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Fiscal Space and Government-Spending & Tax-Rate Cyclicality Patterns: A Cross-Country Comparison, 1960–2016

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Abstract[*]

This paper compares fiscal cyclicality across advanced and developing countries, geographic regions as well as income levels over 1960–2016 period, then identifies factors that explain countries' government spending and tax-policy cyclicality. Public debt/tax base ratio provides a more robust explanation for government-spending cyclicality than public debt/output ratio but the reverse is true when capital investment is accounted for in government spending. On average, a more indebted (relative to tax base) government spends more in good times and cuts back spending indifferently compared with a low-debt country in bad times. We also find that country's sovereign wealth fund has a countercyclical effect in our estimation. Finally, the analysis depicts a significant economic impact of an enduring interest-rate rise on fiscal space, that is, a 10% increase of public debt/tax base ratio is associated with an upper bound of 5.9% increase in government-spending procyclicality.

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1. Introduction

The Global Financial Crisis (GFC) focused attention on unsustainable leverage growth as a key contributing factor in growing financial fragility associated with "bubbly" dynamics. Essentially a prolonged appreciation of financial and real estate markets increases the vulnerability to sharp asset valuation corrections. A deep enough correction may trigger banking crises and fire sales dynamics, potentially pushing the economy into a prolonged depression and a growing exposure to social and political instability.[1] Concerns about reliving the 1930s Great Depression explain the complex set of policies implemented by the U.S. and other affected countries in the aftermath of the GFC: a massive infusion of liquidity in support of financial and banking systems and bailing out systemic banks and prime creditors. The forced deleverage of private borrowers, and the growing fear of a prolonged recession, induced higher household savings and lower investment, further deepening recessionary forces.

To counter these forces, many countries therefore experimented with fiscal stimuli aimed at mitigating the deepening recessions. Stabilizing the banking and financial systems, in addition to the stimuli, ended up sharply raising countries'

[1]See Minsky (1992) for the financial instability hypothesis, which analyzes financial market fragility over the life cycle of an economy with speculative investment bubbles endogenous to financial markets. Rajan (2006) pointed out that banking deregulation during the 1980s–2000s increased leverage and risk taking, contributing to a greater exposure to financial stability associated with tail risks. Schularick and Taylor (2012) and Jordà et al. (2013) provided empirical evidence linking leverage, business cycles, and crises.

public debt/GDP ratio, pushing advanced countries towards a public debt/GDP ratio of above 100% (see Figure 1). Similar trends applied to emerging market economies (EMEs), driving their ratio of public debt to GDP upward, with some reaching well above 50%. Notwithstanding the fact that the average public debt/GDP ratio of EMEs is below that of OECD countries, EMEs' lower tax base/GDP ratios, as well as the higher interest rates paid on their debt (due to sovereign risk premia), imply a rising fragility of EMEs compared with OECD countries. As such, while the ratio of public debt to GDP is used frequently in policy discussions, the ratio of public debt to tax base accounting for tax revenue may provide a more informative measure of the fiscal burden associated with the stock of public debt (Aizenman & Jinjarak, 2011). Henceforth, we refer to this fiscal measure as *limited fiscal space*.[2]

Importantly, the post-GFC trajectory failed to deal with leverage concerns: "At $164 trillion—equivalent to 225% of global GDP—global debt continues to hit new record highs almost a decade after the collapse of Lehman Brothers. Compared with the previous peak in 2009, the world is now 12% of GDP deeper in debt, reflecting a pickup in both public and nonfinancial private sector debt after a short hiatus. All income groups have experienced increases in total debt, but, by far,

[2] The euro crisis provided a vivid example of how focusing on public debt/GDP below a certain threshold caused a failure to recognize the large heterogeneity of the tax base/GDP in the Eurozone (Aizenman et al., 2013). Similarly, the interest expense needed to serve the public debt as a share of tax revenue may provide a robust measure of the burden of serving the public debt and be more informative than the interest cost of the public debt/GDP ratio.

EMEs are in the lead." (International Monetary Fund, 2018). In other words, stabilizing a crisis triggered by an unsustainable leverage growth in turn contributed to a potentially untenable increase in leverage/GDP ratios.

For the past decade, the monetary easing associated with the U.S. Federal Reserve (FED) and the European Central Bank policies in the aftermath of the GFC led to an unprecedented decline of policy interest rates and risk premia. These developments markedly reduced the flow costs of serving the rising public and private debt, thereby masking the increasing fragility associated with the rising aggregate leverage/GDP. This period has now passed: the (so far) robust recovery of the U.S., the gradual unwinding of the FED's balance sheet, the projected upward trajectory of the FED's funds rate, and the recovery of the Eurozone will impose growing fiscal challenges that will test countries' fiscal space and their ability to cope with projected higher interest rates by raising their resilience.

A key resilience margin is securing fiscal space—the fiscal capacity of countercyclical policy aimed at mitigating business cycles and preventing a prolonged depression in the aftermath of financial crises (Auerbach, 2011; Ostry et al., 2010); see also Gavin et al. (1996) on the identification of fiscal procyclicality as a major amplifier of developing countries' vulnerability to shocks. Remarkably, over the last two decades leading to the GFC, a growing share of fiscal policies in developing countries and EMEs had graduated from procyclicality and become countercyclical (see Frankel (2011) and Frankel et al. (2013)). Cross-country

studies offer several explanations. Woo (2009) presented some evidence showing that social polarization, as measured by income and educational inequality, is consistently and positively associated with fiscal procyclicality, controlling for other determinants; there is also a robust negative impact of fiscal procyclicality on economic growth. Aizenman and Jinjarak (2012) found that higher income inequality is strongly associated with a lower tax base, lower de facto fiscal space, and higher sovereign spreads. Végh and Vuletin (2015) find that tax policy is less procyclical (more countercyclical) in countries with better institutional quality and more financially integrated; tax and spending policies are conducted in a symmetric way over the business cycle. For brevity, Table 1 provides a summary of the related literature.[3]

Against this background, we assess definitions and empirical measures of fiscal cyclicality, compare fiscal cyclicality across Asia, Latin America, the OECD, and other regions, then identify factors accounting for spending- and tax-policy cyclicality patterns. We link the capacity of countercyclical policy to the fiscal space and the stage of economic and institutional development, as both are associated with the servicing capabilities of domestic and foreign debt. Our analysis focuses on differences across the country groups and examine the role of economic

[3] Related strands of the literature examine fiscal multipliers: see Ramey and Zubairy (2018), Leeper et al. (2017), and Ilzetzki et al. (2013); fiscal rules: see Budina et al. (2012); and large fiscal adjustments: see Alesina et al. (2015). Empirically, fiscal cyclicality, fiscal multipliers, fiscal rules, and large fiscal adjustments are intertwining issues; their relationships remain an open question and a challenge to address altogether in one go.

structure (commodity versus manufacturing outputs), financial openness, as well as institutional and socio-economic factors (political risks, polarization, and ethnic polarization). The paper concludes with an analysis of possible scenarios and suggested policies aiming at increasing the resilience of EMEs.

Our study reveals a mixed fiscal scenery, where more than half of the countries are characterized by limited fiscal space, and fiscal policy is either pro- or acyclical. More limited fiscal capacity, as measured by the ratio of public debt to 3-years moving-average tax revenue and its volatility are positively associated with fiscal cyclicality, while public debt/GDP are statistically significant in several cases, suggesting that public debt/tax base ratio provides a robust fiscal-space explanation for studying government-spending and tax-rate cyclicality.[4] We calculate the impact of an enduring interest-rate rise on fiscal space, rank countries and regions by the fragility of their fiscal space to such an environment, and discuss policies to increase fiscal resilience. The rest of the paper is organized as follows. Section 2 reports the empirical analysis with the baseline estimation and robustness checks. Section 3 provides the conclusion.

[4] Public debt/tax base in public finance is akin the net debt to earnings before interest depreciation and amortization ratio in the corporate sector (aka Debt/EBITDA). Net debt to earnings ratio is a measurement of leverage, how many years it would take for a company to pay back its debt if net borrowing is zero, and EBITDA are held constant; used frequently by credit rating agencies. "Ratios higher than 4 or 5 typically set off alarm bells because this indicates that a company is less likely to be able to handle its debt burden, and thus is less likely to be able to take on the additional debt required to grow the business", see also for example https://www.economist.com/business/2018/03/08/americas-companies-have-binged-on-debt-a-reckoning-looms.

2. Empirical analysis

2.1. Fiscal cyclicality: panel estimation

While there is a substantial number of papers trying to estimate the cyclical sensitivity of fiscal policy in OECD countries and developing ones, either assessing by group or by individual country, the results are sometimes conflicting.[5] In this section, we simply compare cyclical patterns of fiscal instruments including government spending and tax rates in OECD and non-OECD countries and across income groups by exploiting as much data availability as possible over 1960–2016 period to estimate the following panel regression:

$$FISCAL_{it} = \alpha + \beta * \Delta logRGDP_{it} + \varepsilon_{it}, \quad (1)$$

where i and t denote country and year, α is a constant term, ε_{it} is an error term, *FISCAL* is measured by either growth rate of real general government final consumption (*RGS*) or a tax rate, and *RGDP* is real gross domestic product (GDP).[6] We deflated the nominal government spending and GDP using the GDP deflator. For the government spending, the estimated $\hat{\beta}$ is the measure of spending-policy cyclicality: a positive and statistically significant coefficient indicates fiscal procyclicality; a negative and statistically significant coefficient indicates fiscal countercyclicality, and a statistically insignificant coefficient indicates fiscal

[5] See, for example, Lane (2003), Aghion and Marinescu (2007), Ilzetzki and Végh (2008), Bénétrix and Lane (2013), and Riera-Crichton et al. (2015).
[6] See Table 8 of the Appendix for more details on data source.

acyclicality. We also use Végh and Vuletin (2015)'s novel dataset of tax rates including value-added tax—VAT, personal income tax—PIT, and corporate income tax—CIT. However, the interpretations of the signs of tax-rate cyclicality coefficient are opposite those of spending-policy estimates. We leave in panel estimation the potential bias that is likely due to endogeneity and omitted variables, which will be addressed later in our baseline 2-step model below.

Table 2 shows government-spending cyclicality in the OECD and non-OECD countries with pooled-Ordinary Least Squares (Pooled-OLS) and Fixed Effects (controlling for country and year effects) specifications with robust standard errors. During 1960–2016, the non-OECD countries are more procyclical than the OECD countries, which is in line with Alesina et al. (2008). When it comes to tax-rate cyclicality as shown in Table 3, we find fairly consistent results as of Végh and Vuletin (2015) that OECD countries are fiscally procyclical in VAT, but countercyclical in CIT and PIT; whereas non-OECD countries are acyclical in VAT and associated with tax procyclicality in CIT and PIT.

As studying with panel data estimation of the cyclical patterns of government spending across income groups, the results shown in Table 4 come with no surprise as expected by Ilzetzki and Végh (2008). We find that higher-income countries are least fiscally procyclical, followed by upper-middle-income countries, lower-middle-income countries, and low-income countries.

2.2. Baseline empirical analysis

This section reports the empirical patterns of fiscal cyclicality across geographic regions, the OECD and non-OECD countries, and different income groups by estimating fiscal cyclicality by country. We then explore the determinants of countries' capacities in conducting countercyclical fiscal policy, focusing on tax base, public debt, economic structure, financial openness, as well as institutional and socio-economic factors.

Our choice of explanatory variables takes into consideration the factors associated with fiscal capacity in conducting countercyclical policy—credit constraints, institutional quality, and tax-base variability (these factors are by no means exhaustive and their inclusion is subject to data availability). First, the credit constraints. The shape of the supply of funds facing the public sector in recessions is a key determinant of fiscal space. A flatter supply of funds implies an easier countercyclical policy funded by borrowing, which in turn is affected by the presence of buffers (international reserves, sovereign wealth funds), possibly managed by a fiscal rule that allows for more countercyclicality during recessions. Furthermore, a low external and internal private and public debt-GDP ratios, as well as the ability to borrow in domestic currency, are associated with greater fiscal space, thereby allowing for cheaper borrowing in bad times. Second, the quality of institutions. Institutional quality is among the factors that are associated with fiscal space, which also include default history and inflation, and terms-of-trade volatility.

In particular, the collection efficiency of tax revenue is impacted by the maturity of institutions and the spectrum of taxes (e.g. VAT and income taxes that are properly enforced). Greater political and ethnic polarization, inequality, and corruption may reduce a population's cooperation to pay their "fair share", thereby making tax collection harder, increasing country's sovereign spreads, and leading to lower fiscal space. Public procyclicality may also be weaker in countries with more progressive taxes and transfers, as well as more countercyclical infrastructure expenditure, such as the use of infrastructure and housing investment as a countercyclical policy by the People's Republic of China. Third, the tax-base variability. The magnitude of revenue procyclicality depends on production structure. A higher commodity share in GDP may be associated with greater exposure to the procyclicality of government revenues. Increased urbanization and international trade are associated with the easier collection of taxes, implying that tax compliance is higher and may result in tax-revenue procyclicality.

2.2.1. Empirical specification

To estimate the empirical patterns of fiscal-policy cyclicality and its determinants, we start by using a benchmark framework in the literature; see, for example, Woo (2009). Specifically, we proceed the empirical analysis in two-step estimation:

Step 1: We run the following time-series regressions to measure the cyclicality of fiscal policy (spending, tax rates) by country over 1960–2016 period:

$$FISCAL_{i,t} = \alpha_i + \beta_i * \Delta logRGDP_{i,t} + \varepsilon_{i,t}, \quad (2)$$

where *FISCAL* again reflects either spending side in growth rate of *RGS* or tax side in VAT, PIT, and CIT respectively although we crucially aim to explain government-spending cyclicality more than cyclical tax-rate behaviour. In the baseline model, we use a standard two-step Prais-Winsten regression to correct for the first-order autocorrelation in the residuals (AR(1)). The cyclical behaviour of government spending and each tax rate by country is interpreted according to the signs of estimated $\hat{\beta}$ as in section 2.1.

There is some variation in the estimation of fiscal cyclicality in the literature where output-gap is commonly used.[7] The output gap is the deviation of real output from the potential series by applying filtering tools, for example Hodrick-Prescott filter, Baxter-King filter, and Kalman filter. However, we use real GDP growth in baseline estimation as it is unlikely that any of the potential output estimation and filtering are commonly applicable across countries, though this controversial proxy is employed later in a robustness check. As a bottom line, we aim for an empirical framework that is straightforward and as easy to replicate as possible in a cross-country or panel sample. As constructing the sample to begin with time-series

[7] See Table 1 for some common estimation methods of fiscal-policy cyclicality.

estimation, we replace 33 countries with insufficient data from *World Development Indicators* by *International Financial Statistics* data and keep ones with at least 25 years of observations.

Step 2: We then study the determinants of fiscal (spending, tax rates) cyclicality for the 1960–2016 period by estimating the following cross-country regressions, in which we focus on the measure of limited fiscal capacity, macroeconomic and socio-economic, as well as institutional variables:

$$\hat{\beta}_i = \alpha_0 + \theta_k * X_{ki} + \gamma_l * CONTROL_{li} + e_i, \quad (3)$$

where i denotes country, the estimated $\hat{\beta}$ from the left hand side are either $\widehat{\beta_{GS}}$, $\widehat{\beta_{VAT}}$, $\widehat{\beta_{PIT}}$, and $\widehat{\beta_{CIT}}$ respectively which are estimated from equation (2), X_{ki} includes main variables of interest (limited fiscal capacity, export structure, and country risks), and $CONTROL_{li}$ includes macroeconomic variables, averaged over 1960–2016 period, including inflation, trade openness, financial openness, government size (i.e. its consumption share in the GDP), and political constraints. We estimate equation (3) by OLS with the White robust standard error (RSE).

A brief explanation on our selection of the determinants is needed. To calculate the ratio of public debt to tax revenue, we use general government tax including social contributions. To capture its second moments, we also calculate the volatility of limited fiscal capacity, using its standard deviation. As the size of tax base is persistent in the short- to medium-run, we also add an alternative measure of limited fiscal capacity, using the ratio of public debt to the 3-years

moving-average of tax revenue. In the estimation, we compare the public debt/tax base with the public debt/GDP ratios, as fiscal space is a multidimensional concept, exemplified in several fiscal indicators (International Monetary Fund, 2016). To account for socio-economic and institutional quality, we use several composite risk indicators, including financial, economic, and political conditions from *International Country Risk Guide*. We also control for political constraints—the extent to which the executives face political constraints in implementing their policy—drawn from Henisz (2002). Table 10 of the Appendix reports the descriptive summary statistics of the variables in our baseline sample.

2.2.2. Government-spending cyclicality and its determinants

Table 5 reports the summary of government-spending cyclicality for the 1960–2016 period based on the country-specific coefficients ($\widehat{\beta_{GS}}$).[8] Looking across geographic regions, the government-spending cyclicality of the Sub-Saharan Africa is the highest among the estimates (0.89; most procyclical), followed by Latin American and the Caribbean (0.77), the Middle East and North Africa (0.69), East Asia and Pacific (0.46), Europe and Central Asia (0.41), South Asia (0.35), while North America has negative and the lowest estimates (-0.25; most countercyclical). For OECD and non-OECD countries, the latter group, on average, is more fiscally

[8] Empirical patterns of government-spending cyclicality by country are available in the online appendix.

procyclical (0.74) than the former one (0.19). Looking across income levels, the degree of procyclicality is negatively associated with income level, i.e. the low-income countries are most fiscally procyclical (0.93) followed by lower-middle income countries (0.78), upper-middle income countries (0.69), and the high-income group (0.32). Figure 2 shows the fiscal cyclicality of government spending ($\widehat{\beta_{GS}}$) by geographic region and income level. Overall, the findings from country-specific regressions are consistent with those in panel estimation.

What might explain the cross-country differences? Table 6 reports the estimation of government-spending cyclicality coefficients ($\widehat{\beta_{GS}}$) on socio-economic and institutional variables over 1960–2016 period. The main findings are as follows. Political constraints (*polcon*) are negatively associated with government-spending procyclicality, implying a greater degree of political constraints preventing policy discretions, which in turn limits fiscal procyclicality. Inflation *(inf)* is positively associated with fiscal procyclicality, suggesting the role of macroeconomic instability, seigniorage, and passive monetary policy. Trade openness *(trade)* and financial openness *(TAL)* are negatively associated with fiscal cyclicality, implying that the countries are less likely to conduct procyclical fiscal policy if they are more trade and financially open; fiscal multipliers are smaller for more open economies. Government size, as measured by its consumption share in GDP *(gs)*, is statistically insignificant in explaining fiscal-policy procyclicality.

More limited fiscal capacity, as measured by public debt/tax base ratio *(fiscal, lfiscap)* and its volatility *(fiscal_vol, lfiscap_vol)* are positively associated with fiscal procyclicality, while public debt/GDP ratio *(debt)* and its volatility *(debt_vol)* are statistically insignificant, suggesting that the ratio of public debt to tax base provides a robust explanation for government-spending procyclicality for the 1960–2016 period. Manufacturing export share *(manu)* is negatively associated with while natural resource export share *(nare)* is positively associated with fiscal procyclicality. The composite risk and three component risk indices (economic, financial, and political) as well as eight out of twelve political component risk indices (including social economic conditions, investment profile, internal conflict, corruption, military in politics, law and order, ethnic tensions, and bureaucracy quality) are negatively associated with fiscal procyclicality, thus indicating that higher country risk is associated with higher fiscal procyclicality.

2.2.3. Tax-rate cyclicality and its determinants

Similarly, only countries with at least 25 years of tax-rate observations are taken, hence we are left with 35 countries with VAT, 62 countries with PIT, and 62 countries with CIT. However, because of the infrequent adjustment of tax rates and the non-convergence of the AR(1) coefficient, the estimated coefficients of some

countries cannot be obtained in two-step Prais-Winsten procedure and the sample size thus becomes smaller.[9]

After obtaining tax-rate cyclicality coefficients ($\widehat{\beta_{VAT}}$, $\widehat{\beta_{PIT}}$, and $\widehat{\beta_{CIT}}$), we then regress them on socio-economic and institutional variables with different sets of controlling variables in each case, using OLS (RSE) whose results are summarized in Table 11 (columns 1) of the Appendix. As shown in Table 11a that $\widehat{\beta_{VAT}}$ is little sensitive to socio-economic variables and institutional quality but negatively associated with economic and financial risk indices, i.e. VAT becomes more fiscally procyclical as economic and financial risk decreases. Table 11b reports the determinants of PIT-cyclicality: personal income tax rate is more procyclical with: more limited fiscal space (*lfiscap*) and its volatility (*fiscal_vol, lfiscap_vol*), lower manufacturing export share (*manu*), higher socio-economic and political risks (*CRI*, *ERI*, *FRI*, *PRI, socecon*, *inconflict*, *exconflict*, *ethnic*, and *democracy*), and lower institutional quality (*corrupt*, *law*, and *bureau*). The latter is consistent with the findings of Végh and Vuletin (2015). As reported in Table 11c, among a pool of socio-economics and institutional variables, only natural resource export share (*nare*) and religious tensions (*religious*) are associated with CIT-cyclicality. Corporate income tax rate becomes more procyclical with higher natural resource export share and lower religious risks.

[9] Empirical patterns of tax-rate cyclicality by country are available in the online appendix.

2.2.4. Economic significance on fiscal cyclicality

To derive the economic impact of explanatory variables on fiscal cyclicality, we calculate and rank their economic significance by multiplying their (sample) standard deviation with their estimated coefficient from corresponding regression, thereby approximating the impact of one standard deviation change of that explanatory variable on the degree of fiscal cyclicality. For government-spending cyclicality, Figure 3 highlights the economic impact of natural resource export share (positive), limited fiscal space (positive), socio-economic and institutional risks (negative), and manufacturing export share (negative).

Regarding tax-rate cyclicality, the economic impacts of the explanatory variables on each tax-rate cyclicality vary largely. As shown in Figure 6 of the Appendix for VAT-cyclicality, most of socio-economic, financial, and institutional risks have negative and higher economic impacts than limited fiscal capacity whereas natural resource share has the largest positive economic impact. Nonetheless, in Figure 7, the economic impact patterns of these variables on PIT-cyclicality are quite opposite: limited fiscal capacity (negative and large), natural resource share (negative), socio-economic and institutional risks (positive), and manufacturing export share (positive). This may suggest that the cyclicality patterns of VAT differ significantly from those of PIT. Interestingly for CIT-cyclicality, Figure 8 visualises the economic significance of manufacturing export share

(positive), limited fiscal capacity (positive), religious tensions (negative and largest), natural resource share (negative), while the impacts of other institutional variables are mixed and insignificant.

2.3. Robustness checks

The fiscal-cyclicality literature suggests that the reduced-form relation between government spending and output (equation (2)) is the appropriate framework to study fiscal cyclicality and there is "no strong reason to exclude any equilibrium feedback from fiscal policy to the level of output" (Lane, 2003). As the reverse causality in equation (2) could result in the endogeneity bias, we addressed this potential issue below.

We note that the residuals in Prais-Winsten approach are assumed to follow AR(1) process; they are unobservable. We conduct robustness checks by re-estimating fiscal cyclicality by country in the 1st step estimation, correcting for heteroscedasticity and serial correlation (up to AR(2)). The estimation is done with OLS (RSE) and OLS with Newey-West standard errors. Furthermore, we use the Two-Stage Least Squares (2SLS) to address potential endogeneity issue of real GDP growth rate in equation (2). Following the literature, we use global liquidity shock (*SHOCKGL*) measured as the real return on 6-month Treasury bills weighted by countries' de jure financial openness using Chinn and Ito (2006) index as an excluded instrument; this variable is a proxy for country's exposure to global

liquidity. In addition, an external shock captured in the weighted real GDP growth of trading partners (*SHOCKJP*) and the U.S. business cycle (*KAUS*) defined by the National Bureau of Economic Research (NBER) are also used as alternative excluded instruments (IVs). The shocks from the U.S. business cycle is also weighted by countries' de jure financial openness using Chinn and Ito (2006) index. We check for each country the relevance and exogeneity of the instruments, and the over-identification tests; subject to data availability, the validity of these instruments varies across countries. Then we re-estimate the 2nd step on the cross-country regression, using the Weighted Least Squares (WLS) with the weight being the inverse of standard errors of $\hat{\beta}$ from the 1st step.

Table **12** in the Appendix summarizes the robustness checks for government-spending cyclicality using instrumental variables: the results are supportive to the findings in the baseline model. Public debt/tax base ratio and its volatility are positive and significant in most of specifications but public debt/GDP ratio and its volatility are less so, suggesting the ratio of public debt to tax base as a more informative variable for understanding the cyclical government-spending pattern over 1960–2016 period. The impacts of other variables are consistent with the baseline findings, including natural resource share (positive), manufacturing export share (negative), socio-economic and institutional risks (negative).

We next look into the choice of the output used in estimating the fiscal cyclicality. The robustness check on the country-specific government-spending cyclicality is done by regressing the change of real government spending on the output gap (deviation of real GDP from its Hodrick-Prescott trend); in order to compare with the baseline model using the real GDP growth. The smoothness parameter is set 6.25 for the annual data following Ravn and Uhlig (2002). Across the specifications: Prais-Winsten, OLS with Newey-West standard errors, or 2SLS in the 1st step and WLS in the 2nd step, we find consistent results with the baseline model. The ratio of public debt to tax base and its volatility are positive and significant while the ratio of public debt to GDP and its volatility are not, and institutional variables are negative and significant.

Note that we have so far used the 1st-step estimated coefficients regardless of the statistical significance; their qualitative and quantitative variations reflect the fiscal countercyclicality, procyclicality, or acyclicality in the sample. That is, we do not normalize/set them to zero if they are statistically insignificant in the baseline estimation. This practice is consistent with the existing studies using the 2-stage estimation, i.e. the average time-series estimates as in Lane (2003) and Woo (2009) or the x-year rolling window estimates as in Nerlich and Reuter (2015) and Guerguil et al. (2017). However, to check the robustness of our estimation, we re-do the analysis by setting insignificant estimated $\hat{\beta}$ to zero for both Prais-Winsten

and OLS estimates; while though some variation is inevitable, we do not find this change to overturn the main findings in our baseline estimation.[10]

We note that some of the association between tax-rate cyclicality and the control variables is sensitive to the choice of econometric specifications; coefficients of several variables are weak statistically in the cross-country regressions when 2SLS is used in the 1st step. Table 11 of the Appendix summarizes the 2nd-step regressions for tax-rate cyclicality under alternative estimations. We find that VAT-cyclicality is associated with volatility of debt/GDP ratio in several cases (negative), natural resource share (positive), manufacturing export share (negative), and different institutional risk indices (negative); see Table 11a, columns 2–5. In contrast, PIT-cyclicality is shown to be associated with limited fiscal capacity and its volatility (negative), natural resource share (negative), manufacturing export share (positive), and various socio-economic and political risks proxies (positive); see Table 11b, columns 2–5. CIT-cyclicality are associated with natural resource share (negative), manufacturing export share (positive), and a range of institutional risk indices (positive); when estimated by the Prais-Winsten specification, it is also negatively associated with religious tensions; see Table 11c, columns 2–5.

[10] To save space, we skip these robust results in this paper but they are available in online appendix.

2.4. Fiscal cyclicality at good times and bad times

Recent studies point to the asymmetry of fiscal cyclicality in good times vis-à-vis bad times. Alesina et al. (2017) use the narrative-identified exogenous fiscal stabilizations (i.e. the stabilization is not supposed to be correlated with the economic cycle) to show that, for 16 OECD countries, the cuts in government spending and transfers are much less harmful than tax hikes. Auerbach and Gorodnichenko (2017) show that for G-7 countries, government-spending shocks do not lead to persistent increases in debt to GDP ratios or costs of borrowing, especially during periods of economic weakness. While these lessons from the advanced economies are informative, our study is concerned with both industrial and developing countries. We note that the estimated $\hat{\beta}$'s so far (from equation (2)) provide the interesting patterns of government-spending and tax-rate cyclicality; we could delve further by separating the fiscal reactions in good times from those in bad times. Define good times as the periods with positive real GDP growth rate and bad times as the periods with negative real GDP growth rate, the regression equation is as follows:

$$FISCAL_{i,t} = \alpha_i + \gamma_i * \Delta logRGDP_{i,t} + \lambda_i * D_{i,t} + \theta_i * (\Delta logRGDP_{i,t} * D_{i,t}) + v_{i,t}, \quad (4)$$

where $D_{i,t} = 0$ if good times (strong economic growth in country i at time t), $D_{i,t} = 1$ if bad times (weak economic growth), and θ_i tests the asymmetric response of government spending in bad times compared to good times for country i. To obtain Prais-Winsten estimators, we regress the following separately:

D = 0: $FISCAL_{i,t} = \alpha_i + \gamma_i * \Delta logRGDP_{i,t} + u_{i,t}$, (4a)

D = 1: $FISCAL_{i,t} = (\alpha_i + \lambda_i) + (\gamma_i + \theta_i) * \Delta logRGDP_{i,t} + \omega_{i,t}$, (4b)

We find that the empirical patterns of fiscal cyclicality (either spending or tax) vary significantly across specifications (Prais-Winsten and OLS). Essentially, we have a mixed findings of asymmetries in government-spending cyclicality patterns and the tax-rate policy cyclicality across good times and bad times.[11] When we re-estimate the government-spending estimators on the determinants, we find that the associations between the government-spending procyclicality $\widehat{\beta_{GS}}$ and explanatory variables during good times are largely similar to the baseline model: positive with limited fiscal capacity and its volatility as well as natural resource share of exports, and negative with manufacturing share of exports and country risks (see Table 13 of the Appendix, columns 1–2). Volatility of public debt/GDP ratio is also positively associated with government-spending procyclicality in good times. In bad times, the volatility of limited fiscal capacity and investment profile are statistically significant and negatively associated with government-spending cyclicality (see column 3). Hence, it seems that in bad times, public debt, tax base, and investment confidence play a larger role in the government-spending cyclicality. This implies that a more indebted (relative to tax base) government

[11] The detailed estimated coefficients at good times and bad times by country are available in online appendix.

spends more in good times and cuts back indifferently compared with a low-debt country in bad times.

Our results so far suggest that, for both government-spending and tax-rate cyclicality, there is no one-size-fit-all explanation for all (OECD/developing) countries at all (good/bad) times. In essence, fiscal space, trade and financial openness, the export shares of natural resource and manufacturing, inflation, and institutional risks are associated with the cross-country patterns of fiscal cyclicality.

2.5. Sovereign wealth funds and government-spending cyclicality

We delve deeper into fiscal behaviour by looking at the role of sovereign wealth funds on government-spending cyclicality by regressing the following:

$$\hat{\beta}_i = \alpha_0 + \gamma_k * CONTROL_{ki} + \rho * SWF_i + \delta_1 * fiscap_i + \delta_2 * (SWF_i * fiscap_i) + \theta_1 * CRI_i + \theta_2 * (SWF_i * CRI_i) + \varepsilon_i \quad (5)$$

, where the dummy *SWF* = 1 if country has a sovereign wealth fund in operation starting at any point during 1960–2016 period; *SWF* = 0 otherwise. Focusing on the fiscal space and institutional risks, we include their interactions with the *SWF* variable. We regress equation (5) using the WLS estimation with real GDP (at 2010 US$) as the weight. Table 7 reports the estimation results for the full sample (1960–2016) and a sub-sample of good times. The estimates for bad-times are qualitatively similar but statistically insignificant. The negative coefficients of *SWF* interactions with public debt/tax ratio and institutional quality suggest that the existence of

sovereign wealth funds has a negative association with the government-spending procyclicality. Essentially, the findings point to the benefit of investing in sovereign wealth funds as the countercyclical fiscal buffers in good times to mitigate tax revenue shortfalls in bad times, thereby increasing the availability of countercyclical spending policy.

2.6. Excluding social contributions from tax base

Tax base has several components, among of which social contributions play an important role to many countries' budgets. What would happen if we repeat the estimation using tax base without social security contributions? However, we do not find much difference in the regression results as well as the economic significance of each explanatory variables to $\widehat{\beta_{GS}}$, $\widehat{\beta_{VAT}}$, $\widehat{\beta_{PIT}}$, and $\widehat{\beta_{CIT}}$ in the whole sample period and sub-periods.

2.7. Government-spending cyclicality with capital investment

To further check for the robustness, this sections provides the estimation results with alternative government spending series. We check whether our main findings would hold if the capital investment is accounted for in the government spending. We re-estimate both the panel estimation and the 2-step cross-country estimations using *World Economic Outlook*'s general government total-expenditure; the government spending is defined as total expense plus the net

acquisition of nonfinancial assets for 1980–2016 period. 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. Using this alternative data set, we find that, overall, the rankings of spending-policy cyclicality across OECD and non-OECD countries as well as geographic regions and income levels based on both panel and country-specific time-series estimations are in line with the baseline data set (that is, the government spending without the capital investment).[12] However, there is some discernible differences, as summarized in Table 14 of the Appendix. Public debt/GDP ratio and its volatility are significantly and positively associated with $\widehat{\beta_{GS}}$ but public debt/tax base ratio and its volatility are no longer significant except in several cases. Manufacturing export share remains negatively associated with government-spending procyclicality while natural resources export share is insignificant in some regressions. Composite risk, economic risk, government stability, socioeconomic conditions, and law and order indices are consistently and negatively associated with fiscal procyclicality as in the baseline model, and other proxies for financial risk, political risk, investment profile, internal conflict, external conflict, corruption, military in politics, ethnic tensions, and bureaucracy are significant in several estimations.

[12] Panel estimation results are available in online appendix.

Our findings on the cyclicality of government spending with the capital expenditure suggest that it may be useful to look into not only the size but also the composition of government expenditures (i.e. healthcare, education, defence) to study which components of the spending drive the fiscal cyclicality. Given heterogeneous population and income inequality, it is quite likely that the composition of government spending is influenced by trade and financial openness, political economy consideration, the availability of social safety nets, and fiscal capacity.[13]

2.8. Determinants of government-spending cyclicality by region

It is clear that the degrees of fiscal cyclicality differ markedly across countries and regions. Given the differences in the economic development and institutions, it is unlikely that we can come up with a sweeping explanation, but at least we can try. In order to examine the economic significance of each explanatory variable on government-spending cyclicality on the regional basis, we repeat the 2nd-step estimation by region. North America and South Asia are dropped due to insufficient data. Hence, we study in details five geographic regions: East Asia and the Pacific, Europe and Central Asia, Latin America and the Caribbean, the Middle

[13] Shelton (2007) studies the size and composition of government expenditure across countries from 1970–2000. It is likely that the spending composition is time-varying, especially after the GFC and because of the growing concerns over income inequality across industrial and developing countries in recent years.

East and North Africa, and Sub-Saharan Africa. Figure 9 of the Appendix shows the economic impacts by region, focusing closely on the associations of public debt, export structure, and country risks with the government-spending cyclicality.

East Asia and the Pacific: limited fiscal capacity has positive and significant impacts while governance and institutional quality, as measured by most of the country risk indices, have large and negative effects on fiscal procyclicality. Europe and Central Asia: manufacturing export share and most of institutional indices have a negative association with government-spending procyclicality; however, public debt/GDP ratio has a statistically significant and negative association with the government-spending cyclicality (i.e. lower debt/GDP ratio is associated with more fiscally procyclical). Latin America and the Caribbean: better institutional quality, more stable politics, smaller share of natural resource exports, and lower public debt/GDP ratio are associated with lower government-spending procyclicality. The Middle East and North Africa: somewhat intriguing as good scores on some socio-economic and political-stability variables are negatively associated with fiscal procyclicality as expected, but there democracy risk index is positively associated with fiscal procyclicality. Sub-Saharan African countries: interestingly some evidence of better institutional quality positively associating with procyclicality, yet the positive association of limited fiscal space and negative association of manufacturing export share with government-spending procyclicality are the most obvious in this region.

2.9. Fiscal space in a deteriorating macro environment

An enduring rise in the global interest rate will results in increasing the cost of borrowing and servicing public debt. We now look closely at the economic significance of limited fiscal capacity on government-spending cyclicality, using both the public debt/tax base (see Figure 4) and the public debt/3-years moving-average tax base ratios (see Figure 10 of the Appendix), and calculate to see what would happen if fiscal capacity drops by 10%. It is, specifically, 0.1*(Regional-specific estimated coefficient of public debt/tax base)*(Actual average ratio of regional-specific public debt/tax base over the 1960–2016 period). The top panels in Figure 4 and Figure 10 show the limited fiscal capacity, as measured by the actual ratios of public debt/tax base and public debt/3-years moving-average tax base respectively, average over 2010–2016 period. East Asia and the Pacific and the Middle East and North Africa have on average lower fiscal capacity compared to Latin America and Caribbean, Sub-Saharan Africa, and Europe and Central Asia. However, as shown in the bottom panels, the Sub-Saharan Africa is distinctly fragile fiscally, being exposed to large government-spending procyclicality if the macroeconomic environment and its fiscal space deteriorate. Based on the calculation, a 10% increase in public debt/tax base ratio is associated with an upper bound of 5.9% increase in government-spending procyclicality.

In addition, we look at the economic impact of deteriorating fiscal space, i.e. if a fiscal capacity drops by 10%, what would happen to the government-spending cyclicality. Specifically, we calculate: 0.1*(Actual average country-specific public debt/tax base)*(Regional-specific estimated coefficient of public debt/tax base). We use regional-specific coefficient in place of country-specific coefficient as there is insufficient country-level data to estimate a country-specific 2nd-step regression (i.e., equation (3); $\widehat{\beta_{GS}}$ = f(public debt/tax base, control variables)). As shown in the upper panels of Figure 5 and Figure 11 of the Appendix, Iraq, Japan, Singapore, Egypt, Greece, Libya, Yemen, Jamaica show limited fiscal capacity based on the 2010–2016 data, accumulating public debt four to eight times larger than their tax base (Iraq has public debt approximately forty time higher than its tax revenue). According to the calculation, fiscally fragile countries are mostly in Sub-Saharan Africa (Republic of Congo, Nigeria, Rwanda Seychelles,) and a few cases in East Asia and the Pacific (Vietnam, Indonesia, Cambodia; and Japan, which is rather an exceptional case[14]).

3. Concluding remarks

[14] This is partly due to the historically massive distribution and subscription of government bonds through the Yū-cho Ginkō (less true today) and the preference of Japanese bond holders to the domestic government bonds.

Our study reveals a mixed fiscal environment in which more than half of the countries in the study are characterized by limited fiscal space and fiscal policy is either pro- or acyclical. It confirms that OECD and higher-income countries are more fiscally countercyclical than non-OECD and lower-income countries. We also find that, compared to public debt/GDP, the ratio of public debt to tax base is a robust measure of limited fiscal space and provides a more robust explanation for government-spending cyclicality but the reverse is true when capital investment is accounted for in government spending. Moreover, the cyclicality is asymmetric: on average, a more indebted (relative to tax base) government spends more in good times and cuts back indifferently compared with a low-debt country in bad times. Lastly, the analysis predicts that a 10% enduring increase of interest-rate is associated with an upper bound of 5.9% increase in government-spending procyclicality.

Considering the sizable increase in total leverage/GDP in the aftermath of the GFC, countries could use the global recovery as an opportune time to invest in greater fiscal space, which could be done by increasing the tax base. Countries could also benefit by investing in countercyclical fiscal buffers, including the accumulation of sovereign wealth funds in good times to mitigate tax revenue shortfalls in bad times (e.g., Chile, Norway); indeed, it is shown that countries' sovereign wealth funds have a countercyclical effect in our estimation. Likewise, a

deeper safety net will add a countercyclical buffer that mitigates the adverse income effects of recessions, thus reducing income inequalities over time.

A limitation of our study is that, due to data constraints, we focus on the general government and thereby overlook the contribution of local and state government in a federal union system to cyclicality patterns. Chances are that controlling for these issues, we would find deeper pro- or acyclical patterns (e.g., in the U.S., state governments are frequently forced to apply procyclical expenditure patterns, which means cutting budgets at time of deep and prolonged recessions). Furthermore, while it is widely agreed that procyclical fiscal policy should be mitigated as much as possible (International Monetary Fund, 2017), there is no consensus on the practical approach, i.e. which spending components receive priority, and the fiscal rules to achieve such optimal degree of fiscal cyclicality.

As different governments face a wide range of political pressures and several targets (i.e. allocation efficiency, redistribution, debt stabilization, and structural reforms) with various ranking priority, fiscal challenges are mostly context specific without one-size fitting for all countries at all times. Our cross-country findings suggest that we need a better understanding on the mixes of (i) components of government spending, public debt, and tax base; (ii) fiscal policy, monetary policy, socio-economics, and institutions; and (iii) the role of central banks and quasi-government entities (e.g. sovereign wealth funds, state-owned

enterprises). We study these monetary-fiscal-political economy interactions in our follow-up.

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Table 1
Empirical literature on estimation of fiscal-policy cyclicality.

Studies	Methodology	Measurement of fiscal cyclicality	Sample	Key findings
Lane (2003)	$\Delta\, log(G_{it}) = \alpha_i + \beta_i * \Delta\, log(Y_{it}) + \varepsilon_{it}$ (1) $\widehat{\beta}_i = \alpha_0 + \alpha_1 Z_i + \varepsilon_i$ (2) *G*: various components of government spending *Y*: real GDP *Z*: control variables (1): Country regression using OLS procedure with a correction for AR(1) in the residuals; (2): WLS.	$\beta_i > 0$: procyclicality $\beta_i < 0$: countercyclicality	22 OECD countries 1960–1998	The level of procyclicality varies across spending categories and countries. Volatile output and dispersed political power are associated with government spending procyclicality.
Kaminsky et al. (2004)	*ρ(GS,OG), φ(inflationtax,OG)* ρ, φ: country correlation coefficient *GS*: cyclical government spending; *OG*: output gap. The cyclical series are estimated by the Hodrick-Prescott filter method.	$\rho > 0$: procyclicality $\rho < 0$: countercyclicality $\varphi > 0$: countercyclicality $\varphi < 0$: procyclicality	104 countries 1960–2003	Most OECD countries have countercyclical fiscal policy while most of developing countries have procyclical fiscal policy.
Talvi and Végh (2005)	*ρ(FC,OG), φ(inflationtax,OG)* ρ, φ: country correlation coefficient *FC*: cyclical government consumption, cyclical revenue; *OG*: output gap. The cyclical series are estimated by the Hodrick-Prescott filter method.	$\rho > 0$: procyclicality $\rho < 0$: countercyclicality $\varphi > 0$: countercyclicality $\varphi < 0$: procyclicality	56 countries 1970–1994	Fiscal revenues are procyclical in both developing and industrial countries. Government consumption in the G7 countries is acyclical when that in non-G7 industrial countries and developing countries is procyclical. Inflation tax rate is countercyclical in industrial countries and procyclical in developing countries.
Aghion and Marinescu (2007)	$\frac{b_{1t}-b_{i,t-1}}{y_{it}} = -a_{1it} y_{gap,it} + a_{2it} + \varepsilon_{it}$ (1) *b*: gross government debt *y*: GDP y_{gap} is computed using Hodrick-Prescott filter (1): 10-year centered rolling window; local Gaussian-weighted OLS; AR(1) Markov Chain Monte Carlo process	$a_{1it} > 0$: countercyclical $a_{1it} < 0$: procyclical	19 OECD countries 1961–2005	The budget deficit has become increasingly countercyclical in most OECD countries over the past 20 years. However, this trend has been significantly less pronounced in the EMU.
Alesina et al. (2008)	$\Delta\, F_{it} = \alpha_i + \beta_i * OG_{it} + \gamma X_{it} + \lambda F_{it-1} + \nu_t + \varepsilon_{it}$ (1) *F*: government surplus or public spending; *OG*: output gap, *X*: control variables. *OG* is estimated by the Hodrick-Prescott filter method. (1): Fixed Effects where *OG* of country *i* is instrumented by *OG* of the region of country *i*. Alternatively, (1) is estimated by country to get $\widehat{\beta}_i$ and then run cross-country regression of $\widehat{\beta}_i$ on X_i.	β_i is interpreted depending on the fiscal policy variable	83 countries 1960–2003	Fiscal policy is procyclical in many developing countries. Political distortion (i.e. corruption) is positively correlated with procyclicality of fiscal policy.
Ilzetzki and Végh (2008)	$\Delta\, log(GS_{it}) = \alpha_i + \beta_i * \Delta\, log(Y_{it}) + \varepsilon_{it}$ (1) *Y*: output, *GS*: government spending, or its components (1) is regressed using alternative methods include 2SLS, GMM, OLS estimation of simultaneous equations, Granger causality tests, VAR.	$\beta_i > 0$: procyclicality $\beta_i < 0$: countercyclicality	49 countries 1960–2006	Fiscal policy is always procyclical in developing countries and acyclical/procyclical in high-income countries.
Woo (2009)	$\Delta\, log\, GS_{it} = \alpha_i + \beta_i * \Delta\, log\, Y_{it} + \varepsilon_{it}$ (1) $\widehat{\beta}_i = \alpha_0 + \alpha_1(\text{Social polarization})_i + \phi X_i + \varepsilon_i$ (2) *GS*: real general government spending *Y*: real GDP *X*: control variables (1): Country regression using Prais-Winsten procedure; (2): OLS, WLS.	$\beta_i > 0$: procyclicality $\beta i < 0$: countercyclicality	96 countries 1960–2003	Developing countries are more procyclical than OECD countries. Latin America is the most fiscally procyclical region, followed by Sub-Saharan Africa and East Asian. Income inequality and educational inequality is positively associated with fiscal procyclicality.

Végh and Vuletin (2015)	$Tax_{it} = \alpha_i + \beta_i * OG_{it} + \varepsilon_{it}$ (1) $\Delta Taxrate_{it} = \alpha_i + \beta_i * \Delta\ log(RGDP_{it}) + \varepsilon_{it}$ (2) *Tax*: Inflation tax, cyclical component of revenues, and Revenues/GDP *OG*: output gap *Taxrate*: VAT, PIT, CIT, Tax index The cyclical series are estimated by the Hodrick-Prescott filter method. (1): Fixed Effects (2): Fixed Effects, Instrumental Variables	β_i is interpreted depending on the fiscal policy variable	62 countries 1960–2013	Tax policy is acyclical in industrial countries but mostly procyclical in developing countries. Better institutional quality (less corruption and more bureaucratic quality) and more financially integration are associated with less procyclical/more countercyclical fiscal policy.
Guerguil et al. (2017)	$\Delta logG_{it} = \alpha_{it} + \delta_{it}*\Delta logG_{it-1} + \beta_{it}*\Delta logY_{it} + \gamma_{it}*X_{it} + \varepsilon_{it}$ (1) *Y*: real GDP *G*: public spending (total spending or investment spending) *X*: control variables (1): Local Gaussian-Weighted OLS	$\beta_{it} < 0$: countercyclicality $\beta_{it} > 0$: procyclicality	167 countries 1990–2012	Total public spending was countercyclical in both fiscal-rule countries and non-fiscal rule countries but the degree of countercyclicality is more pronounced in the former group. In contrast, investment spending was procyclical in both groups and it is more procyclical in the fiscal-rule countries.

Table 2
Fiscal behaviour of government spending of OECD and non-OECD countries, 1960–2016.

Dependent variable: Percentage change of real government spending

VARIABLE	OECD			Non-OECD		
	OLS	**FE**	**FE**	**OLS**	**FE**	**FE**
Percentage change of real GDP	**0.537*****	**0.486*****	**0.508*****	**0.714*****	**0.698*****	**0.706*****
	(0.057)	(0.086)	(0.101)	(0.055)	(0.059)	(0.060)
Constant	0.022***	0.023***	0.046***	0.014***	0.015***	0.041***
	(0.002)	(0.003)	(0.011)	(0.003)	(0.002)	(0.013)
Number of countries		35	35		161	161
Observations	1,692	1,692	1,692	6,368	6,368	6,368
R-squared	0.114	0.088	0.259	0.085	0.076	0.101
Country Fixed Effects		YES	YES		YES	YES
Year Fixed Effects			YES			YES

Note: Ordinary least squares and fixed effects with robust standard errors are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Table 3
Fiscal behaviour of tax rates of OECD and non-OECD countries, 1960–2016.

VARIABLE	Dependent variable: Tax rate											
	VAT				PIT				CIT			
	OECD		Non-OECD		OECD		Non-OECD		OECD		Non-OECD	
Real GDP growth rate	**-0.149*** **	**-0.149*** **	**-0.009**	**-0.009**	**0.486** **	**0.484** **	**-0.191** **	**-0.191** **	**0.315** **	**0.313*** **	**-0.148** **	**-0.147** **
	(0.045)	(0.044)	(0.033)	(0.033)	(0.204)	(0.202)	(0.087)	(0.087)	(0.121)	(0.120)	(0.065)	(0.065)
Constant	17.294***	16.818***	14.739***	14.268***	48.061***	46.268***	30.831***	30.974***	33.220***	32.213***	32.774***	32.205***
	(0.114)	(1.062)	(0.116)	(0.653)	(0.538)	(1.943)	(0.309)	(2.330)	(0.341)	(1.387)	(0.238)	(1.244)
Number of countries	26	26	42	42	27	27	49	49	27	27	49	49
Observations	926	926	958	958	1,097	1,097	1,661	1,661	1,200	1,200	1,740	1,740
R-squared	0.031	0.028	0.001	0.002	0.012	0.000	0.008	0.001	0.014	0.011	0.009	0.000
Fixed Effect	YES		YES		YES		YES		YES		YES	
Random Effect		YES		YES		YES		YES		YES		YES

Note: Fixed effects and random effects with robust standard errors are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Table 4
Fiscal behaviour of government spending by income level, 1960–2016.

	Dependent variable: Percentage change of real government spending							
	HICs		UMCs		LMCs		LICs	
Percentage change of real GDP	**0.517*** **	**0.586*** **	**0.715*** **	**0.725*** **	**0.639*** **	**0.632*** **	**0.877*** **	**0.866*** **
	(0.079)	(0.080)	(0.055)	(0.064)	(0.156)	(0.159)	(0.141)	(0.147)
Constant	0.023***	0.062***	0.014***	0.021	0.016**	0.042**	0.011**	0.036
	(0.003)	(0.014)	(0.002)	(0.022)	(0.006)	(0.018)	(0.004)	(0.026)
Number of countries	62	62	52	52	52	52	30	30
Observations	2,576	2,576	2,133	2,133	2,063	2,063	1,288	1,288
R-squared	0.078	0.163	0.112	0.164	0.052	0.091	0.077	0.108
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE		YES		YES		YES		YES

Note: HICs = high-income countries, UMCs = upper-middle-income countries, LMCs = lower-middle-income countries, LICs = lower-income countries.
Fixed effects with robust standard errors are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Table 5
Government-spending cyclicality by region and income.

	Mean	SD	Minimum	Maximum
Region				
East Asia and Pacific	0.46	0.72	-0.98	1.84
Europe and Central Asia	0.41	0.55	-1.36	1.47
Latin America and Caribbean	0.77	0.54	-0.13	2.42
Middle East and North Africa	0.69	0.35	0.16	1.36
North America	-0.25	0.36	-0.50	0.01
South Asia	0.35	1.02	-0.67	2.08
Sub-Saharan Africa	0.89	0.93	-2.90	3.44
Level				
High income	0.32	0.53	-1.36	1.56
Low income	0.93	1.13	-2.90	3.44
Lower-middle income	0.78	0.67	-0.98	2.08
Upper-middle income	0.69	0.50	-0.54	2.42
OECD group				
OECD	0.19	0.55	-1.36	1.36
non-OECD	0.74	0.72	-2.90	3.44
Total countries			**170**	
Entire sample	**0.64**	**0.72**	**-2.90**	**3.44**

Note: $\widehat{\beta_{GS}}$ is the estimated coefficient from equation (2) using Prais-Winsten approach to measure government-spending cyclicality. Higher $\widehat{\beta_{GS}}$ indicates greater procyclicality (lesser countercyclicality).

Table 6

Cross–country regression of government-spending cyclicality using Prais–Winsten estimates, 1960–2016.

Dependent variable: Government-spending cyclicality $\widehat{\beta_{GS}}$

VARIABLE	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**	**(13)**
polcon	-1.951***	-1.744***	-1.743***	-1.744***	-1.744***	-1.961***	-1.947***	-1.783***	-1.433***	-1.673***	-1.720***	-1.778***	-1.709***
	(0.551)	(0.567)	(0.568)	(0.567)	(0.568)	(0.547)	(0.553)	(0.557)	(0.515)	(0.607)	(0.607)	(0.611)	(0.617)
inf	0.135**	0.120	0.119	0.120	0.119	0.138**	0.127**	0.107	0.115*	0.082	0.092	0.104	0.089
	(0.064)	(0.082)	(0.082)	(0.082)	(0.082)	(0.062)	(0.062)	(0.065)	(0.061)	(0.065)	(0.071)	(0.068)	(0.061)
trade	-0.335***	-0.213*	-0.213*	-0.213*	-0.213*	-0.330***	-0.339***	-0.280**	-0.296**	-0.134	-0.148	-0.170	-0.134
	(0.120)	(0.125)	(0.125)	(0.125)	(0.125)	(0.120)	(0.118)	(0.119)	(0.131)	(0.102)	(0.107)	(0.107)	(0.103)
TAL	-0.002	-0.003**	-0.003**	-0.003**	-0.003**	-0.002*	-0.002	-0.002	-0.003**	-0.002*	-0.003**	-0.003**	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
gs	1.070	-0.099	-0.098	-0.096	-0.098	1.091	1.064	1.346	0.935	1.284	0.785	0.609	1.411
	(1.363)	(1.590)	(1.591)	(1.590)	(1.591)	(1.384)	(1.367)	(1.389)	(1.337)	(1.917)	(1.990)	(1.962)	(1.907)
fiscap		**0.001*****											
		(0.000)											
fiscap_vol			**0.001*****										
			(0.000)										
lfiscap				**0.002*****									
				(0.000)									
lfiscap_vol					**0.001*****								
					(0.000)								
debt						-0.048							
						(0.194)							
debt_vol							0.068						
							(0.220)						
nare								**0.499****					
								(0.228)					
manu									**-0.804*****				
									(0.241)				
CRI										**-0.018*****			
										(0.005)			
ERI											**-0.030****		
											(0.012)		
FRI												**-0.024****	
												(0.011)	
PRI													**-0.016*****
													(0.004)
Constant	1.420***	1.367***	1.368***	1.366***	1.368***	1.445***	1.404***	1.064***	1.448***	2.380***	2.254***	2.139***	2.188***
	(0.327)	(0.324)	(0.324)	(0.324)	(0.324)	(0.318)	(0.331)	(0.343)	(0.326)	(0.527)	(0.547)	(0.594)	(0.472)
Number of countries	144	94	94	94	94	144	144	143	143	117	117	117	117
R-squared	0.133	0.178	0.177	0.178	0.177	0.133	0.134	0.162	0.190	0.190	0.167	0.161	0.196
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 6
(continued).

VARIABLE	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)
polcon	-2.086***	-1.627***	-1.532**	-1.890***	-1.898***	-1.610**	-1.823***	-1.985***	-1.785***	-1.994***	-1.669**	-1.596***
	(0.653)	(0.600)	(0.616)	(0.643)	(0.645)	(0.618)	(0.617)	(0.635)	(0.653)	(0.624)	(0.646)	(0.606)
inf	0.122*	0.081	0.068	0.112*	0.127*	0.085	0.106	0.141**	0.095	0.121**	0.114*	0.093
	(0.066)	(0.064)	(0.065)	(0.064)	(0.065)	(0.053)	(0.064)	(0.065)	(0.061)	(0.057)	(0.063)	(0.066)
trade	-0.162	-0.133	-0.114	-0.126	-0.179	-0.209**	-0.132	-0.195*	-0.170	-0.163	-0.223**	-0.185*
	(0.114)	(0.099)	(0.102)	(0.121)	(0.122)	(0.101)	(0.114)	(0.117)	(0.104)	(0.112)	(0.111)	(0.099)
TAL	-0.002	-0.001	-0.002*	-0.003**	-0.003**	-0.000	-0.003**	-0.003**	-0.002	-0.003**	-0.002**	-0.002*
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
gs	0.644	1.038	1.229	0.725	0.215	1.830	1.431	0.390	1.766	0.378	0.802	1.364
	(2.046)	(1.957)	(1.897)	(1.962)	(2.001)	(2.052)	(1.943)	(1.924)	(2.035)	(1.966)	(1.887)	(2.020)
govstab	-0.116											
	(0.083)											
socecon		**-0.118*****										
		(0.028)										
invest			**-0.155*****									
			(0.043)									
inconflict				**-0.076****								
				(0.038)								
exconflict					-0.044							
					(0.041)							
corrupt						**-0.219*****						
						(0.046)						
military							**-0.110*****					
							(0.041)					
religious								-0.050				
								(0.055)				
law									**-0.156*****			
									(0.044)			
ethnic										**-0.124****		
										(0.060)		
democracy											-0.088	
											(0.055)	
bureau												**-0.184*****
												(0.044)
Constant	2.292***	1.842***	2.255***	1.982***	1.861***	1.761***	1.602***	1.670***	1.720***	1.917***	1.640***	1.556***
	(0.706)	(0.397)	(0.505)	(0.476)	(0.563)	(0.353)	(0.397)	(0.491)	(0.371)	(0.491)	(0.433)	(0.366)
Number of countries	117	117	117	117	117	117	117	117	117	117	117	117
R-squared	0.151	0.204	0.205	0.164	0.146	0.223	0.182	0.146	0.189	0.177	0.156	0.191
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: OLS specification with robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Table 7
Sovereign wealth funds and government-spending cyclicality.

	Dependent variable: Government-spending cyclicality $\widehat{\beta_{GS}}$			
VARIABLES	**Full sample**		**Good times**	
	(1)	**(2)**	**(3)**	**(4)**
polcon	-0.817	-0.826	-0.311	-0.327
	(0.751)	(0.748)	(0.671)	(0.669)
inf	-0.091	-0.090	-0.041	-0.040
	(0.080)	(0.080)	(0.060)	(0.060)
trade	0.058	0.066	0.033	0.043
	(0.132)	(0.131)	(0.146)	(0.146)
TAL	-0.004	-0.004	-0.001	-0.000
	(0.003)	(0.003)	(0.003)	(0.003)
fiscap	**0.121*** **		**0.103***	
	(0.041)		(0.054)	
SWF*fiscap	**-0.125*** **		**-0.105***	
	(0.041)		(0.054)	
lfiscap		**0.119*** **		**0.103****
		(0.038)		(0.049)
SWF*lfiscap		**-0.125*** **		**-0.106****
		(0.038)		1.592**
CRI	**-0.019****	**-0.019****	**-0.016***	**-0.017***
	(0.008)	(0.008)	(0.009)	(0.009)
SWF*CRI	**-0.046*** **	**-0.046*** **	**-0.024***	**-0.024***
	(0.011)	(0.011)	(0.013)	(0.013)
Constant	1.778***	1.810***	1.560**	1.592**
	(0.660)	(0.653)	(0.675)	(0.669)
Number of countries	81	81	80	80
R-squared	0.584	0.586	0.367	0.372
p-value	0.000	0.000	0.000	0.000

Note: WLS specification, the weight is real GDP (2010 US$) by country averaged over the full period in full sample, over good times in good-times sub-sample.
Robust standard errors are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

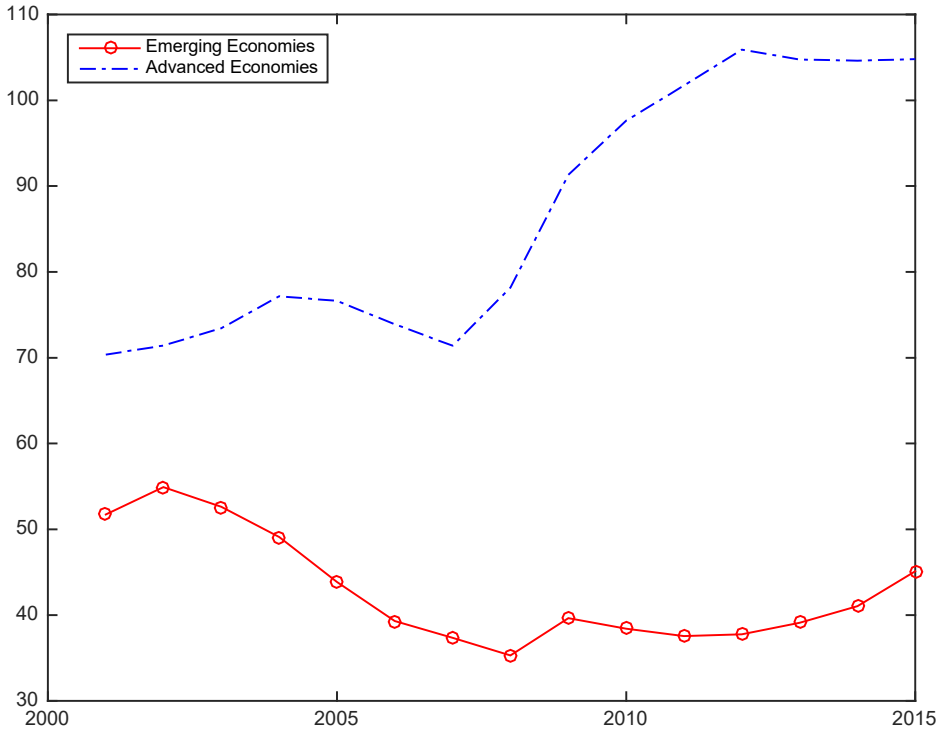


Figure 1. Public debt/GDP (%) in advanced economies, and emerging markets and developing economies.

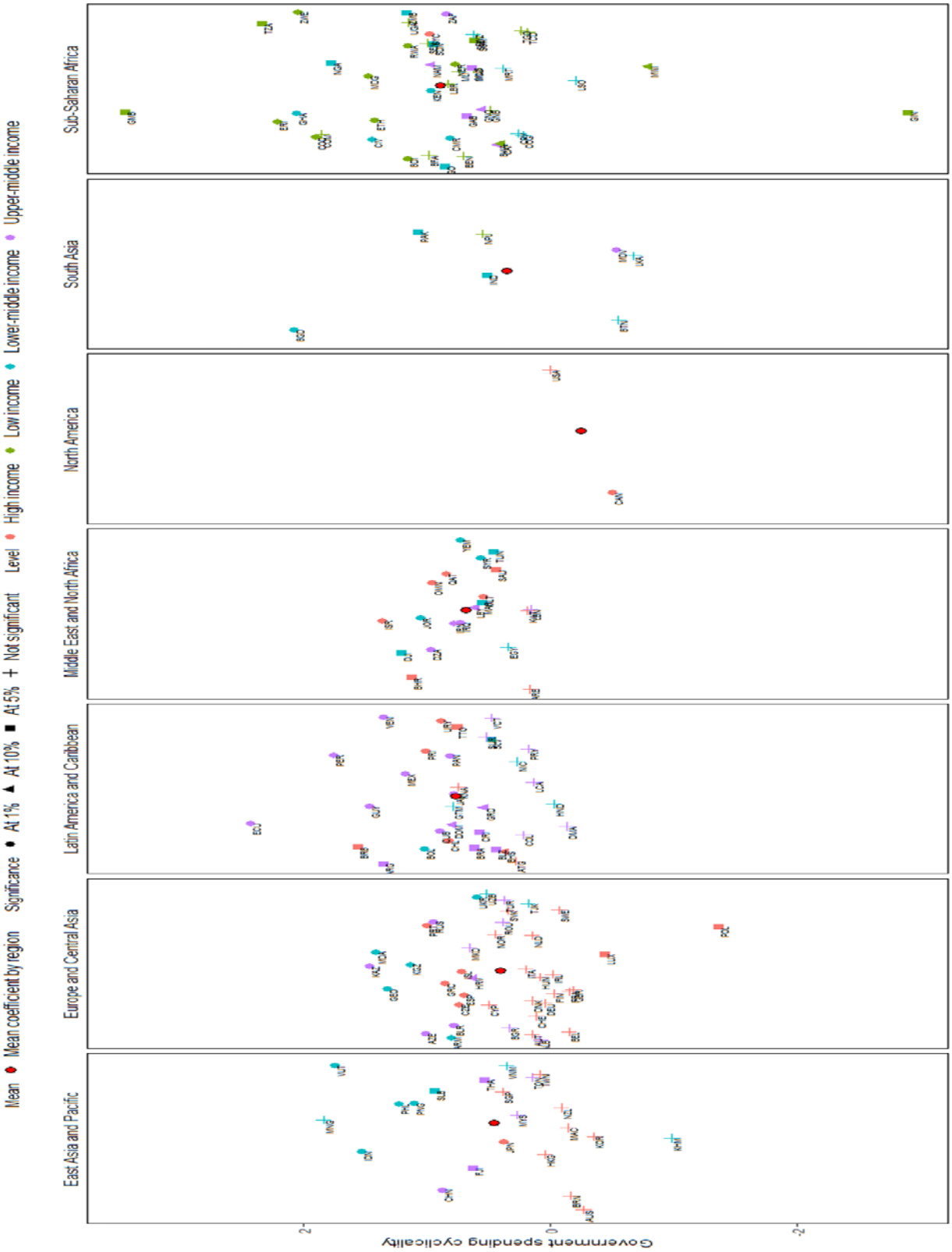


Figure 2. Government spending cyclicality by region and income, 1960–2016.

Note: $\widehat{\beta_{GS}}$ is estimated in equation (2) by country using Prais-Winsten approach to correct for the first order-autocorrelation in the residuals.

The countries are grouped according to World Bank regions.

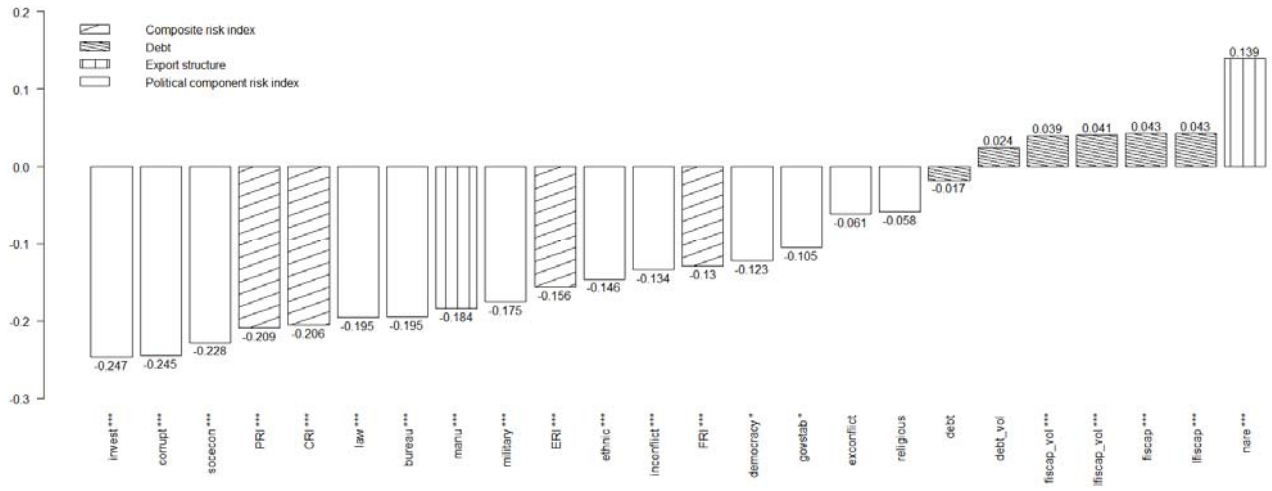


Figure 3. Economic significance of variables to government-spending cyclicality, 1960–2016.
Note: $\widehat{\beta_{GS}}$ by country is estimated from equation (2) using Prais-Winsten approach.
*** p<0.05, ** p<0.01, * p<0.2.

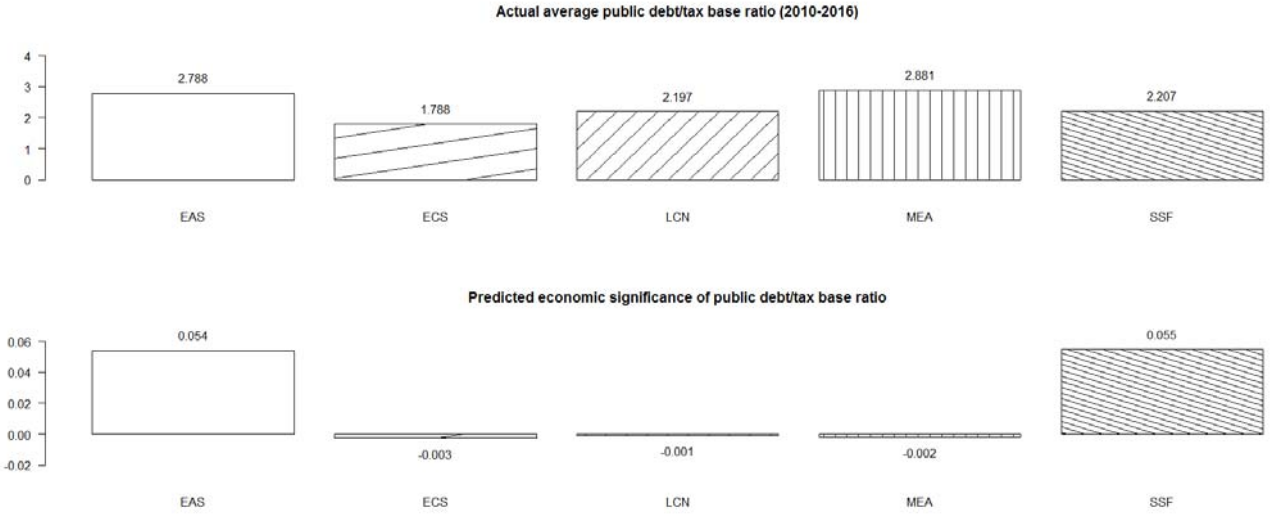


Figure 4. Economic significance of public debt/tax base to government-spending cyclicality by region.
Note: $\widehat{\beta_{GS}}$ by country is estimated from equation (2) using Prais-Winsten approach.
EAS: East Asia & Pacific; ECS: Europe & Central Asia; LCN: Latin America & Caribbean; MEA: Middle East & North Africa; SSF: Sub-Saharan Africa.
The countries are grouped according to World Bank regions.

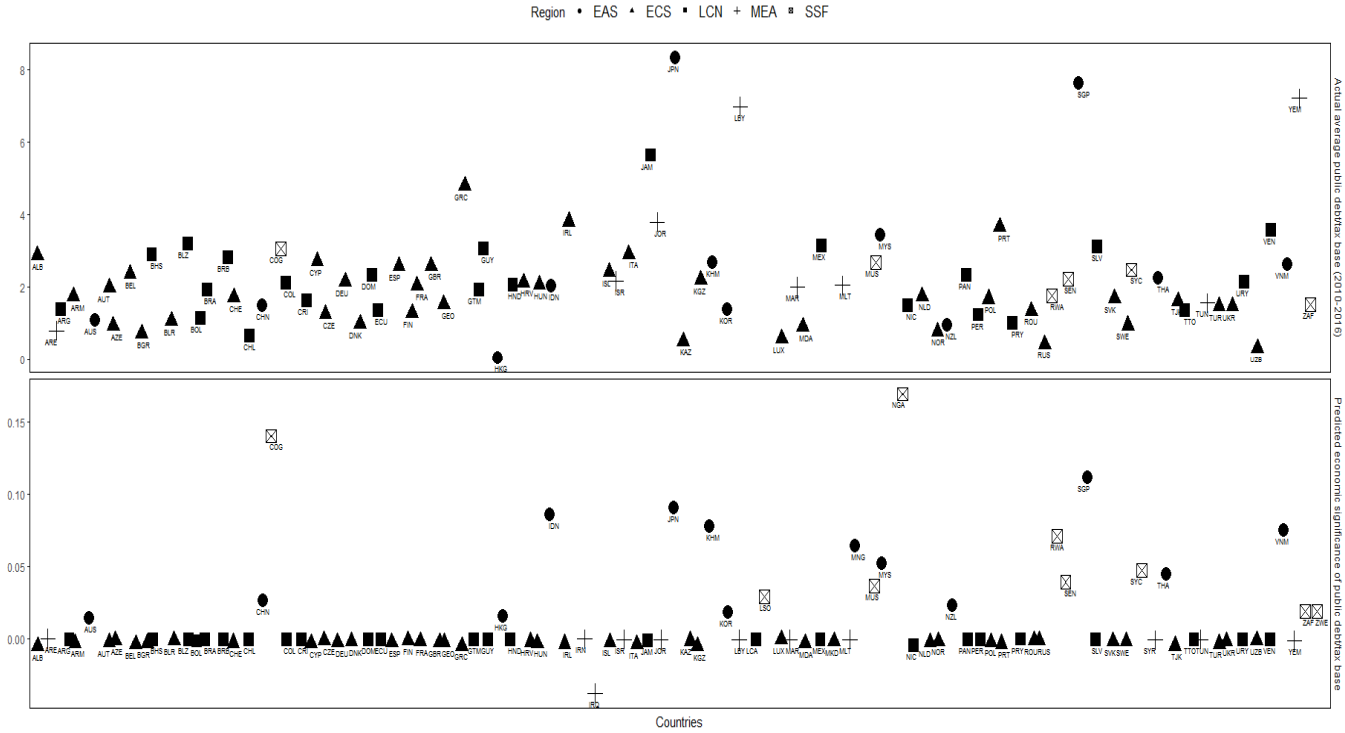


Figure 5. Economic significance of public debt/tax base to government-spending cyclicality by country.

Note: $\widehat{\beta_{GS}}$ by country is estimated from equation (2) using Prais-Winsten approach.

EAS: East Asia & Pacific; ECS: Europe & Central Asia; LCN: Latin America & Caribbean; MEA: Middle East & North Africa; SSF: Sub-Saharan Africa.

The countries are grouped according to World Bank regions.

APPENDIX

Table 8: Data description and source.

Variable	Description	Source/Methodology
Data used in the panel and country-specific time-series regressions		
deflator	GDP deflator.	World Development Indicators (156 countries), International Financial Statistics (40 countries).
NGDP	Nominal Gross Domestic Product (in millions of local currency).	World Development Indicators (156 countries), International Financial Statistics (40 countries).
NGS	Nominal government spending (in millions of local currency). In the baseline model for the 1960–2016 period, that is general government final consumption expenditure (formerly general government consumption) which includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditures on national defence and security, but excludes government military expenditures that are part of government capital formation.	World Development Indicators (156 countries), International Financial Statistics (40 countries).
	In the robust check for the 1980–2016 period, that is general government total expenditure which is defined as total expense plus the net acquisition of nonfinancial assets.	World Economic Outlook.
VAT	Standard value-added tax rate.	Vegh and Vuletin (2015).
PIT	Highest marginal personal income tax rate.	Vegh and Vuletin (2015).
CIT	Standard corporate tax rate.	Vegh and Vuletin (2015).
KAUS	The U.S. business cycle shock, defined by NBER, weighted by Chinn and Ito (2006)'s de jure financial openness by country.	Authors' calculation.
SHOCKGL	Global liquidity shock, measured by real return on 6-month Treasury bills, weighted by Chinn and Ito (2006)'s de jure financial openness by country.	Authors' calculation.
SHOCKJP	Panizza and Jaimovich (2007)'s real external shocks, measured by real GDP growth of each country's trading partners.	Authors' calculation, Direction of Trade Statistics Database.
Data used in the cross-country regression		
$\widehat{\beta_{GS}}$	The time-series estimated coefficient from regression of growth rate of real government spending on growth rate of real GDP, 1960–2016.	Authors' calculation.
$\widehat{\beta_{VAT}}$	The time-series estimated coefficient from regression of value-added tax rate on real GDP growth rate, 1960–2016.	Authors' calculation.
$\widehat{\beta_{PIT}}$	The time-series estimated coefficient from regression of personal income tax rate on real GDP growth rate, 1960–2016.	Authors' calculation.
$\widehat{\beta_{CIT}}$	The time-series estimated coefficient from regression of corporate income tax on real GDP growth rate, 1960–2016.	Authors' calculation.
debt	General government gross debt-to-GDP ratio, average 1960–2016. Gross debt consists of all liabilities that require payment or payments of interest and/or principal by the debtor to the creditor at a date or dates in the future. This includes debt liabilities in the form of SDRs, currency and deposits, debt securities, loans, insurance, pensions and standardized guarantee schemes, and other accounts payable.	Historical Public Debt Database.
debt_vol	Standard deviation of general government gross debt-to-GDP ratio, 1960–2016.	Authors' calculation.
fiscap	Limited fiscal capacity measured by public debt/tax revenue ratio, average 1960–2016. The denominator refers to the ratio of general government total tax revenue including social contributions to GDP (ICTD/UNU-WIDER).	Authors' calculation.
fiscap_vol	Volatility of limited fiscal capacity measured by standard deviation of public debt/tax revenue ratio, 1960–2016.	Authors' calculation.
lfiscap	Limited fiscal capacity measured by public debt/3-year moving-average tax revenue, average 1960–2016.	Authors' calculation.
lfiscap_vol	Volatility of limited fiscal capacity measured by standard deviation of public debt/3-year moving-average tax revenue, 1960–2016.	Authors' calculation.
polcon	The extent of political constraints faced by executives in implementing policy, average 1960–2016, ranging 0–1 point, higher value indicates greater political constraints.	Henisz, W. J. (2002).

trade	The ratio of total exports and imports to GDP, average 1960–2016.	World Development Indicators.
inf	Inflation, average 1960–2016.	World Development Indicators.
nare	The ratio of natural resources in export (including agricultural raw materials, ores and metals, fuel, and food) in total exports, average 1960–2016.	World Development Indicators.
manu	The ratio of manufactured export (including chemicals, basic manufactures, machinery and transport equipment, and miscellaneous manufactured goods, excluding non-ferrous metals) in total exports, average 1960–2016.	World Development Indicators.
TAL	The ratio of total foreign assets and liabilities to GDP to measure de facto financial integration, average 1970–2011.	Lane and Milesi-Ferretti (2007).
gs	Government size, measured by its consumption share of GDP, average 1960–2016.	World Development Indicators (137 countries), International Financial Statistics (33 countries).
CRI	Composite Risk Index, ranging 0%–100%, higher point indicates lower risk.	International Country Risk Guide Database.
ERI	Economic Risk Index, ranging 0%–50%, higher point indicates lower risk.	International Country Risk Guide Database.
FRI	Financial Risk Index, ranging 0%–50%, higher point indicates lower risk.	International Country Risk Guide Database.
PRI	Political Risk Index, ranging 0%–100%, higher point indicates lower risk.	International Country Risk Guide Database.
govstab	Government Stability, ranging 0–12 point, higher point indicates lower risk.	International Country Risk Guide Database.
socecon	Socioeconomic Conditions, ranging 0–12 point, higher point indicates lower risk.	International Country Risk Guide Database.
invest	Investment Profile, ranging 0–12 point, higher point indicates lower risk.	International Country Risk Guide Database.
inconflict	Internal Conflict, ranging 0–12 point, higher point indicates lower risk.	International Country Risk Guide Database.
exconflict	External Conflict, ranging 0–12 point, higher point indicates lower risk.	International Country Risk Guide Database.
corrupt	Corruption, ranging 0–6 point, higher point indicates lower risk.	International Country Risk Guide Database.
military	Military in Politics, ranging 0–6 point, higher point indicates lower risk.	International Country Risk Guide Database.
religious	Religious Tensions, ranging 0–6 point, higher point indicates lower risk.	International Country Risk Guide Database.
law	Law and Order, ranging 0–6 point, higher point indicates lower risk.	International Country Risk Guide Database.
ethnic	Ethnic Tensions, ranging 0–6 point, higher point indicates lower risk.	International Country Risk Guide Database.
democracy	Democratic Accountability, ranging 0–6 point, higher point indicates lower risk.	International Country Risk Guide Database.
bureau	Bureaucracy Quality, ranging 0–4 point, higher point indicates lower risk.	International Country Risk Guide Database.

Table 9: Country list in cross-country regression.

No.	Country	No.	Country
1	Albania	86	Kyrgyz Republic
2	Algeria	87	Lebanon*
3	Angola	88	Lesotho*
4	Antigua and Barbuda*	89	Liberia
5	Argentina	90	Libya*
6	Armenia	91	Luxembourg
7	Australia	92	Macao SAR, China
8	Austria	93	Macedonia, FYR
9	Azerbaijan	94	Madagascar
10	Bahamas, The	95	Malawi
11	Bahrain*	96	Malaysia
12	Bangladesh	97	Maldives*
13	Barbados*	98	Mali
14	Belarus	99	Malta
15	Belgium	100	Mauritania
16	Belize*	101	Mauritius
17	Benin	102	Mexico
18	Bhutan	103	Moldova*
19	Bolivia	104	Mongolia*
20	Botswana	105	Morocco
21	Brazil	106	Mozambique
22	Brunei Darussalam	107	Namibia
23	Bulgaria	108	Nepal
24	Burkina Faso	109	Netherlands
25	Burundi	110	New Zealand
26	Cabo Verde*	111	Nicaragua
27	Cambodia*	112	Niger
28	Cameroon	113	Nigeria
29	Canada	114	Norway
30	Central African Republic	115	Oman
31	Chad	116	Pakistan
32	Chile	117	Panama
33	China	118	Papua New Guinea
34	Colombia	119	Paraguay*
35	Comoros*	120	Peru
36	Congo, Dem. Rep.	121	Philippines
37	Congo, Rep.	122	Poland*
38	Costa Rica	123	Portugal
39	Côte d'Ivoire	124	Puerto Rico
40	Croatia*	125	Qatar*
41	Cuba	126	Romania*
42	Cyprus	127	Russian Federation
43	Czech Republic	128	Rwanda
44	Denmark	129	Saudi Arabia
45	Djibouti*	130	Senegal
46	Dominica*	131	Seychelles
47	Dominican Republic	132	Sierra Leone
48	Ecuador	133	Singapore
49	Egypt, Arab Rep.	134	Slovak Republic
50	El Salvador	135	Solomon Islands*
51	Equatorial Guinea	136	Somalia
52	Eritrea*	137	South Africa
53	Ethiopia*	138	Spain
54	Fiji	139	Sri Lanka
55	Finland	140	St. Kitts and Nevis*
56	France	141	St. Lucia
57	Gabon	142	St. Vincent and the Grenadines*
58	Gambia, The	143	Sudan
59	Georgia	144	Suriname

60	Germany	145	Swaziland
61	Ghana	146	Sweden
62	Greece	147	Switzerland
63	Grenada*	148	Syrian Arab Republic
64	Guatemala	149	Taiwan, China*
65	Guinea*	150	Tajikistan
66	Guinea-Bissau	151	Tanzania*
67	Guyana	152	Thailand
68	Honduras	153	Togo
69	Hong Kong SAR, China	154	Tonga
70	Hungary*	155	Trinidad and Tobago
71	Iceland	156	Tunisia
72	India	157	Turkey
73	Indonesia	158	Uganda
74	Iran, Islamic Rep.	159	Ukraine
75	Iraq	160	United Arab Emirates*
76	Ireland	161	United Kingdom
77	Israel	162	United States
78	Italy	163	Uruguay
79	Jamaica	164	Uzbekistan
80	Japan	165	Vanuatu
81	Jordan*	166	Venezuela, RB
82	Kazakhstan	167	Vietnam
83	Kenya	168	Yemen, Rep.
84	Korea, Rep.	169	Zambia*
85	Kuwait	170	Zimbabwe

Note: The above countries are used in the baseline model for 1960-2016 period.

* denotes countries replaced with *International Financial Statistics* without sufficient data from *World Development Indicators* in the 1st estimation step.

Table 10
Summary statistics of the variables, 1960-2016.

VARIABLE	Observation	Mean	SD	Min	Max
$\widehat{\beta_{GS}}$	170	0.64	0.72	-2.90	3.44
$\widehat{\beta_{VAT}}$	35	-0.01	0.09	-0.20	0.22
$\widehat{\beta_{PIT}}$	46	-0.05	0.23	-0.84	0.62
$\widehat{\beta_{CIT}}$	61	-0.01	0.13	-0.38	0.36
polcon	148	0.38	0.11	0.07	0.67
inf	164	0.36	1.01	0.02	7.16
trade	169	0.80	0.43	0.19	3.31
TAL	165	2.81	13.42	0.36	172.45
gs	170	0.16	0.06	0.06	0.36
GDP	169	0.04	0.02	-0.01	0.17
debt	167	0.57	0.36	0.02	2.60
debt_vol	167	0.31	0.35	0.01	3.18
fiscap	104	6.12	32.70	0.26	335.23
fiscap_vol	104	5.55	40.03	0.13	408.07
lfiscap	104	5.70	28.23	0.27	289.60
lfiscap_vol	104	5.23	36.67	0.16	373.88
nare	165	0.44	0.28	0.01	1.44
manu	165	0.26	0.23	0.00	0.84
CRI	132	66.56	11.17	34.36	90.05
ERI	132	33.85	5.28	19.08	44.80
FRI	132	34.98	5.51	18.56	47.36
PRI	132	64.16	12.94	27.70	91.89
govstab	132	7.62	0.91	4.54	10.65
socecon	132	5.70	1.93	1.26	10.19
invest	132	7.45	1.59	2.42	10.52
inconflict	132	8.85	1.78	3.52	12.00
exconflict	132	9.66	1.37	5.23	11.98
corrupt	132	2.96	1.12	0.74	5.93
military	132	3.80	1.60	0.34	6.00
religious	132	4.55	1.16	1.08	6.00
law	132	3.69	1.25	0.99	6.00
ethnic	132	3.98	1.18	0.86	6.00
democracy	132	3.79	1.39	0.89	6.00
bureau	132	2.17	1.06	0.00	4.00

Note: $\widehat{\beta_{GS}}$, $\widehat{\beta_{VAT}}$, $\widehat{\beta_{PIT}}$, and $\widehat{\beta_{CIT}}$ are estimated coefficients from equation (2) using Prais-Winsten approach.

Table 11
Summarized cross-country regressions for tax-rate cyclicality.

a. Determinants of VAT cyclicality

Dependent variable: VAT cyclicality $\widehat{\beta_{VAT}}$

Main variables	**Model (1)**	**Model (2)**	**Model (3)**	**Model (4)**	**Model (5)**
fiscap	0.010	-0.009	0.011	-0.059	-0.062
	(0.014)	(0.038)	(0.012)	(0.051)	(0.051)
fiscap_vol	0.013	0.057	0.014	0.003	0.004
	(0.017)	(0.048)	(0.012)	(0.054)	(0.053)
lfiscap	0.009	-0.010	0.011	-0.057	-0.059
	(0.014)	(0.037)	(0.012)	(0.050)	(0.050)
lfiscap_vol	0.012	0.054	0.013	0.005	0.005
	(0.017)	(0.049)	(0.013)	(0.054)	(0.054)
debt	-0.002	-0.258	0.025	-0.322	-0.336
	(0.073)	(0.210)	(0.055)	(0.260)	(0.257)
debt_vol	-0.136	-0.599**	-0.077	-0.647**	-0.652**
	(0.097)	(0.276)	(0.080)	(0.247)	(0.247)
nare	0.089	0.467**	0.042	0.185	0.188
	(0.072)	(0.216)	(0.058)	(0.248)	(0.244)
manu	-0.080	-0.323*	-0.062	-0.175	-0.199
	(0.056)	(0.186)	(0.044)	(0.212)	(0.206)
CRI	-0.003	-0.010*	-0.002	-0.003	-0.003
	(0.002)	(0.006)	(0.001)	(0.008)	(0.007)
ERI	-0.009**	-0.023*	-0.008***	-0.003	-0.002
	(0.004)	(0.013)	(0.003)	(0.018)	(0.017)
FRI	-0.007**	-0.016	-0.006***	-0.001	-0.001
	(0.003)	(0.010)	(0.002)	(0.014)	(0.013)
PRI	-0.001	-0.008*	-0.001	-0.004	-0.004
	(0.002)	(0.005)	(0.001)	(0.006)	(0.005)
govstab	-0.024	-0.009	-0.019*	-0.016	-0.011
	(0.016)	(0.050)	(0.010)	(0.099)	(0.100)
socecon	-0.019	-0.053	-0.017*	-0.020	-0.019
	(0.012)	(0.034)	(0.008)	(0.042)	(0.041)
invest	-0.013	-0.038	-0.011	-0.002	-0.003
	(0.012)	(0.035)	(0.009)	(0.033)	(0.033)
inconflict	-0.007	-0.044	-0.004	-0.011	-0.012
	(0.013)	(0.032)	(0.010)	(0.035)	(0.034)
exconflict	0.008	-0.068	0.010	-0.026	-0.029
	(0.018)	(0.042)	(0.013)	(0.053)	(0.051)
corrupt	-0.003	-0.032	0.003	0.052	0.055
	(0.013)	(0.046)	(0.011)	(0.049)	(0.048)
military	-0.006	-0.076**	-0.003	-0.054	-0.056
	(0.013)	(0.034)	(0.011)	(0.040)	(0.040)
religious	-0.009	-0.128**	0.002	-0.116**	-0.116**
	(0.017)	(0.052)	(0.015)	(0.047)	(0.046)
law	-0.021	-0.062	-0.015	-0.012	-0.010
	(0.014)	(0.039)	(0.011)	(0.050)	(0.050)
ethnic	0.000	-0.084**	0.006	-0.081**	-0.079**
	(0.018)	(0.041)	(0.013)	(0.038)	(0.036)
democracy	-0.000	-0.044	0.009	0.034	0.033
	(0.020)	(0.051)	(0.015)	(0.057)	(0.056)
bureau	-0.001	-0.037	0.002	0.059	0.060
	(0.018)	(0.048)	(0.014)	(0.063)	(0.062)

b. Determinants of PIT cyclicality

Dependent variable: PIT cyclicality $\widehat{\beta_{PIT}}$

Main variables	**Model (1)**	**Model (2)**	**Model (3)**	**Model (4)**	**Model (5)**
fiscap	-0.048	-0.026	-0.011	0.091	0.057
	(0.052)	(0.085)	(0.054)	(0.236)	(0.232)
fiscap_vol	-0.036***	-0.098***	-0.033***	0.281	0.237
	(0.005)	(0.024)	(0.012)	(0.283)	(0.293)
lfiscap	-0.050**	-0.049	-0.030	0.111	0.078
	(0.024)	(0.086)	(0.038)	(0.232)	(0.230)
lfiscap_vol	-0.029***	-0.083***	-0.027***	0.286	0.245
	(0.003)	(0.017)	(0.007)	(0.264)	(0.275)
debt	-0.188	0.254	-0.223	-0.624	-0.729
	(0.180)	(0.805)	(0.171)	(1.020)	(1.001)
debt_vol	-0.221	-0.067	-0.080	0.901	0.860
	(0.207)	(1.195)	(0.244)	(1.425)	(1.530)
nare	-0.142	-1.601***	0.009	-0.578*	-0.540
	(0.104)	(0.447)	(0.123)	(0.305)	(0.323)
manu	0.257*	2.254***	0.140	0.603	0.574
	(0.145)	(0.563)	(0.120)	(0.475)	(0.460)
CRI	0.012***	0.058***	0.005**	0.024	0.025
	(0.004)	(0.016)	(0.002)	(0.023)	(0.022)
ERI	0.017**	0.124***	0.007	0.069	0.071
	(0.008)	(0.029)	(0.005)	(0.047)	(0.044)
FRI	0.016**	0.109***	0.008**	0.062	0.066
	(0.006)	(0.031)	(0.004)	(0.049)	(0.046)
PRI	0.010***	0.040**	0.004*	0.010	0.011
	(0.003)	(0.015)	(0.002)	(0.018)	(0.017)
govstab	0.030	0.298	0.032	-0.079	-0.071
	(0.047)	(0.193)	(0.021)	(0.326)	(0.320)
socecon	0.054***	0.331***	0.026**	0.107	0.112
	(0.016)	(0.062)	(0.010)	(0.118)	(0.112)
invest	0.045	0.299**	0.013	0.095	0.104
	(0.033)	(0.126)	(0.020)	(0.090)	(0.083)
inconflict	0.063**	0.332***	0.033*	0.051	0.057
	(0.027)	(0.116)	(0.018)	(0.136)	(0.134)
exconflict	0.046*	0.168	0.024	0.075	0.098
	(0.026)	(0.145)	(0.018)	(0.153)	(0.146)
corrupt	0.101***	0.251**	0.038**	-0.049	-0.046
	(0.028)	(0.114)	(0.017)	(0.161)	(0.154)
military	0.048	0.076	0.011	-0.018	-0.016
	(0.036)	(0.183)	(0.022)	(0.161)	(0.158)
religious	0.020	0.048	-0.012	0.102	0.138
	(0.054)	(0.244)	(0.030)	(0.190)	(0.182)
law	0.077**	0.296***	0.042**	0.083	0.086
	(0.029)	(0.103)	(0.019)	(0.140)	(0.137)
ethnic	0.072*	0.287*	0.033	0.270*	0.289*
	(0.037)	(0.169)	(0.025)	(0.146)	(0.141)
democracy	0.094***	0.161	0.039*	-0.114	-0.131
	(0.025)	(0.185)	(0.021)	(0.232)	(0.214)
bureau	0.101***	0.482***	0.042*	0.023	0.018
	(0.032)	(0.168)	(0.025)	(0.207)	(0.206)

c. Determinants of CIT cyclicality

Dependent variable: CIT cyclicality $\widehat{\beta_{CIT}}$

Main variables	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
fiscap	0.012	0.003	0.002	0.014	0.014
	(0.009)	(0.031)	(0.003)	(0.017)	(0.016)
fiscap_vol	0.000	-0.010	-0.002	0.016	0.016
	(0.002)	(0.015)	(0.001)	(0.015)	(0.015)
lfiscap	0.010	-0.007	-0.000	0.016	0.016
	(0.008)	(0.030)	(0.003)	(0.020)	(0.020)
lfiscap_vol	0.000	-0.011	-0.001	0.019	0.019
	(0.002)	(0.010)	(0.001)	(0.017)	(0.017)
debt	0.042	-0.760	-0.044	-0.375	-0.367
	(0.070)	(0.470)	(0.050)	(0.347)	(0.334)
debt_vol	-0.079	-0.167	-0.044	0.098	0.087
	(0.136)	(0.473)	(0.085)	(0.310)	(0.299)
nare	-0.084*	-0.817***	-0.057	-0.530*	-0.528*
	(0.048)	(0.283)	(0.045)	(0.277)	(0.273)
manu	0.120	1.010**	0.100**	0.847***	0.844***
	(0.072)	(0.418)	(0.050)	(0.264)	(0.263)
CRI	0.000	0.042***	0.001	0.023***	0.022***
	(0.002)	(0.010)	(0.001)	(0.008)	(0.008)
ERI	0.001	0.098***	0.003	0.051***	0.050***
	(0.003)	(0.028)	(0.003)	(0.018)	(0.018)
FRI	-0.001	0.070***	0.001	0.034**	0.033**
	(0.003)	(0.025)	(0.003)	(0.015)	(0.014)
PRI	-0.000	0.031***	0.000	0.018***	0.018***
	(0.002)	(0.007)	(0.001)	(0.006)	(0.006)
govstab	-0.002	0.166	0.004	0.153	0.142
	(0.013)	(0.115)	(0.011)	(0.093)	(0.089)
socecon	0.008	0.218***	0.005	0.129***	0.128***
	(0.007)	(0.050)	(0.005)	(0.036)	(0.036)
invest	-0.006	0.217***	0.001	0.149***	0.145***
	(0.012)	(0.064)	(0.008)	(0.045)	(0.045)
inconflict	0.003	0.209***	0.002	0.116***	0.114**
	(0.012)	(0.056)	(0.008)	(0.043)	(0.042)
exconflict	-0.014	0.158**	-0.016	0.114	0.112
	(0.016)	(0.065)	(0.015)	(0.078)	(0.075)
corrupt	0.012	0.250***	0.007	0.176***	0.174***
	(0.014)	(0.057)	(0.009)	(0.062)	(0.061)
military	0.000	0.096	0.002	0.066	0.065
	(0.018)	(0.084)	(0.009)	(0.055)	(0.054)
religious	-0.039**	0.079	-0.029**	0.073	0.070
	(0.019)	(0.086)	(0.013)	(0.058)	(0.057)
law	0.014	0.232***	0.012	0.129**	0.127**
	(0.016)	(0.065)	(0.010)	(0.055)	(0.054)
ethnic	-0.010	0.197**	0.002	0.116*	0.107*
	(0.018)	(0.081)	(0.012)	(0.064)	(0.062)
democracy	0.008	0.187***	0.008	0.192**	0.191**
	(0.013)	(0.070)	(0.013)	(0.079)	(0.075)
bureau	0.015	0.338***	0.009	0.252***	0.251***
	(0.014)	(0.108)	(0.010)	(0.077)	(0.076)

Note:

Model (1): 1st step by Prais-Winsten estimation, 2nd step by OLS estimation with robust standard errors.

Model (2): 1st step and 2nd step by OLS estimation with robust standard errors.

Model (3): 1st step by Prais-Winsten estimation, 2nd step by Weighted Least Squares estimation (weight is the inverse of standard errors of $\hat{\beta}$ in the 1st step).

Model (4): 1st step by OLS estimation with Newey-West standard errors to correct heteroscedasticity and AR(1) of the residuals, 2nd step by Weighted Least Squares estimation (weight is the inverse of standard errors of $\hat{\beta}$ in the 1st step).

Model (5): 1st step by OLS estimation with Newey-West standard errors to correct heteroscedasticity and AR(2) of the residuals, 2nd step by Weighted Least Squares estimation (weight is the inverse of standard errors of $\hat{\beta}$ in the 1st step).

Different sets of control variables (among *polcon*, *inf*, *trade*, *TAL*, *gs*) are used in each model. Their estimators are not shown in the table. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 12

Summarized cross-country regressions of government-spending cyclicality, 1960-2016: robustness checks.

Dependent variable: Government-spending cyclicality $\widehat{\beta_{GS}}$

Main variables	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)	Model (8)
fiscap	0.002***	0.001***	0.001***	0.001***	0.006***	0.136*	0.027***	0.166**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.073)	(0.002)	(0.069)
fiscap_vol	0.001***	0.001**	0.001***	0.001***	0.005***	0.073	0.020***	0.095*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.051)	(0.002)	(0.051)
lfiscap	0.002***	0.001***	0.001***	0.001***	0.007***	0.146**	0.031***	0.172***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.062)	(0.002)	(0.058)
lfiscap_vol	0.001***	0.001**	0.001***	0.001***	0.005***	0.072**	0.022***	0.089**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.034)	(0.002)	(0.037)
debt	-0.038	-0.079	-0.016	-0.013	0.617	0.226	0.489	0.448
	(0.146)	(0.187)	(0.128)	(0.124)	(0.450)	(0.356)	(0.535)	(0.313)
debt_vol	0.074	0.050	0.070	0.074	0.241	0.406	1.051	0.641**
	(0.197)	(0.200)	(0.175)	(0.174)	(0.594)	(0.355)	(0.821)	(0.293)
nare	0.604***	0.395*	0.544***	0.544***	0.602	0.394	1.132**	0.581
	(0.167)	(0.229)	(0.153)	(0.154)	(0.609)	(0.461)	(0.536)	(0.406)
manu	-0.676***	-0.571**	-0.562***	-0.548***	-1.449***	-0.493	-1.477**	-0.623
	(0.187)	(0.230)	(0.150)	(0.152)	(0.493)	(0.453)	(0.635)	(0.415)
CRI	-0.021***	-0.012**	-0.016***	-0.016***	-0.040***	-0.028**	-0.074***	-0.032***
	(0.004)	(0.005)	(0.004)	(0.004)	(0.014)	(0.014)	(0.020)	(0.011)
ERI	-0.036***	-0.019*	-0.023**	-0.021**	-0.079**	-0.062*	-0.122**	-0.063**
	(0.010)	(0.011)	(0.009)	(0.009)	(0.036)	(0.033)	(0.053)	(0.026)
FRI	-0.030***	-0.012	-0.019**	-0.019**	-0.077***	-0.038	-0.107***	-0.048**
	(0.008)	(0.011)	(0.008)	(0.008)	(0.027)	(0.025)	(0.038)	(0.021)
PRI	-0.018***	-0.011**	-0.015***	-0.015***	-0.029**	-0.022*	-0.055***	-0.024***
	(0.004)	(0.004)	(0.003)	(0.003)	(0.013)	(0.011)	(0.014)	(0.009)
govstab	-0.145**	-0.087	-0.125*	-0.119*	-0.331	-0.274	-0.678**	-0.398**
	(0.069)	(0.077)	(0.064)	(0.064)	(0.218)	(0.223)	(0.314)	(0.189)
socecon	-0.123***	-0.086***	-0.091***	-0.089***	-0.193**	-0.128*	-0.345***	-0.192***
	(0.023)	(0.026)	(0.022)	(0.022)	(0.085)	(0.075)	(0.118)	(0.062)
invest	-0.166***	-0.111***	-0.130***	-0.128***	-0.267**	-0.275***	-0.401**	-0.300***
	(0.031)	(0.041)	(0.030)	(0.031)	(0.110)	(0.087)	(0.157)	(0.074)
inconflict	-0.116***	-0.048	-0.094***	-0.096***	-0.121	-0.126	-0.297***	-0.118*
	(0.027)	(0.035)	(0.024)	(0.024)	(0.088)	(0.081)	(0.108)	(0.063)
exconflict	-0.060*	-0.019	-0.052*	-0.053*	-0.016	-0.142	-0.356**	-0.114
	(0.032)	(0.038)	(0.029)	(0.030)	(0.114)	(0.096)	(0.147)	(0.077)
corrupt	-0.186***	-0.164***	-0.144***	-0.143***	-0.287**	-0.211*	-0.576***	-0.216**
	(0.038)	(0.043)	(0.035)	(0.035)	(0.133)	(0.116)	(0.184)	(0.091)
military	-0.131***	-0.071*	-0.102***	-0.103***	-0.243**	-0.127	-0.368***	-0.169**
	(0.028)	(0.040)	(0.029)	(0.029)	(0.105)	(0.084)	(0.116)	(0.067)
religious	-0.088**	-0.019	-0.079**	-0.085**	-0.218	-0.107	-0.081	-0.084
	(0.040)	(0.053)	(0.036)	(0.037)	(0.148)	(0.107)	(0.124)	(0.083)
law	-0.181***	-0.114***	-0.137***	-0.135***	-0.298**	-0.239**	-0.537***	-0.240**
	(0.036)	(0.040)	(0.033)	(0.034)	(0.127)	(0.111)	(0.167)	(0.092)
ethnic	-0.133***	-0.087	-0.120***	-0.125***	-0.013	-0.138	-0.276**	-0.145*
	(0.041)	(0.057)	(0.037)	(0.038)	(0.114)	(0.109)	(0.131)	(0.087)
democracy	-0.124***	-0.040	-0.103***	-0.101***	-0.238	-0.055	-0.277**	-0.140
	(0.036)	(0.054)	(0.035)	(0.035)	(0.184)	(0.109)	(0.126)	(0.093)
bureau	-0.193***	-0.123***	-0.157***	-0.153***	-0.383**	-0.197	-0.389**	-0.280***
	(0.040)	(0.043)	(0.040)	(0.041)	(0.164)	(0.127)	(0.181)	(0.099)

Note:

Model (1): 1st step by Prais-Winsten estimation, 2nd step by Weighted Least Squares estimation (weight is the inverse of standard errors of $\hat{\beta}$ in the 1st step).

Model (2): 1st step and 2nd step by OLS estimation with robust standard errors.

Model (3): 1st step by OLS estimation with Newey-West standard errors to correct heteroscedasticity and AR(1) of the residuals, 2nd step by Weighted Least Squares estimation (weight is the inverse of standard errors of $\hat{\beta}$ in the 1st step).

Model (4): 1st step by OLS estimation with Newey-West standard errors to correct heteroscedasticity and AR(2) of the residuals, 2nd step by Weighted Least Squares estimation (weight is the inverse of standard errors of $\hat{\beta}$ in the 1st step).

Model (5): 1st step by Two-Stage Least Squares estimation (excluded instrument is *lag.SHOCKGL*), 2nd step by Weighted Least Squares estimation (weight is the inverse of standard errors of $\hat{\beta}$ in the 1st step). In the 1st step, there are 48/135 countries having F-partial statistics (1st stage) >= 2; and 122/135 countries having p-value (Durbin test for endogeneity) > 5%.

Model (6): 1st step by Two-Stage Least Squares estimation (excluded instruments are *lag6.SHOCKGL and lag5.SHOCKJP*), 2nd step by Weighted Least Squares estimation (weight is the inverse of standard errors of $\hat{\beta}$ in the 1st step). In the 1st step, there are 33/124 countries having F-partial statistics (1st stage) >= 2; 117/124 countries having p_value (Durbin test for endogeneity) > 5%; and 122/124 countries having p-value (Sargan test for overidentification) > 5%.
Model (7): 1st step by Two-Stage Least Squares estimation (excluded instrument is *lag.KAUS*), 2nd step by Weighted Least Squares estimation (weight is the inverse of standard errors of $\hat{\beta}$ in the 1st step). In the 1st step, there are 40/135 countries having F-partial statistics (1st stage) >= 2; and 119/135 countries having p-value (Durbin test for endogeneity) > 5%.
Model (8): 1st step by Two-Stage Least Squares estimation (excluded instruments are *lag.KAUS, lag6.SHOCKGL, and lag5.SHOCKJP*), 2nd step by Weighted Least Squares estimation (weight is the inverse of standard errors of $\hat{\beta}$ in the 1st step). In the 1st step, there are 51/130 countries having F-partial statistics (1st stage) >= 2; 122/130 countries having p-value (Durbin test for endogeneity) > 5%; and 124/130 countries having p-value (Sargan test for overidentification) > 5%.
The same set of control variables (*polcon*, *inf*, *trade*, *TAL*, *gs*) is used in each cross-country regression. Their estimators are not shown in the table.
Robust standard errors are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Table 13
Summarized cross-country regressions on government-spending cyclicality at good times versus bad times, 1960-2016.

Dependent variable: Government-spending cyclicality $\widehat{\beta_{GS}}$

	Good times		**Bad times**
Main variables	**Model (1)**	**Model (2)**	**Model (3)**
fiscap	0.001***	0.001*	-0.021
	(0.000)	(0.000)	(0.017)
fiscap_vol	0.001***	0.001*	-0.090**
	(0.000)	(0.000)	(0.044)
lfiscap	0.002***	0.001*	-0.023
	(0.000)	(0.000)	(0.020)
lfiscap_vol	0.001***	0.001*	-0.242*
	(0.000)	(0.000)	(0.133)
debt	0.037	0.014	-0.426
	(0.146)	(0.142)	(0.431)
debt_vol	0.292**	0.243**	-0.710
	(0.115)	(0.103)	(0.579)
nare	0.373*	0.226	-1.572
	(0.223)	(0.206)	(1.337)
manu	-0.733***	-0.468**	1.467
	(0.253)	(0.227)	(1.404)
CRI	-0.018***	-0.011	-0.027
	(0.007)	(0.007)	(0.032)
ERI	-0.047***	-0.032**	-0.093
	(0.015)	(0.014)	(0.100)
FRI	-0.034***	-0.021*	-0.051
	(0.012)	(0.012)	(0.072)
PRI	-0.012**	-0.006	-0.019
	(0.006)	(0.006)	(0.027)
govstab	-0.075	-0.032	-0.565
	(0.104)	(0.101)	(0.490)
socecon	-0.099***	-0.063**	-0.190
	(0.032)	(0.030)	(0.223)
invest	-0.105*	-0.051	-0.602*
	(0.062)	(0.062)	(0.349)
inconflict	-0.071	-0.036	0.124
	(0.053)	(0.052)	(0.180)
exconflict	-0.086	-0.058	0.080
	(0.062)	(0.058)	(0.257)
corrupt	-0.118*	-0.067	0.219
	(0.063)	(0.061)	(0.404)
military	-0.045	-0.020	0.001
	(0.052)	(0.050)	(0.225)
religious	-0.062	-0.031	-1.286
	(0.056)	(0.056)	(1.189)
law	-0.095	-0.045	-0.096
	(0.068)	(0.064)	(0.235)
ethnic	-0.078	-0.035	0.169
	(0.058)	(0.060)	(0.405)

democracy	-0.047 (0.066)	0.003 (0.067)	-0.493 (0.508)
bureau	-0.094 (0.071)	-0.033 (0.067)	-0.041 (0.267)

Note:
Model (1): 1st step by Prais-Winsten estimation, 2nd step by OLS estimation with robust standard errors.
Model (2) and model (3): 1st step and 2nd step by OLS estimation with robust standard errors.
The same set of control variables (*polcon*, *inf*, *trade*, *TAL*, *gs*) is used in each cross-country regression. Their estimators are not shown in the table.
Robust standard errors are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Table 14
Summarized cross-country regressions on government-spending cyclicality, 1980-2016.

Dependent variable: Government-spending cyclicality $\widehat{\beta_{GS}}$

Main variables	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
fiscap	0.068 (0.071)	0.136 (0.088)	0.089 (0.060)	0.044 (0.058)	0.042 (0.058)	0.187** (0.084)
fiscap_vol	0.110 (0.119)	0.292* (0.161)	0.144 (0.102)	0.106 (0.107)	0.112 (0.109)	0.168 (0.136)
lfiscap	0.079 (0.074)	0.141 (0.087)	0.099 (0.063)	0.047 (0.059)	0.044 (0.060)	0.210** (0.081)
lfiscap_vol	0.126 (0.125)	0.312* (0.157)	0.159 (0.107)	0.120 (0.112)	0.126 (0.114)	0.183 (0.140)
debt	0.707** (0.288)	0.684*** (0.237)	0.747** (0.303)	0.743*** (0.265)	0.715*** (0.253)	1.376*** (0.384)
debt_vol	1.411** (0.557)	1.564*** (0.565)	1.587*** (0.534)	1.490** (0.620)	1.475** (0.595)	2.957*** (0.884)
nare	0.648 (0.416)	0.597* (0.344)	0.698* (0.415)	0.424 (0.338)	0.425 (0.333)	-0.724 (0.611)
manu	-1.342*** (0.380)	-1.090*** (0.340)	-1.370*** (0.340)	-0.815** (0.330)	-0.841** (0.326)	-1.215* (0.624)
CRI	-0.030* (0.016)	-0.033*** (0.010)	-0.030* (0.016)	-0.031*** (0.010)	-0.031*** (0.009)	-0.072*** (0.019)
ERI	-0.071* (0.037)	-0.085*** (0.026)	-0.066* (0.037)	-0.080*** (0.026)	-0.079*** (0.025)	-0.157*** (0.046)
FRI	-0.055 (0.034)	-0.066*** (0.021)	-0.055 (0.034)	-0.069*** (0.021)	-0.068*** (0.020)	-0.121*** (0.041)
PRI	-0.016 (0.012)	-0.016* (0.009)	-0.017 (0.012)	-0.015* (0.008)	-0.015** (0.007)	-0.047*** (0.012)
govstab	-0.443** (0.173)	-0.343*** (0.124)	-0.358** (0.172)	-0.320** (0.130)	-0.316** (0.120)	-0.703*** (0.235)
socecon	-0.209*** (0.072)	-0.224*** (0.055)	-0.220*** (0.068)	-0.247*** (0.054)	-0.248*** (0.052)	-0.402*** (0.117)
invest	-0.159 (0.114)	-0.221*** (0.059)	-0.146 (0.115)	-0.212*** (0.058)	-0.215*** (0.055)	-0.483*** (0.100)
inconflict	-0.050 (0.065)	-0.045 (0.054)	-0.052 (0.067)	-0.043 (0.045)	-0.042 (0.045)	-0.244** (0.099)
exconflict	0.067 (0.104)	0.021 (0.070)	0.064 (0.101)	-0.007 (0.053)	-0.011 (0.052)	-0.213* (0.108)
corrupt	-0.293** (0.144)	-0.141 (0.090)	-0.297** (0.146)	-0.125 (0.076)	-0.120 (0.074)	-0.227 (0.143)
military	-0.039 (0.096)	-0.093 (0.067)	-0.039 (0.097)	-0.116* (0.066)	-0.120* (0.063)	-0.413*** (0.125)
religious	0.069 (0.113)	-0.004 (0.065)	0.047 (0.119)	-0.028 (0.057)	-0.033 (0.058)	-0.204* (0.117)
law	-0.285** (0.114)	-0.225** (0.094)	-0.261** (0.112)	-0.200** (0.097)	-0.195** (0.092)	-0.356** (0.151)
ethnic	-0.062 (0.102)	-0.024 (0.068)	-0.086 (0.107)	-0.087 (0.068)	-0.091 (0.069)	-0.253* (0.143)
democracy	0.087 (0.187)	0.022 (0.092)	0.046 (0.194)	-0.044 (0.084)	-0.047 (0.080)	-0.306 (0.187)
bureau	-0.179 (0.127)	-0.172* (0.100)	-0.212* (0.123)	-0.190** (0.094)	-0.192** (0.091)	-0.594*** (0.167)

Note:
Model (1): 1st step by Prais-Winsten estimation, 2nd step by OLS with robust standard errors.
Model (2): 1st step by Prais-Winsten estimation, 2nd step by Weighted Least Squares estimation (weight is the inverse of standard errors of $\hat{\beta}$ in the 1st step).
Model (3): 1st step and 2nd step by OLS estimation with robust standard errors.
Model (4): 1st step by OLS estimation with Newey-West standard errors to correct heteroscedasticity and AR(1) of the residuals, 2nd step by Weighted Least Squares estimation (weight is the inverse of standard errors of $\hat{\beta}$ in the 1st step).
Model (5): 1st step by OLS estimation with Newey-West standard errors to correct heteroscedasticity and AR(2) of the residuals, 2nd step by Weighted Least Squares estimation (weight is the inverse of standard errors of $\hat{\beta}$ in the 1st step).
Model (6): 1st step by Two-Stage Least Squares estimation (excluded instruments are *lag5.SHOCKJP, lag.KAUS)*, 2nd step by Weighted Least Squares estimation (weight is the inverse of standard errors of $\hat{\beta}$ in the 1st step). In the 1st step, there are 37/84 countries having F-partial statistics (1st stage) >= 2; 76/84 countries having p (Durbin test for endogeneity) > 5%; and 81/84 countries having p-value (Sargan test for overidentification) > 5%.
The same set of control variables (*polcon*, *inf*, *trade*, *TAL*, *gs*) is used in each cross-country regression. Their estimators are not shown in the table.
Robust standard errors are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

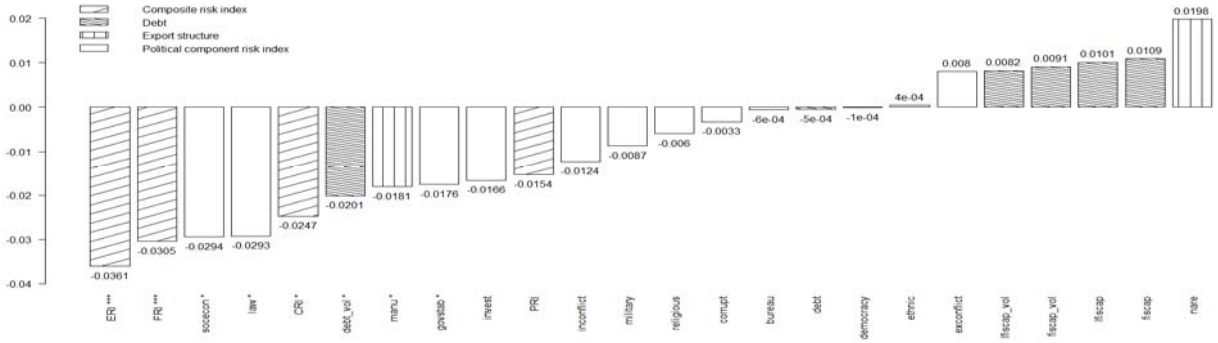


Figure 6. Economic significance of variables to VAT cyclicality.
Note: $\widehat{\beta_{VAT}}$ by country is estimated from equation (2) using Prais-Winsten approach.
*** p<0.05, ** p<0.01, * p<0.2.

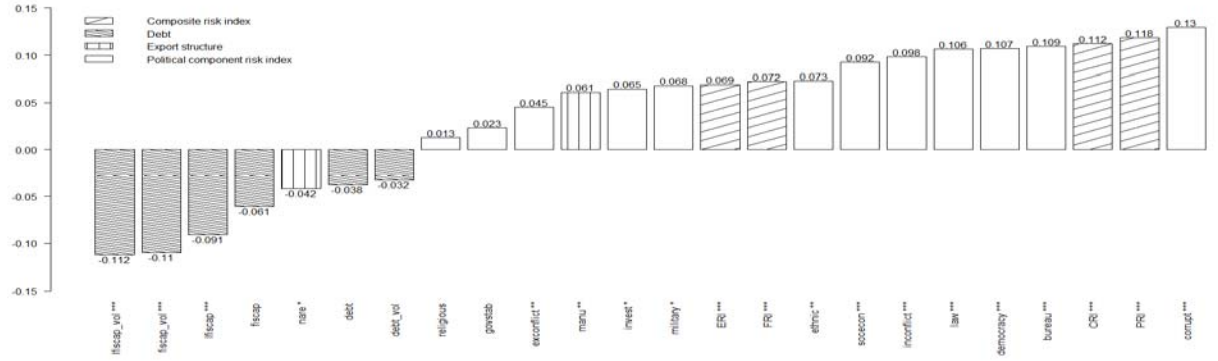


Figure 7. Economic significance of variables to PIT cyclicality.
Note: $\widehat{\beta_{PIT}}$ by country is estimated from equation (2) using Prais-Winsten approach.
*** p<0.05, ** p<0.01, * p<0.2.

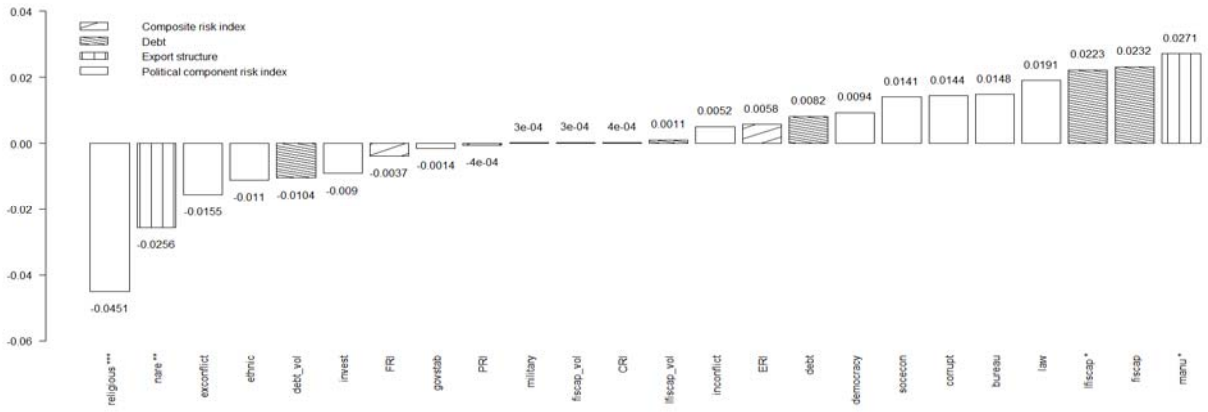
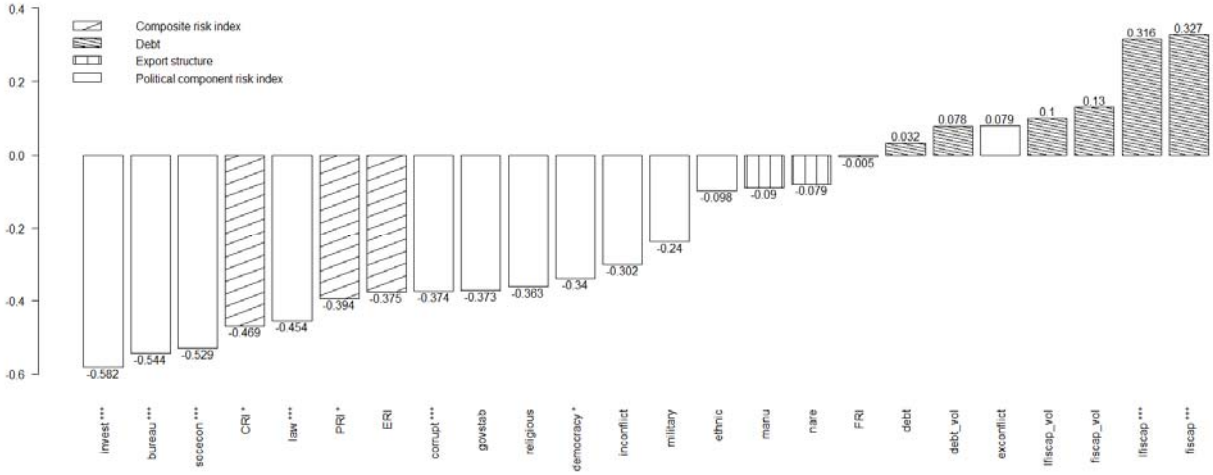


Figure 8. Economic significance of variables to CIT cyclicality.

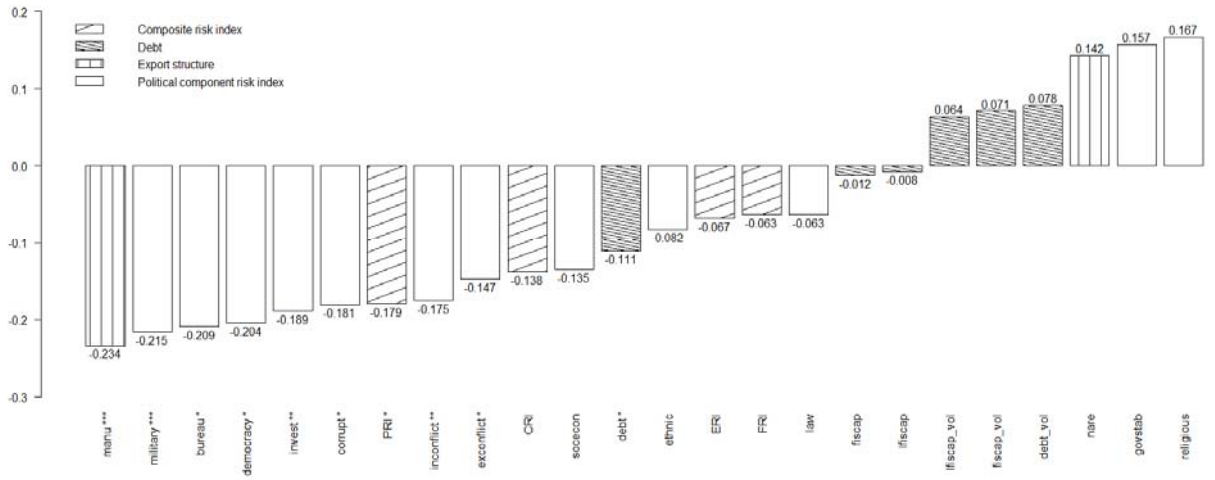
Note: $\widehat{\beta_{CIT}}$ by country is estimated from equation (2) using Prais-Winsten approach.

*** p<0.05, ** p<0.01, * p<0.2.

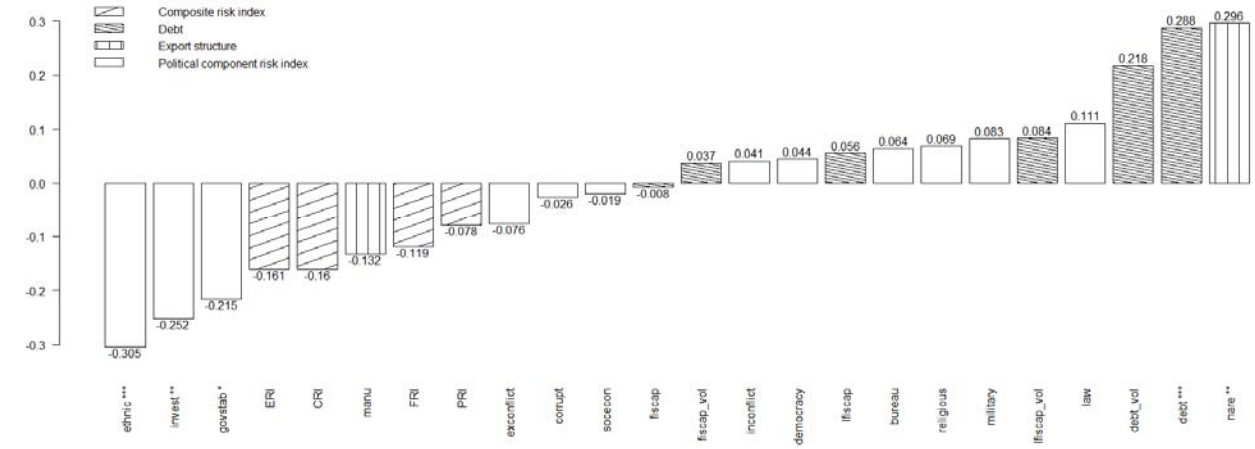
a. East Asia and Pacific



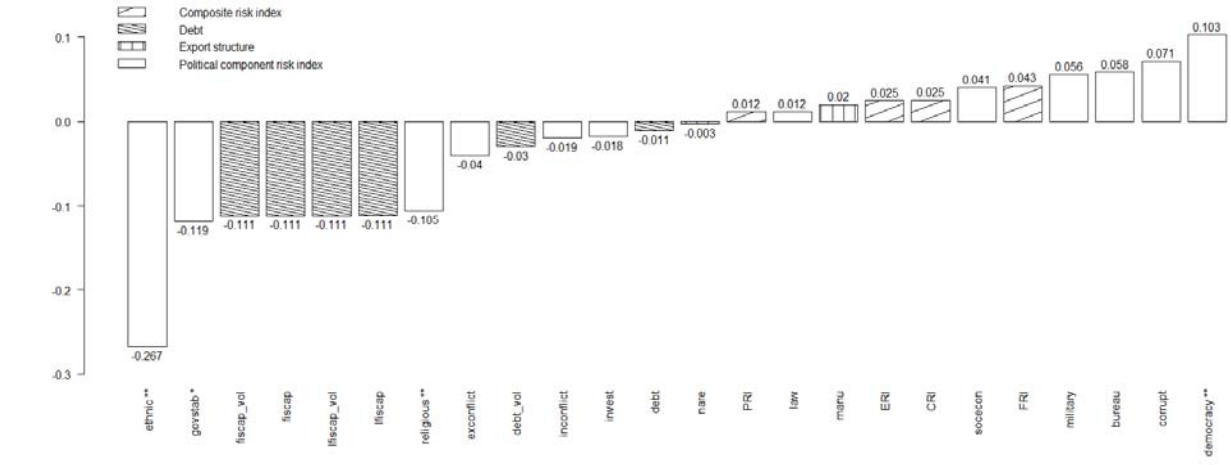
b. Europe and Central Asia



c. Latin America and Caribbean



d. Middle East and North Africa



e. Sub-Saharan Africa

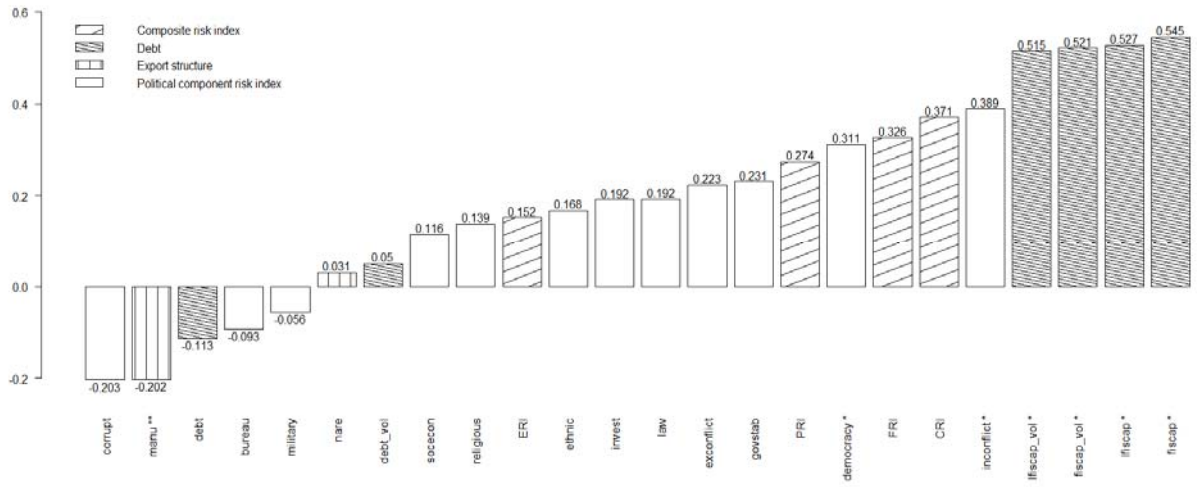


Figure 9. Economic significance of variables to government-spending cyclicality by region.

Note: $\widehat{\beta_{GS}}$ by country is estimated from equation (2) using Prais-Winsten approach.

The economic significance of each explanatory variable in each region is calculated by multiplying its corresponding standard deviation with its estimated coefficient from cross-country regression for that region (similar to equation (3)) to approximate the effect of its one standard deviation increase on the fiscal cyclicality.

The countries are grouped according to World Bank regions.

*** p<0.05, ** p<0.01, * p<0.2.

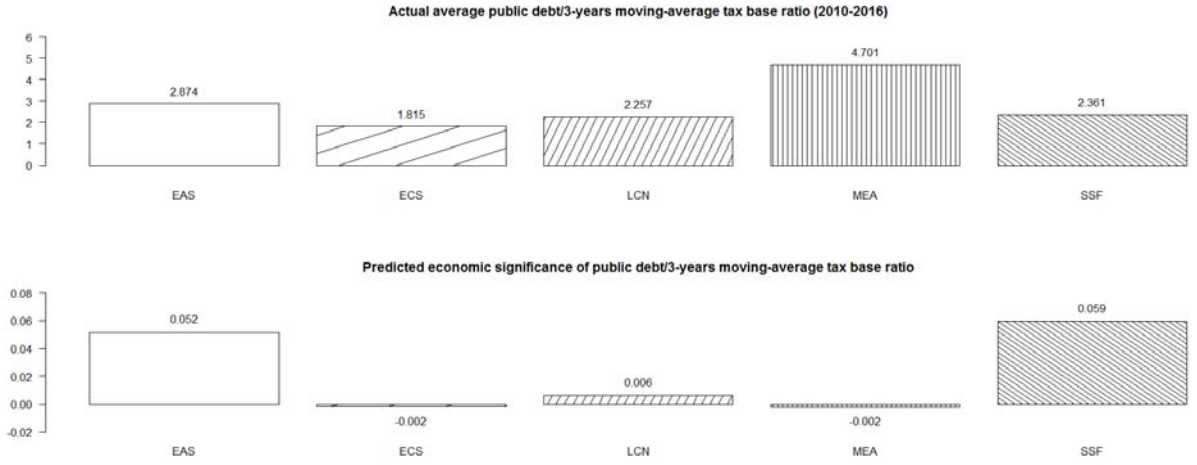


Figure 10. Economic significance of public debt/3-years moving-average tax base to government-spending cyclicality by region.

Note: $\widehat{\beta_{GS}}$ by country is estimated from equation (2) using Prais-Winsten approach.

EAS: East Asia and Pacific; ECS: Europe and Central Asia; LCN: Latin America and Caribbean; MEA: Middle East and North Africa; SSF: Sub-Saharan Africa.

The countries are grouped according to World Bank regions.

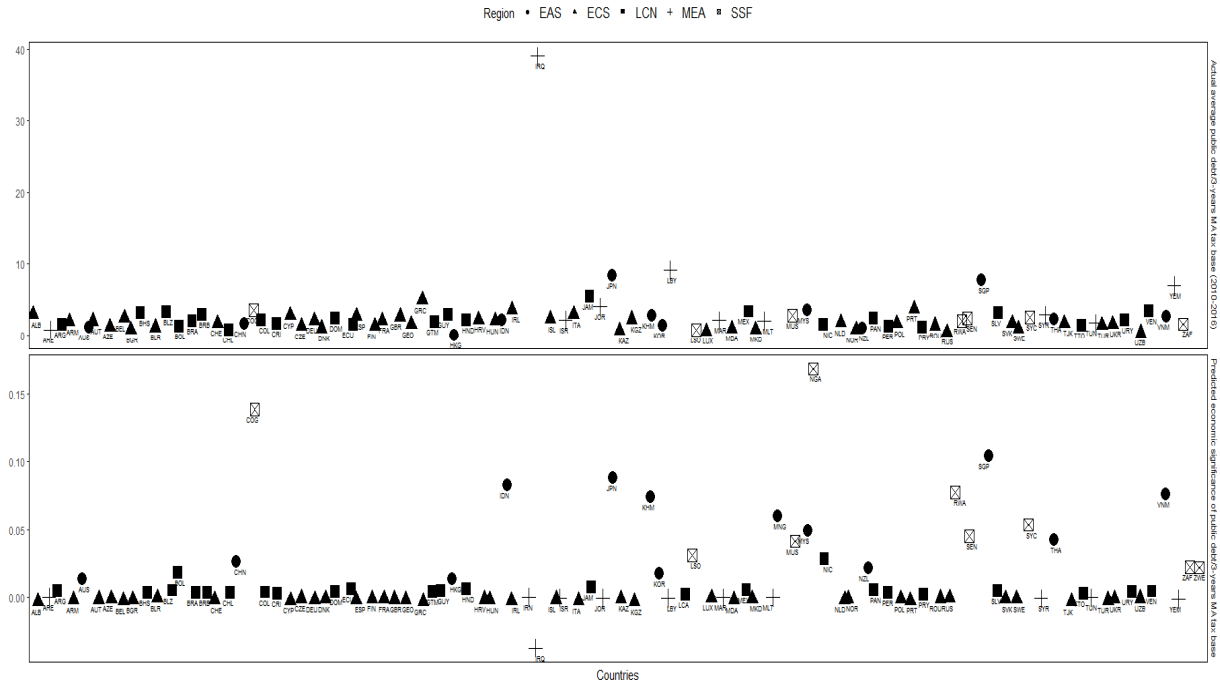


Figure 11. Economic significance of public debt/3-years moving-average tax base to government-spending cyclicality by country.
Note: $\widehat{\beta_{GS}}$ by country is estimated from equation (2) using Prais-Winsten approach.
EAS: East Asia & Pacific; ECS: Europe & Central Asia; LCN: Latin America & Caribbean; MEA: Middle East & North Africa; SSF: Sub-Saharan Africa.
The countries are grouped according to World Bank regions.