations of control variables. Results available upon request confirm our main findings.

<sup>9</sup> Before adding additional controls, we estimate a more parsimonious model in which we drop several variables that are rarely significant, namely Debt, FDI Inflows, and Terms of trade. Dropping these variables improves the magnitude and the significance of our composition effect in all specifications of Table 1; in particular, the positive (negative) effect of current spending (public investment) is now significant at the 1% significance level in our main specifications, namely models (4) and (5) from Table 1, and is equal to 0.0515 (-0.0402)—full results can be obtained upon request.

<sup>10</sup> Given the importance of the variable government revenue, we equally perform estimations in which we introduce it while dropping the variable expenditure. We report that the coefficients of our main variables are comparable with those presented in columns (1) and (2) of Table 2 (results are available upon request).

Second, we add different control variables selected to capture the monetary and fiscal stance, namely the US Treasury bill rate and the cumulated defaults in the past, as well as domestic and international conditions, namely oil reserves and the 2008-9 financial crisis. Although the significance of the main coefficients of interest is somehow weakened, estimations reported in columns (1)-(8) of Table 3 confirm, yet again, that the composition effect that we highlighted in our benchmark estimations is still at work in the presence of a wide set of additional control variables.

Table 3. Robustness—additional controls

Bond spreads (embig)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lag embig	0.768*** (0.118)	0.594*** (0.0804)	0.719*** (0.143)	0.583*** (0.0839)	0.697*** (0.0989)	0.565*** (0.103)	0.729*** (0.0885)	0.765*** (0.0841)
Expenditure	-0.0158 (0.0243)	-0.0113 (0.0155)	-0.0256 (0.0253)	-0.00155 (0.0187)	-0.00317 (0.0156)	-0.0138 (0.0170)	-0.0143 (0.0177)	-0.00219 (0.0174)
Net Current	0.0262** (0.0117)		0.0320* (0.0190)		0.0162* (0.00872)		0.0273** (0.0118)	
Public Investment		-0.0321* (0.0164)		-0.0251* (0.0144)		-0.0174* (0.0103)		-0.0387** (0.0164)
Includes as control	US Treasury bill rate		Cumulated past defaults		Oil reserves		Financial crisis	
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	326	325	326	325	275	275	326	325
Groups/instruments	28/26	28/26	28/23	28/26	23/22	23/23	28/26	28/25
AR1 p-value	0.022	0.013	0.015	0.009	0.014	0.013	0.006	0.000
AR2 p-value	0.210	0.128	0.334	0.112	0.121	0.289	0.942	0.539
Hansen p-value	0.253	0.178	0.314	0.317	0.133	0.299	0.114	0.148

Note: Robust standard errors in brackets. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table 4. Robustness—sub-samples of countries

Bond spreads (embig)	(1)	(2)	(3)	(4)	(5)	(6)
Expenditure	<b>-0.0325</b> <b>(0.0239)</b>	<b>-0.0127</b> <b>(0.0115)</b>	0.0298 (0.0270)	0.0224 (0.0142)	-0.0288 (0.0244)	-0.00744 (0.0215)
Net Current	<b>0.0345**</b> <b>(0.0141)</b>		0.137* (0.0729)		0.0293** (0.0126)	
Public investment		<b>-0.0280**</b> <b>(0.0134)</b>		-0.0683*** (0.0208)		-0.0654* (0.0369)
Sample	Full sample		Latin America		Asia & East. Europe	
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	326	325	149	147	125	125

Note: Robust standard errors in brackets. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Finally, we compare our main results derived for the full sample with the effect of disaggregated public spending on government bond spreads in Latin America and Asia & Eastern Europe, as these regions are particularly concerned with bond spreads.<sup>11</sup> Panel-IV results reported

<sup>11</sup> Given the low number of countries in Sub-Saharan Africa and the Middle East, we were unable to provide consistent inference for these regions.

in columns (3)-(6) of Table 4 show the following. In each of these two regions there exists a significant composition effect of disaggregated government spending on sovereign bond spreads. However, some differences arise with respect to our main findings, notably regarding the magnitude of the effect. On the one hand, the positive impact of government current spending is lower in Asia & Central Europe, and particularly in Latin America (by a factor of roughly 2.5, see columns (1) and (3)), suggesting that on average investors penalize less, in terms of higher spreads, increases in government current spending in these regions compared with the entire panel of emerging countries in our analysis. On the other hand, the negative effect of public investment is stronger in both Latin America and Asia & Central Europe by a factor of roughly 2.3, as indicated by columns (2), (4), and (6), suggesting that investors value more, in terms of lower spreads, increases of public investment in these two regions with respect to other emerging countries. While confirming the existence of a composition effect, these differences motivate the next section that explores the potential presence of heterogeneities in this composition effect.

## **V. Heterogeneity and nonlinearity**

We focus on two issues. First, we investigate the response of government bond spreads when further disaggregating government expenditures by functional types. Second, we look at potential nonlinearities in the effect of government expenditure on sovereign bond spreads.

### *5.1. Heterogeneity: functional government spending*

Table 5 reports the estimations of the effect of government spending disaggregated by functional type, expressed in ratio of total expenditure, on sovereign bond spreads.<sup>12</sup> On the one hand, columns (1)-(2) show a negative and significant effect of public spending with education and health on spreads. Since these categories of public spending may be considered as investments in human capital, their increase is expected to improve labor productivity; a well-educated and healthy population may contribute to investors' confidence in a country's capacity to honor its commitments. On the other hand, higher public spending with social protection and military spending is found to increase spreads in columns (3)-(4). The former result may be related to the fact that social protection is usually considered as an "unproductive" type of public spending, while the latter result may signal instability in the future related to potential conflicts that will

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<sup>12</sup> This analysis was inspired by simple unconditional correlations that suggest possible differences in the effect of various types of functional public spending on government bond spreads (see Appendix A5).

require additional public revenues devoted to military goals. These findings (the effect of public spending with economic affairs is not significant in column (5) of Table 5) complement our main results, and show that the precise functional type of public spending is important in terms of spreads.<sup>13</sup> The fact that spreads can increase, not be affected, or decrease in response to different types of public spending calls for a closer look at possible nonlinearities.

Table 5. The effect of public spending by functional type (expressed in ratio of total spending) on spreads

Bond spreads (embig)	(1)	(2)	(3)	(4)	(5)
Lag embig	0.421*** (0.106)	0.501*** (0.115)	0.708*** (0.153)	0.559*** (0.100)	0.635*** (0.135)
Expenditure	0.0184 (0.0116)	0.00813 (0.0139)	0.00196 (0.0219)	0.0223 (0.0222)	0.0256*** (0.00808)
Education	-0.0376** (0.0164)				
Health		-0.0476*** (0.0164)			
Social Protection			0.0205* (0.0122)		
Defense				0.0627* (0.0350)	
Economic affairs					0.0115 (0.0209)
Controls	Yes	Yes	Yes	Yes	Yes
Observations	217	217	217	190	215
Groups/instruments	24/21	24/20	24/22	21/20	24/21
AR1 p-value	0.030	0.017	0.005	0.021	0.007
AR2 p-value	0.967	0.979	0.014	0.455	0.184
Hansen p-value	0.286	0.618	0.433	0.859	0.662

Note: Robust standard errors in brackets. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

## 5.2. Nonlinearity

We now investigate if the effect of public spending on government bond spreads is subject to nonlinearities. To do so, we draw upon the popular [Hansen \(1999\)](#) panel threshold regression (PTR) model,<sup>14</sup> which allows estimating endogenous thresholds with panel data, namely

$$y_{it} = \mu_i + \beta_x x_{it} + \beta_{xz} x_{it} F(z_{it}; \tilde{z}) + \beta_z z_{it} + \gamma Q_{it} + \varepsilon_{it}. \quad (2)$$

In our analysis,  $y$  and  $x$  are government bond spreads and public spending, respectively; and  $\mu$ ,  $Q$ , and  $\varepsilon$  are country fixed effects, the vector of control variables, and residuals, respectively.

<sup>13</sup> Several alternative specifications support these conclusions. For example, the significant coefficients of the variables health and social protection equal -0.0401 and 0.0377, respectively, when we control for the global financial crisis, and -0.0634 and 0.0310, respectively, when we control for the US Treasury bill rate (other results are available upon request).

<sup>14</sup> In the fiscal policy literature, e.g. [Combes et al. \(2017\)](#) use the PTR model to investigate the nonlinear effects of public debt on fiscal policy cyclicality.

By writing the effect of public spending on government bond spreads, namely  $dy/dx = \beta_x + \beta_{zx}F(z_{it}; \tilde{z})$ , we observe that nonlinearities are at work if the estimated coefficient of the interactive term between public spending and the variable  $z$  (to be discussed below) is statistically significant. In this case, assuming that  $F(\cdot)$  is a dummy function equal to 0 (1) when  $z_{it} < (>) \tilde{z}$ , with  $\tilde{z}$  the endogenously-estimated threshold, the effect of  $x$  on  $y$  is nonlinear depending on the variable  $z$ , since it equals  $\beta_x$  ( $\beta_x + \beta_{zx}$ ) when  $z_{it} < (>) \tilde{z}$  (see Hansen, 1999, for additional details on this method).

Of course, there are many possible candidates for the variable  $z$ . Among such candidates that may drive nonlinearities, we choose to focus on a broad proxy of the overall environment in a country, namely the quality of its institutions. This choice is motivated by the literature on the political underpinnings of fiscal policy that highlights the key role of governance for fiscal transparency, which supports the credibility of fiscal policy and limits political budget cycles, leading to better ratings (Arbatli and Escolano, 2015) and lower spreads (see e.g. Ciocchini et al., 2003; Glennerster and Shin, 2008). In addition, institutions also affect the nature of public spending in a country: Rajkumar and Swaroop (2008) show that good institutions positively impact the efficiency of public investment, which may explain their favorable effect on spreads (see e.g. Martinez et al., 2013; Eichler, 2014). Consequently, institutions may influence the effect of government spending on sovereign bond spreads.

Among different variables that aim at capturing institutions, we draw upon the popular government effectiveness ( $GE$ ) variable from the Worldwide Governance Indicators (WGI) of (Kaufmann et al., 2011), which is an important determinant of spreads for emerging markets (Martinez et al., 2013; Eichler, 2014). Comprised between -2.5 and 2.5, with a higher value signaling better institutions,  $GE$  measures perceptions of the quality of public services, their independence from political pressures, the quality of policy formulation and implementation, and the credibility of the commitment of government with respect to these policies.

Columns (1)-(3) of Table 6 present PTR estimations.<sup>15</sup> As shown by column (1) devoted to total spending (in % of GDP), there exists a threshold for a  $GE$  value estimated around 0.7 (the F-statistic reported at the bottom of the table confirms its statistical relevance); however, the effect of total spending on government bond spreads is never significant, i.e. neither when

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<sup>15</sup> Estimations presented in this section are performed on a balanced panel of 22 countries selected to present few missing values; these missing values were computed using a linear interpolation.



government effectiveness is below the threshold (low institutions), nor when it is above it (high institutions), in accordance with the lack of a significant effect of total spending illustrated by the main regressions. Moreover, GE exerts important nonlinearities in the effect of government net current spending (as a share of total government spending) on government bond spreads, as illustrated by column (2): an increase in current spending has no effect on spreads when institutions are low, namely below a threshold value estimated at around 0.7, but they decrease spreads above the threshold. Compared to the positive impact in our main results, this favorable effect may be a sign of the importance of institutions for investors: good institutions may foster investors' confidence in the economy. Finally, the GE threshold estimated for public investment is not statistically significant (see column (3)), suggesting that government effectiveness does not alter the effect of public investment on spreads.

Table 6. Nonlinearities driven by institutions in the effect of public spending on spreads (brutal transition)

Bond spreads (embig)	Government effectiveness			Quality of institutions		
	(1)	(2)	(3)	(4)	(5)	(6)
	Expenditure	Net Current	Public Inv.	Expenditure	Net Current	Public Inv.
Low institutions	0.0159 (0.0104)	-0.00555 (0.00752)	– –	0.0122 (0.0103)	-0.00124 (0.00722)	– –
High institutions	-0.00988 (0.0114)	-0.0203** (0.00814)	– –	-0.0110 (0.0111)	-0.0135* (0.00780)	– –
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Threshold $\bar{z}$	0.71	0.71	-0.86	0.65	0.65	-0.83
F-statistic (p-value)	30.8 (0.00)	32.7 (0.00)	4.86 (0.86)	27.0 (0.00)	28.3 (0.00)	10.8 (0.42)

Note: Standard errors in brackets. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

In the following, we explore the sensitivity of these findings in two ways. On the one hand, given the importance of the transition variable (institutions) in driving possible nonlinearities, we consider an alternative measure, namely the Quality of institutions. Being computed as the average of three variables, namely control of corruption, government effectiveness, and political stability, this variable allows capturing other dimensions of institutions. Using this different variable does not qualitatively change the effect of public spending on government bond spreads, as illustrated by columns (4)-(6) in Table 6: contrary to the lack of a significant influence on the effect on total spending, good institutions (corresponding to quality of institutions values above an estimated value of roughly 0.65) trigger a favorable effect of net current spending on spreads (see column (5)), while the relationship between public investment and spreads is yet again not subject to nonlinearities related to institutions (see column (6)).

On the other hand, despite its popularity, the PTR model present at least two shortcomings. First, it abstracts of the dynamics of the endogenous variable (see [Caner and Hansen, 2004](#), for such a model, and [Kremer et al., 2013](#), and [Hailemariam and Dzhumashev, 2019](#), for applications). Second, and more important for our analysis, it restricts the transition around the threshold  $\tilde{z}$  to be brutal; in particular, this restriction may explain the lack of a significant effect of public spending on government bond spreads when institutions are weak in Table 6. To cope with this latter shortcoming, [Gonzalez et al. \(2005\)](#) develop a model that allows for a smooth transition around the threshold. Specifically, the dummy function  $F(\cdot)$  from the PTR model can be replaced by a continuous logistic function with one threshold, namely:  $F(z_{it}; \tilde{z}; \phi) = [1 + \exp(-\phi(z_{it} - \tilde{z}))]^{-1}$ . Nonlinearities are at work if the positive transition parameter  $\phi$  is statistically different from zero, while the model collapses to a PTR with a brutal transition if  $\phi \rightarrow \infty$ . Between these extreme values, the derivative  $dy/dx = \beta_x + \beta_{zx}F(z_{it}; \tilde{z}; \phi)$  is nonlinear, with a smooth transition around the threshold  $\tilde{z}$  (see [Gonzalez et al., 2005](#), for more details on the model, and the estimation procedure).

Table 7. Nonlinearities driven by institutions in the effect of public spending on spreads (smooth transition)

Bond spreads (embig)	Government effectiveness			Quality of institutions		
	(1)	(2)	(3)	(4)	(5)	(6)
	Expenditure	Net Current	Public Inv.	Expenditure	Net Current	Public Inv.
Public spending	0.0179* (0.0090)	0.0083 (0.0069)	-0.0134* (0.0069)	0.0367*** (0.0107)	0.0117* (0.0070)	-0.0938*** (0.0181)
Spend*Institutions	-0.0751** (0.0264)	-0.0339*** (0.0088)	0.0177 (0.0216)	-0.0219*** (0.0038)	-0.0101*** (0.0018)	0.0007 (0.0006)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Value for the change in sign	0.15	—	—	—	—	—
Threshold $\tilde{z}$ / parameter $\phi$	0.29/8.41	0.23/10.1	0.28/8.67	0.65/74.9	0.66/54.8	0.58/13.1
LM F-test (p-value)	4.29 (0.00)	6.75 (0.00)	3.28 (0.00)	11.5 (0.00)	9.79 (0.00)	1.99 (0.05)

Note: Standard errors in brackets. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Results reported in Table 7 extend our previous findings from the model with brutal transition. First, accounting for a smooth transition allows better emphasizing the importance of institutions when assessing the effect of total public spending on government bond spreads. As shown by columns (1) and (4), when government effectiveness and the quality of institutions are low, higher public spending are associated with an increase in spreads. As institutions improve, this detrimental effect is weaker, and even turns into favorable for government effectiveness, i.e. the derivative of spreads with respect to total public spending changes from positive to negative,

above an estimated value for government effectiveness of roughly 0.15.<sup>16</sup> Second, corroborating our findings based on the PTR model, results in columns (2) and (5) show that when institutions improve, the overall effect of government net current spending on spreads decreases; however, although it is negative for government effectiveness (see column (2)), it remains positive when using the quality of institutions (see column (5)) as in our main estimations. Third, given that the coefficient of the interactive term is not significant in columns (3) and (6), a higher public investment (as a share of total government spending) is associated with the same marginal decrease in spreads irrespective of the quality of institutions, corroborating, yet again, our main findings. Altogether, these results suggest that improving institutions may mitigate the detrimental effect of public spending on spreads, particularly for government current spending.

## VI. Conclusion

This paper contributes to the surprisingly sparse literature on fiscal policy as a determinant of government bond spreads by focusing on one of the most important components of fiscal policy, namely government spending. Drawing upon a System-GMM model augmented with external instrumental variables (IV) to capture a causal effect, estimations performed on a panel of 30 emerging countries that are part of the JP Morgan EMBIG revealed the following.

First, contrary to the lack of influence of total spending in % of GDP (no *level* effect), we found that higher current spending (public investment) expressed in ratio of total spending significantly increase (decrease) government bond spreads. Moreover, this *composition* effect was found to be robust when: (i) controlling for total spending in % of GDP; (ii) including or not interest payments in the accountancy of current spending; (iii) accounting for the level effect of current spending and public investment (in % of GDP, see [Akitoby and Stratmann, 2008](#), and [Baldacci et al., 2008, 2011](#)); and (iv) using alternative estimation methods, additional controls, or different subsamples. Finally, using methods that potentially allow for the identification of endogenous thresholds with panel data, we unveiled that the effect of disaggregated public spending on government bond spreads are subject to nonlinearities related to the quality of institutions. While confirming our main findings, these estimations suggest that better institutions may support a favorable effect of public spending on spreads, particularly for current spending.

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<sup>16</sup> Compared with the PTR model in which these values equal the threshold, here they depend, in addition to the threshold  $\bar{z}$ , upon the estimated coefficients  $\beta_x$  and  $\beta_{xz}$ , and the transition parameter  $\phi$ .

Overall, our analysis shows that, contrary to aggregated public spending, disaggregated public spending are not neutral for government bond spreads. From a policy perspective, the main takeaway of our study is that emerging countries could improve their borrowing conditions on international capital markets when increasing public investment or controlling their current expenditures, such as public wages, social transfers, and so forth. Although they may be domestically unpopular, the latter policies could be valued by financial markets, and allow emerging countries to raise international funding at lower costs in order to further finance their economic development.

We see several developments of our work. First, given that public investment was found to decrease government bond spreads, it would be interesting to further investigate other variables that may foster this favorable effect, all the more given that the quality of institutions was not found to be such a driver. Second, one could explore spillovers in the effect of public spending in one country on spreads in other countries. We leave such topics for future research.

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## APPENDICES

### Appendix A1. Presentation of government spending data

<b>Total Expenditure = Expense (1) + Net acquisition of non-financial assets (2)</b>
<b>Expense (1) = Current expenditure</b>
Compensation of employees
Wages and salaries
Social Contributions
Uses of goods and services
Consumption of fixed capital assets
Interest
Subsidies
Grants
Excludes grants to other government units (Due to consolidation and for the purpose of this exercise)
Social benefits
Other expense
<b>Net acquisition of non-financial assets (2)= Public Investment</b>
Fixed assets
Inventories
Valuables
Nonproduced assets

Source: The IMF's Government Finance Statistics Yearbook—Maps of Government for 74 Countries

Net Current spending	It equals the General government expense, <sup>17</sup> and is expressed as a ratio of total expenditure.	IMF World Economic Outlook
Public investment	It encompasses the General government net acquisition of nonfinancial assets, <sup>18</sup> and is expressed as a ratio of total expenditure.	
Total Expenditure	Expense plus the net acquisition of nonfinancial assets (excluding valuables, <sup>19</sup> if possible), and is expressed in % of GDP.	

<sup>17</sup> It comprises spending on goods and services consumed within the current year in order to sustain the production process. This includes compensation of employees, the use of goods and services, consumption of fixed capital assets, interests, subsidies, grants, social benefits, and other expenses. We subtract interest payment to obtain the net current expenditure.

<sup>18</sup> The net acquisition of nonfinancial assets equals gross fixed capital formation less consumption of fixed capital plus changes in inventories and transactions in other nonfinancial assets (IMF Government Finance Statistics Manual, 2001).

<sup>19</sup> Valuables are produced assets that are not used primarily for purposes of production or consumption but are held as stores of value over time (IMF Government Finance Statistics Manual, 2001).



Appendix A2. Definition and sources of variables

<i>Variable</i>	<i>Definition</i>	<i>Source</i>
Sovereign bond spreads	It covers all sovereign foreign debt instruments issued by emerging countries, including international borrowings denominated in US dollars such as Brady bonds, loans, and Eurobonds with a face value of at least US\$ 500 million and a maturity of 12 years.	JP Morgan, Datastream
Growth rate of GDP	Annual percentage growth rate of GDP per capita.	WDI database
Inflation rate	Annual percentage change of consumer price index.	
Net Official Development Assistance	Disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of the Development Assistance Committee (DAC), by multilateral institutions, and by non-DAC countries to promote economic development and welfare in countries and territories in the DAC list of ODA recipients. It includes loans with a grant element of at least 25 percent.	
Total Reserves/months of imports	Reserves expressed in terms of the number of months of imports of goods and services they could pay for [Reserves/(Imports/12)].	
Inflows of FDI to GDP	Net inflows (new investment inflows less disinvestment) in a given economy from foreign investors, divided by GDP.	
Age dependency ratio	The ratio of dependent people younger than 15 or older than 64 to the working-age population (aged 15-64), in ratio of dependents per 100 working-age people.	
Urbanization rate	People living in urban areas as defined by national statistical offices, in total population.	
Debt to GDP	Ratio of total debt to GDP.	Reinhart and Rogoff (2008)
Payments default of debt	Dummy equal to 1 if a country did not pay its debt or restructured it with a lost for investors, and 0 if there was no payment default or debt restructuring.	
Terms of Trade	Ratio of export prices index and import prices index, in percentage.	IMF WEO
Net Current spending	Ratio of government current spending, net of interest payments, to total expenditure.	
Public investment	Ratio of government capital spending to total expenditure.	
Total expenditure	Ratio of government total spending to GDP.	
US Treasury bill rate	6-month Treasury bill secondary market rate.	FED database
Crisis	Dummy equal to 1 if year=2008, and to 0 if not.	Authors' calculations
Pass default	Number of default cumulated in the past.	Authors' calculations
Government effectiveness	Government Effectiveness captures perceptions of the quality of public services, the quality of the civil service, and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. Estimates give a country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.	WGI database
Control of corruption	Control of Corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. Estimates give a country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.	
Political stability	Political Stability and Absence of Violence/Terrorism measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism. Estimates give a country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.	
Quality of institutions	A composite measure of the quality of institution, computed as the simple average of government effectiveness, control of corruption, and political stability.	Authors' calculations

Government stability	This is an assessment of both the government's ability to carry out its declared program(s), and its ability to stay in office.	ICRG Database
Internal & external conflict	This is an assessment of political violence in the country and its actual or potential impact on governance. The highest rating is given to those countries where there is no armed or civil opposition to the government and the government does not indulge in arbitrary violence, direct or indirect, against its own people. It also includes an assessment both of the risk to the incumbent government from foreign action, ranging from non-violent external pressure (diplomatic pressures, withholding of aid, trade restrictions, territorial disputes, sanctions, etc) to violent external pressure (cross-border conflicts to all-out war).	
Corruption	This is an assessment of corruption within the political system. Such corruption is a threat to foreign investment for several reasons: it distorts the economic and financial environment; it reduces the efficiency of government and business by enabling people to assume positions of power through patronage rather than ability; and, last but not least, introduces an inherent instability into the political process.	
Military in politics	The military is not elected by anyone. Therefore, its involvement in politics, even at a peripheral level, is a diminution of democratic accountability.	
Religious tensions	Religious tensions may stem from the domination of society and/or governance by a single religious group that seeks to replace civil law by religious law and to exclude other religions from the political and/or social process; the desire of a single religious group to dominate governance; the suppression of religious freedom; the desire of a religious group to express its own identity, separate from the country as a whole.	
Ethnic tensions	This component is an assessment of the degree of tension within a country attributable to racial, nationality, or language divisions. Lower ratings are given to countries where racial and nationality tensions are high because opposing groups are intolerant and unwilling to compromise. Higher ratings are given to countries where tensions are minimal, even though such differences may still exist.	
Democratic accountability	This is a measure of how responsive government is to its people, on the basis that the less responsive it is, the more likely it is that the government will fall, peacefully in a democratic society, but possibly violently in a non-democratic one.	
Index	A composite index of institutions, computed as the simple average of six ICRG indicators (government stability, internal & external conflict, corruption, military in politics, religious & ethnic tensions, and democratic accountability).	
Education spending	Ratio of education expenditure in total expenditure.	IFPRI SPEED database
Health spending	Ratio of health expenditure in total expenditure.	
Social protection	Ratio of social protection expenditure in total expenditure.	
Economic affairs	Ratio of economic affairs expenditure in total expenditure.	
Defense spending	Ratio of defense expenditure in total expenditure.	

### Appendix A3. Descriptive statistics

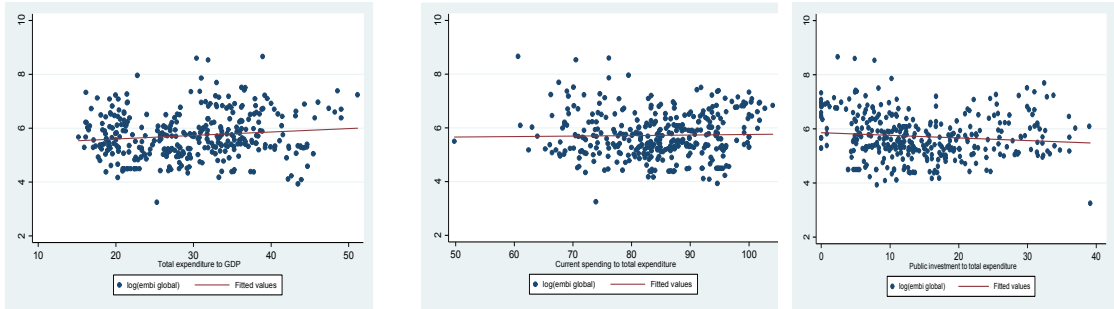
Variable name	count	Mean	Sd	Min	Max
Log (embig)	347	5.698198	.8323937	3.250815	8.662101
GDP growth	364	4.509779	3.808713	-14.8	33.73577
Inflation rate	353	.0690067	.0658476	-.0172513	.6734245
Reserves months	362	5.656501	3.259067	.4167565	19.01295
Terms of trade	378	115.5317	51.25785	76.3327	530.993
Debt to GDP	364	48.28221	30.59699	3.9	181.9
Debt default	364	.0521978	.2227319	0	1
FDI inflows	364	3.760869	3.463629	-2.75744	30.99529
Total expenditure	364	29.29719	8.009214	14.72533	51.12439
Current spending	364	83.60862	9.537809	49.80733	100
Public investment	363	15.30528	9.24079	0	40.69975
Index	420	5.129	.818	2.607	6.609
Government effectiveness	390	-.017	.594	-1.201	1.286
Rule of law	390	-.279	.655	-1.812	1.374
Control of corruption	390	-.274	.62	-1.333	1.573
Quality of institutions	390	-.243	.619	-1.557	1.23
Political stability	390	-.44	.846	-2.806	1.177
Government stability	420	8.213	1.639	4.04	12
Internal & external conflict	420	8.868	1.567	3.42	12
Corruption	420	2.309	.738	1	4.92
Military in politics	420	3.552	1.445	0	6
Religious tensions	420	4.526	1.456	.5	6
Ethnic tensions	420	4.253	1.329	1	6
Democratic accountability	420	4.182	1.506	0	6

### Appendix A4. Unit root tests

Test	Levin, Lin and Chu	Im, Pesaran and Shin	ADF-Fisher	PP-Fisher	Integration Order
Log (embig)	-18.3725	-5.63803	115.280	65.9214	I (0)
GDP growth	-11.9862	-7.22417	155.194	152.352	I (0)
Inflation rate	-26.9707	-10.7788	159.705	196.667	I (0)
Reserves months	-3.48995	-1.49833	74.2991	72.5710	I (0)
Terms of trade	-6.97228	-2.42743	76.8109	123.795	I (0)
Debt to GDP	-10.4868	-2.54687	101.944	86.2031	I (0)
Debt default	-3.62094	-3.04151	19.8771	20.2056	I (0)
Government effectiveness	-4.88536	-1.45350	79.0375	68.7527	I (0)
FDI inflows	-7.73394	-5.65667	130.947	141.380	I (0)
Current spending	-6.02245	-2.35588	95.0481	106.240	I (0)
Public investment	-6.85918	-1.13276	76.1460	126.724	I (0)
Total expenditure	-3.68749	-1.24111	82.0980	90.7725	I (0)
Index	-2.52763	-1.87895	86.4975	90.2303	I (0)
Rule of law	-3.18267	-1.32920	75.3331	82.9858	I (0)
Control of corruption	-8.23533	-3.94862	116.171	156.437	I (0)
Quality of institutions	-4.56343	-0.86609	72.0208	116.788	I (0)
Political stability	-3.40939	-1.07909	77.4062	86.3846	I (0)
Government stability	-1.31895	-0.74426	79.3035	87.6267	I (0)
Internal & external conflict	-5.04375	-2.79581	102.486	130.516	I (0)
Corruption	-317.024	-76.1771	113.908	160.403	I (0)
Military in politics	-13.0859	-6.41122	99.8541	120.406	I (0)
Religious tensions	-8.52557	-4.17868	69.0885	96.1276	I (0)
Ethnic tensions	-18.1732	-8.47783	78.3874	89.5681	I (0)
Democratic accountability	-3.73164	0.95133	41.6253	78.7308	I (0)

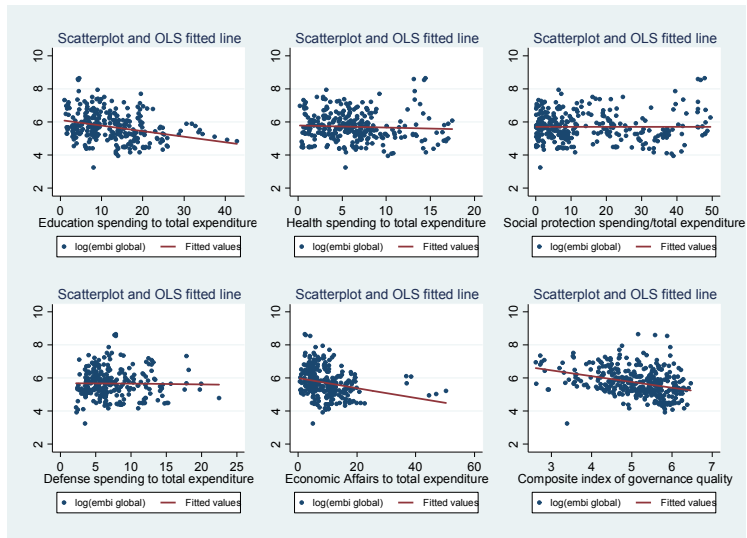
Appendix A5. Unconditional correlations

Figure A5.1. EMBIG and selected fiscal variables



Note: The Y axis illustrates the value of the EMBIG index (in Log) and the X axis illustrates each type of public spending considered.

Figure A5.2. EMBIG and functional repartition of government expenditures



Note: The Y axis illustrates the value of the EMBIG index (in Log) and the X axis illustrates each type of functional public expenditure.