Macroeconomic Dynamics, **26**, 2022, 726–768. Printed in the United States of America.
doi:10.1017/S136510052000036X

GOVERNMENT SPENDING MULTIPLIERS IN GOOD TIMES AND BAD TIMES: THE CASE OF EMERGING MARKETS

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We investigate the presence of nonlinear effects of government spending shocks during good and bad times in a panel of 17 emerging markets through the lens of a Bayesian panel threshold VAR model. We find that the responses of gross domestic product, consumption, investment, trade balance, real exchange rate, and real interest rates vary depending on the state of the economy. Particularly, in slump periods, both consumption and investment may respond negatively to a government purchase stimulus, unlike in normal times. Our estimated government spending multipliers are less than one in the two regimes and can be zero in bad times.

Keywords: Fiscal Policy, Emerging Markets, Bayesian Threshold Hierarchical Panel VAR, State-Dependent Multipliers

1. INTRODUCTION

Government spending stimulus has received renewed interest as a tool for recovering economic growth during crises. However, from a theoretical perspective, the sign and the size of the government spending multiplier on gross domestic product (GDP) in bad times are ambiguous. On one hand, expansionary government spending policy during turbulent times may be associated with lower (or even negative) multipliers for the following reasons. First, if the government shock comes with a higher cost of borrowing, the private sector might postpone consumption and investment because of the increase in the relative price of future consumption and because of a higher investment opportunity cost. Second, a weaker fiscal position may induce the private sector to fear government default (e.g., Corsetti et al. (2013)), driving macroeconomic uncertainty to a higher level and ultimately increasing precautionary savings. Finally, as emphasized by Blanchard (1990)

The authors would like to thank the associate editor and anonymous referee for helpful suggestions and constructive comments. Fábio Augusto Reis Gomes acknowledges financial support from the CNPq—Brazil. Address correspondence to: Gian Paulo Soave, Department of Economics, Federal University of Bahia - UFBA, Praça da Piedade, no. 06, Salvador, BA 40060-300, Brazil. email: gianps@ufba.br.

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and Huidrom et al. (2019), the "Ricardian channel" might be in place: under a tighter fiscal space during bad times, households can expect tax increases sooner than in an economy with a good fiscal position. One the other hand, a positive and larger government spending multiplier would occur if bad times are followed by tighter financial constraints in the sense of Mankiw (2000) and Galí et al. (2007). Moreover, higher multipliers can be expected in times of crisis under larger unutilized productive capacity.[1]

Indeed, a recent empirical literature has suggested that the effects of government spending shocks vary depending on whether the economy is under normal or slack times. In particular, the evidence from advanced economies (AEs) suggests that the government purchase multiplier could be larger in slump times compared with regular times, with a higher probability of "crowding-in" effects—namely, a government spending multiplier on GDP higher than one—during slack periods (Corsetti et al. (2012), Auerbach and Gorodnichenko (2012a,b, 2013), Owyang et al. (2013), Fazzari et al. (2015), Ferraresi et al. (2015)). As a result, expansionary government spending policy would be an effective tool for recovering economic growth, at least in AEs.[2]

Such pieces of evidence are, however, largely confined to the AEs group mainly because of the short time series in groups of emerging markets (EMs) or developing countries (DCs)—a problem that may result in imprecise estimates of the fiscal multipliers, especially in nonlinear analyses. Thus, a natural question emerges: Would fiscal multipliers in bad times estimated from AEs' data be informative for EMs? The well-established literature that has suggested substantial differences in business cycles properties among AEs' and EMs' groups (see, e.g., Neumeyer and Perri (2005), Uribe and Yue (2006), Uribe and Schmitt-Grohé (2017)) indicates that using estimations from AEs may be an unsuitable strategy for the EMs. In particular, although the dynamics of the fiscal variables in AEs are typically counter-cyclical, EMs fiscal variables are likely to feature a pro-cyclical pattern (Gavin and Perotti (1997), Talvi and Végh (2005), Ilzetzki (2011)).[3] Moreover, EMs are more prone to sudden stops in capital inflows that may affect their financial conditions (Calvo et al. (2006)). In such events, EMs might have tighter liquidity constraints than AEs. Additionally, EMs typically suffer from higher perceived sovereign default risk, which, as we argued, may affect the incentives of the private sector to save after a fiscal stimulus. Not surprisingly, the empirical literature has suggested that there may also be differences in the dynamic responses of macroeconomic variables to a government purchase shock, with a lower government spending multiplier in EMs compared with those estimated for AEs (Ilzetzki et al. (2013), (Kraay, 2014), Chian Koh (2017), Furceri and Li (2017), Carriere-Swallow et al. (2018)).

This paper contributes to the empirical literature by investigating the presence of nonlinear, state-dependent effects of government spending shocks in EMs in normal times and turbulent times.[4] To achieve this objective, we use a Bayesian panel threshold VAR (BPT-VAR) model with data from 17 emerging economies from 1994Q3 to 2017Q4 and condition the data on realizations of state variables that indicate whether the economy is experiencing normal or bad times.

Our empirical model is closely related to the nonlinear Bayesian Hierarchical approach of Ruisi (2018) and Mumtaz et al. (2018). Such modeling strategy is useful in our context of EMs because it efficiently combines information from all countries in the sample to estimate the parameters associated with a "typical" (weighted average) emerging economy, providing better estimates of dynamic responses than estimates from a single country. Most notably, our model features a data-driven mechanism that endogenously estimates whether the economy is under bad times—defined as episodes in which a measure of the (scaled) output is below some estimated threshold—or good times,[5] a crucial characteristic for estimating the state-dependent fiscal multipliers.[6]

Based on the posterior median of the "panel" threshold parameter, our model labels 346 data-points—roughly 1/4 out of a total of 1397 observations—as bad times and approximately 1051 data-points as normal times. Using these separated data-points, we first document that during bad times, a typical emerging economy experiences much higher—sometimes skyrocketing—real interest rates (RIRs) and a higher level of global volatility, both increasing the incentives for the private sector to save, thus suggesting that government multipliers may have a state-dependent behavior in EMs.

To analyze this question, we compute nonlinear history-dependent impulse response functions (IRFs) (Koop et al. (1996)) for a government purchase shock in each regime. To identify the government shock, we follow the widely used recursive identification scheme proposed by Blanchard and Perotti (2002) (see also Auerbach and Gorodnichenko (2012b) and Ilzetzki et al. (2013)). Next, we compute the implied state-dependent present-value multipliers.

We find that, in EMs, the dynamic responses of some important macroeconomic variables to government spending shocks depend crucially on whether the economy is in a good or bad regime. Notably, in bad times, consumption and investment may respond negatively to the shock, but this does not occur in normal times. These results suggest that in turbulent times, the private sector is unlikely to be stimulated by the government spending shock in EMs. Moreover, there are clear nonlinear effects between good times and bad times on the trade-balance-to-GDP ratio, the real exchange rate (RER), and the interest rate. Government spending shocks worsen the trade-balance in both regimes, but with different magnitudes. Regarding prices, government spending shocks play a central role only during bad times. In normal times, the responses of the RER and the RIR are indistinguishable from zero. However, in turbulent times, the government spending shock leads to a depreciation of the local currency coupled and an increase in the RIR. These nonlinear responses of the interest rate are consistent with the following notion: When the EM is under financial stress, fiscal stimulus may increase concerns of the international markets of sovereign default risk; thus, the RIR tends to increase more than in normal times (see, e.g., Corsetti et al. (2013)).

Focusing on the implied multipliers, contrary to the case of AEs, we find that the spending multiplier can be significantly less than a unit in normal times—reinforcing the findings from the (linear) literature on multipliers in EMs (Ilzetzki et al. (2013), Kraay (2014), Chian Koh (2017))—but even lower in bad times. Thus, for EMs, multipliers seem to be smaller in recessions compared with booms, in a strikingly different fashion from what has been observed for some advanced countries. Such results are robust in a variety of exercises, including accounting for financial stress regimes and periods of high uncertainty. Importantly, our results have serious implications for policymakers: a typical EM is unlikely to present "crowding-in" effects in bad times, implying that expansionary spending policy may not lead to the desired economic recovery.

This paper complements the empirical literature that estimates fiscal multipliers in a panel context, with a particular interest in EMs (Ilzetzki (2011), Ilzetzki et al. (2013), Kraay (2014), Chian Koh (2017), Carriere-Swallow et al. (2018)). Few papers, however, have estimated fiscal multipliers for EMs in a nonlinear context. A notable exception is Furceri and Li (2017), but their focus is on public investment. A remarkable finding from the literature using linear methods suggest that government spending multipliers are lower in groups composed of both poor DCs and EMs compared with AEs. Indeed, Carriere-Swallow et al. (2018) reviewed many papers that estimated government multipliers in developing and emerging countries. They find that, on average, fiscal multipliers seem to be 50% larger in AEs compared with those in EMs and DCs. Thus, our results add to the literature by suggesting that multipliers in EMs may differ from those estimated from AEs in yet another dimension, namely, during bad times.

The paper is organized as follows: Section 2 discusses the econometric strategy. Section 3 presents the results, and Section 4 highlights the concluding remarks.

2. EMPIRICAL ANALYSIS

This section presents our empirical strategy. We discuss the empirical model and the selected set of priors, briefly consider the Bayesian algorithm to compute the posterior of the reduced forms parameters, and describe how we recover the structural shocks within the panel.

2.1. Empirical Model

The BPT-VAR is composed of a collection of the following idiosyncratic threshold VAR (T-VAR) model:

$$\boldsymbol{y}_{c,t} = \begin{cases} \sum_{l=1}^{L} \boldsymbol{B}_{c,l}^{1\,\prime} \boldsymbol{y}_{c,t-l} + \boldsymbol{\Delta}_c^{1\prime} \boldsymbol{w}_{c,t} + \boldsymbol{\Gamma}_c^{1\prime} \boldsymbol{z}_{c,t} + \boldsymbol{u}_{c,t}^{1} & \text{if} \quad \tilde{y}_{c,t-d_c} \leq \mathcal{Y}_c^{*} \\ \sum_{l=1}^{L} \boldsymbol{B}_{c,l}^{2\,\prime} \boldsymbol{y}_{c,t-l} + \boldsymbol{\Delta}_c^{2\prime} \boldsymbol{w}_{c,t} + \boldsymbol{\Gamma}_c^{2\prime} \boldsymbol{z}_{c,t} + \boldsymbol{u}_{c,t}^{2} & \text{if} \quad \tilde{y}_{c,t-d_c} > \mathcal{Y}_c^{*}, \end{cases} \tag{1}$$

where c, $c \in \{1, \ldots, C\}$, is the emerging economy c out of a total of C countries in the sample. The emerging country c is allowed to have an idiosyncratic total

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of T^c observations. In (1), $\tilde{y}_{c,t} \in \boldsymbol{y}_{c,t}$ is a measure of the output gap in country c, where $\boldsymbol{y}_{c,t}$ is a vector of $K \times 1$ endogenous variables, $\boldsymbol{w}_{c,t}$ is a $W \times 1$ vector of exogenous variables (possibly common to all countries), and $\boldsymbol{z}_t$ is a $Z^c \times 1$ vector of deterministic variables in country c. The idiosyncratic threshold value, $\mathcal{Y}_c^* \in \tilde{y}_{c,t}$, and country-specific delay parameter, d_c, are unobservables and should be inferred from the data.

The idiosyncratic residual covariance matrix is defined as

$$var(\boldsymbol{u}_{c,t}) = \boldsymbol{\Sigma}_c = \boldsymbol{\Sigma}_c^1 \odot S_{c,t} + \boldsymbol{\Sigma}_c^2 \odot (1 - S_{c,t}), \quad \textbf{(2)}$$

where $S_{c,t} = 1 \iff \tilde{y}_{c,t-d_c} \leq \mathcal{Y}_c^*$, $\odot$ is the Hadamard (element-wise) product, and $\boldsymbol{\Sigma}_c^r$, $r = \{1, 2\}$, is the regime-specific covariance matrix.

It is convenient to rewrite the model in the following compact form:

$$\boldsymbol{Y}_c = \left[\boldsymbol{X}_c\boldsymbol{B}_c^1 + \boldsymbol{Z}_c\boldsymbol{\Gamma}_c^1 + \boldsymbol{U}_c^1\right] \odot S_{c,t} + \left[\boldsymbol{X}_c\boldsymbol{B}_c^2 + \boldsymbol{Z}_c\boldsymbol{\Gamma}_c^2 + \boldsymbol{U}_c^2\right] \odot (1 - S_{c,t}), \quad \textbf{(3)}$$

in which $\boldsymbol{Y}_c$, $\boldsymbol{X}_c$, and $\boldsymbol{Z}_c$ are, respectively, $T^c \times K$, $T^c \times M$, and $T^c \times Z^c$ matrices, with $M = Kp + W$. $\boldsymbol{B}_c^r$ is given by $\boldsymbol{B}_c^r = \left[\boldsymbol{B}^{r\prime}_{c,1} \;\cdots\; \boldsymbol{B}^{r\prime}_{c,L^r} \;\; \boldsymbol{\Delta}^{r\prime}_c\right]$ and $\boldsymbol{\Gamma}_c^r$ is a $(Z^c \times K)$ matrix. Letting $\mathbf{y}_c = vec(\boldsymbol{Y}_c)$, $\boldsymbol{\beta}_c^r = vec(\boldsymbol{B}_c^r)$, $\boldsymbol{\gamma}_c^r = vec(\boldsymbol{\Gamma}_c^r)$, and $\boldsymbol{u}_c^r = vec(\boldsymbol{U}_c^r)$, (3) can be conveniently restated as

$$\begin{aligned}\mathbf{y}_c = &\left[(\mathbf{I}_M \otimes \mathbf{X}_c)\boldsymbol{\beta}_c^1 - (\mathbf{I}_M \otimes \mathbf{Z}_c^r)\boldsymbol{\gamma}_c^1 + \boldsymbol{u}_c^1\right] \odot S_t \\ &+ \left[(\mathbf{I}_M \otimes \mathbf{X}_c)\boldsymbol{\beta}_c^2 - (\mathbf{I}_M \otimes \mathbf{Z}_c^r)\boldsymbol{\gamma}_c^2 + \boldsymbol{u}_c^2\right] \odot (1 - S_t).\end{aligned} \quad \textbf{(4)}$$

Considering that EMs may share similarities in the dynamic relationships between the endogenous variables, we assume hierarchical priors for a subset of parameters of the individual models. As in Mumtaz and Sunder-Plassmann (2017), Mumtaz et al. (2018), and Ruisi (2018), we assume a regime-dependent exchangeable prior for the reduced VAR parameters in the spirit of Jarociński (2010) denoted by

$$p(\boldsymbol{\beta}_c^r|\bar{\boldsymbol{\beta}}^r) \sim N(\bar{\boldsymbol{\beta}}^r, \lambda_r\boldsymbol{\Lambda}_c), \quad \textbf{(5)}$$

where $\bar{\boldsymbol{\beta}}^r$ is the weighted average (panel) VAR coefficients in the regime r and $\boldsymbol{\Lambda}_c$ is a diagonal matrix reflecting the scale of the data. The degree of pooling is determined by the regime-dependent λ_r. As long as $\lambda_r \to 0$, the mean posterior for $\boldsymbol{\beta}_c^r$ becomes more influenced by the cross-sectional information, whereas $\lambda_r \to \infty$ imply completely heterogeneous dynamics across countries. λ_r is assumed to be independent across regimes, such that the degree of pooling may differ in each regime. As in Mumtaz and Sunder-Plassmann (2017), we assume that $p(\bar{\boldsymbol{\beta}}^r) \propto N(\boldsymbol{\beta}_0, \boldsymbol{\Lambda}_0)$, for $r = \{1, 2\}$.

Similar to Bahaj (2019), reflecting our beliefs that $\bar{\boldsymbol{\beta}}^r$ may be associated with a "panel" covariance matrix, we assume an inverse Wishart prior for the regime-dependent country-specific covariance matrix denoted by

$$p(\boldsymbol{\Sigma}_c^r|\bar{\boldsymbol{\Sigma}}^r, \kappa) \sim iW(\bar{\boldsymbol{\Sigma}}^r, \kappa) \quad \textbf{(6)}$$

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together with the panel regime-specific Wishart prior:

$$p(\bar{\mathbf{\Sigma}}^r) \sim |\bar{\mathbf{\Sigma}}^r|^{-0.5(K+1)}, \tag{7}$$

where κ is the degrees of freedom.

Moreover, in the spirit of Mumtaz et al. (2018), we introduce a hierarchical prior for the threshold variable $\mathcal{Y}_c^*$. However, we restrict the proposed values to be consistent with both our definition of crisis—a threshold value indicating that the economy is in a bad regime, meaning some threshold point below the trend—and the data availability. Such prior is expressed as

$$p(\mathcal{Y}_c^*|\bar{\mathcal{Y}}^*) \sim N(\bar{\mathcal{Y}}^*, \omega\mathbf{\Omega}_c) \times I_{(l,u)}, \tag{8}$$

where, as before, $\bar{\mathcal{Y}}^*$ is the cross-sectional weighted average of the threshold value in the sample with prior distribution $p(\bar{\mathcal{Y}}^*) \propto 1$, $\mathbf{\Omega}_c$ is the scale, and ω is the degree of pooling in which the idiosyncratic threshold variable $\mathcal{Y}_c^*$ shrinks to $\bar{\mathcal{Y}}^*$. $I_{(l,u)}$ truncates the distribution to the interval given by the minimum value l and the maximum value u.[7]

The parameters controlling the degrees of pooling, λ_r and ω, are assumed to have a prior distribution given by $IG(s_0, v_0)$. Finally, the parameters stacked in γ_c^r are assumed to be merely country-specific, with prior $p(\gamma_c^r) \propto 1$.

In summary, our prior scheme allows for a high degree of heterogeneity both in the initial conditions and in the magnitude of shocks on the countries while accounting for similarities in the dynamic responses of the variables across the countries. Importantly, the hierarchical structure assumed for the parameters $(\boldsymbol{\beta}_c^r, \mathbf{\Sigma}_c^r, \mathcal{Y}_c^*)$ can be considered an efficient method to exploit the information from all countries to better estimate the idiosyncratic coefficients, which is ultimately used to estimate the average parameters. This feature is relevant in our case because the data are likely to be scarce for EMs, with short time series for important macroeconomic variables, particularly a sovereign risk measure. We emphasize that our main results are based on an "average" analysis—instead of an idiosyncratic analysis—because our primary focus is on a typical, representative EM economy. Thus, our empirical analysis is primarily based on the parameters $(\bar{\boldsymbol{\beta}}^r, \bar{\mathbf{\Sigma}}^r)$ conditioning on all observations in each regime for all countries.

2.2. Bayesian Estimation and Identification

The technical appendix presents the Metropolis-Within-Gibbs algorithm used to estimate the model; loosely, it is similar to the algorithm used in Ruisi (2018), except that there are additional estimated parameters related to the covariance matrices and some refinements to restrict the algorithm to propose draws for threshold values only in the recessionary state, given our definition of bad times. Here, we discuss how we set up some key hyperparameters of the model. The parameters controlling for the degree of pooling in priors (5) and (7) are set by following Gelman (2006). In all cases, the priors have scale parameters set to $s_0 = 0$ with $v_0 = -1$. For κ, we follow Bahaj (2019) and set it as $\kappa = 3$. The scale matrices for the reduced form parameters are set using dummy observations as in Bańbura et al. (2010) with the tightness parameter set to 1, resulting in a slightly informative prior. The mean of the prior for $\bar{\boldsymbol{\beta}}^r$, $r = \{1, 2\}$, is set following the spirit of the Minnesota prior, with the first own lag set to 0.95 and the others to 0.

We use a Metropolis-Within-Gibbs algorithm to approximate the marginal posterior distributions by using 1,000,000 replications, discarding the first 100,000 as burn-in, and retaining every 50-th draw for inference.

2.2.1. Econometric strategy. The vector of endogenous variables $\boldsymbol{y}_{c,t}$ in equation (1) contains a collection of country-specific macroeconomic variables gathered at a quarterly frequency. The choice of variables entering the VAR follows Ilzetzki et al. (2013), Ravn et al. (2012), Galí et al. (2007), and Uribe and Yue (2006), to account for the important sources of fluctuation in EMs (e.g., changes in foreign markets as well as the cost of borrowing in international financial markets) while relating government spending to the private sector variables. Thus, each idiosyncratic VAR contains the following measures: (i) government spending; (ii) GDP; (iii) private consumption; (iv) investment; (v) trade-balance-to-GDP ratio (TB); (vi) RER; and (vii) RIR.[8] Following Ramey and Zubairy (2018), the variables (i)–(iv) are scaled by a measure of potential GDP. This transformation makes it easier to compute the state-dependent multipliers in our nonlinear context.[9] The potential GDP is estimated by fitting a 6th-degree polynomial (Ramey and Zubairy (2018)). As in Uribe and Yue (2006) and Akinci (2013), the variables (vi) and (vii) are entered into the VAR in log-levels. Finally, we take into account the cross-section correlation by following a strategy similar to that used by Owyang et al. (2013) and Mumtaz et al. (2018). To achieve this objective, we include the variable $f_t = \frac{1}{C-1} \sum_{-c} X_{-c,t}$, where $\sum_{-c}$ indicates a summation over all countries but c, and $X_{c,t}$ is the sum of the standardized government spending, standardized GDP, standardized consumption, and standardized investment in country c divided by 4. This variable cannot be used to decompose the potential spillover effects of fiscal expansions in one country to another, but it is useful in controlling for the cross-sectional correlation.

Notably, as in Ilzetzki et al. (2013), our set-up does not include tax policy variables, because of data availability, which may bias the estimates of private variables responses. However, the similarities between the results of Ilzetzki et al. and those of Ilzetzki (2011), which do control for tax policies, suggest that such bias, if it exists, may not be substantial for developing and emerging countries.[10] Obviously, as these tax data become available for emerging countries, this issue can be investigated empirically.

The (weakly) exogenous variables entering the system through $\boldsymbol{Z}_c$ are a constant, the RIR charged to a typical EM (calculated using the Global EMBI+), and the growth rate of the AEs. The emerging countries in the sample are selected based on data availability for the endogenous variables in the VAR.

Our identification assumption to recover fiscal shocks is similar to that used by Ilzetzki et al. (2013) and relies on the widely used recursive proposed by

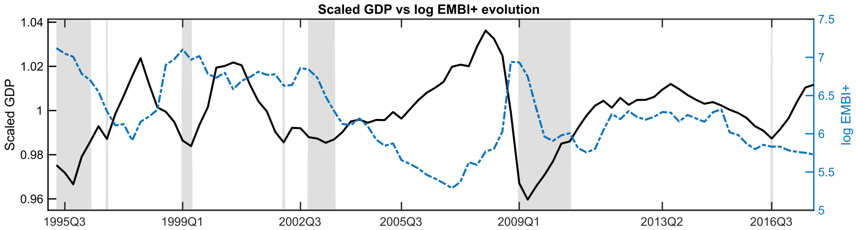

FIGURE 1. Typical EM vs EMBI+ evolution.

Blanchard and Perotti (2002) (BP). The BP scheme assumes that, because of institutional framework rigidity, the fiscal authority may take a while to react to the business cycle conditions. Such a timing hypothesis is achieved by ordering the government spending first in the VAR. For the remaining variables, we follow Uribe and Yue (2006), who show that ordering financial variables above the macroeconomic variables may result in unreasonable responses, and Ravn et al. (2012), who show that a similar ordering scheme can generate IRFs consistent with IRFs from a theoretical two-country model in which there are both a deep-habit and imperfect competition. Thus, our identification strategy is based on the sequential ordering of the variables (i)–(vii), with f_t last.

Because the BP's timing assumption does not *per se* consider expectational effects implied by the forward-looking behavior of the private sector, which cast doubt on the identification of the true structural fiscal shock, we view the inclusion of the RIR faced by EMs into our VAR as a means of strengthening the BP approach to control for such channel. As long as the sovereign spreads of an EM reflect the market price of the risk related to the country's fundamentals—particularly the fiscal stance—if markets are efficient an anticipated expansionary fiscal policy that affects the country's cost of borrowing will be reflected in the country spread by the perceptions of the international financial markets. In this sense, the information on the government debt price incorporates the forward-looking component associated with the fiscal policy in the spirit of Leeper et al. (2013).[11]

3. BAD TIMES VS NORMAL TIMES IN EMS

Before presenting the results for the IRFs and the implied multipliers, in this section, we highlight several important features of the recessionary times in a typical emerging economy that might affect the fiscal policy transmission, particularly the government spending shock. To achieve this objective, we first construct a series of scaled GDP for a "typical EM" but using all available information in the sample at each point in time. The "typical EM" is merely the simple average of the data.[12]

Figure 1 plots the evolution—from early-1995 to late-2017—of our GDP gap measure (solid line) and the logarithm of the Global EMBI+ (dashed line), which

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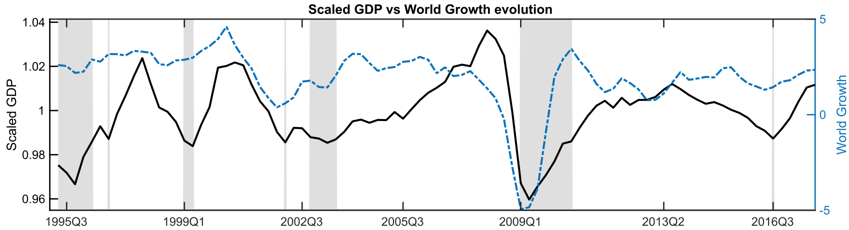

FIGURE 2. Typical EM vs world growth evolution.

is considered a proxy for measuring the spreads charged from the international financial markets to a typical EM. The shaded area highlights the situations in which the typical EM is experiencing a bad regime, given the estimated median threshold of the panel $\bar{\mathcal{Y}}^*$ (=0.9837)—.

Figure 1 illustrates the first potential problem to the private sector in slump times: as the typical EM faces a bad regime, the international markets charge higher interest rates for the EM, making spreads go up. This process, in turn, ultimately affects the cost of borrowing in an emerging country, and such cost is essential in fiscal transmission. A rising interest rate makes current consumption more expensive relative to future consumption, an issue which tends to reduce the willingness of the private sector to buy goods and services in the present. Moreover, a higher interest rate raises both the opportunity cost of the investment and the costs of borrowing to buy investment goods. Thus, we expect a lower potential for the government spending shock as a stimuli policy during slack times in a typical EM.

Another potential problem for an emerging economy is related to the international goods markets because they are typically specialized in producing (a few) commodity goods. Figure 2 plots the evolution of our GDP measure *vis-à-vis* the word growth, proxied by the G7 quarterly GDP growth. Notably, some recessionary periods in EMs are related to a decrease in the foreign demand for home goods. If we interpret an unanticipated spending fiscal shock as a demand shock, which might increase the home demand for international goods, the government spending shock could worsen the trade-balance account in a situation in which the current account is usually just under pressure.

Moreover, international crises are typically coupled with a higher level of uncertainty, and the business cycles in EMs seem to be related to global uncertainty, as suggested by Figure 3. Because uncertainty may create incentives for the private sector to save because of precautionary motives, fiscal expenditure shocks may not be able to stimulate private activity during recessions.

Finally, a point raised by Ramey and Zubairy (2018) is worth discussing. The authors argued that the standard practice in the literature to convert the estimated elasticities into multipliers by using the sample average of the GDP/Gov ratio may result in biased (between regimes) multipliers[13] because such a ratio is likely to change during crises. Because Figure 4 suggests a quite volatile relationship between GDP and government spending in EMs and a slightly negative trend

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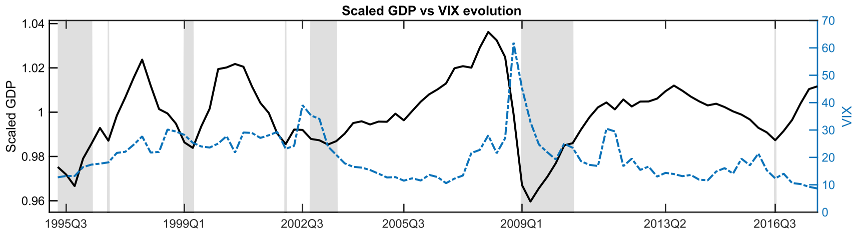

FIGURE 3. Typical EM vs global volatility (VIX) evolution.

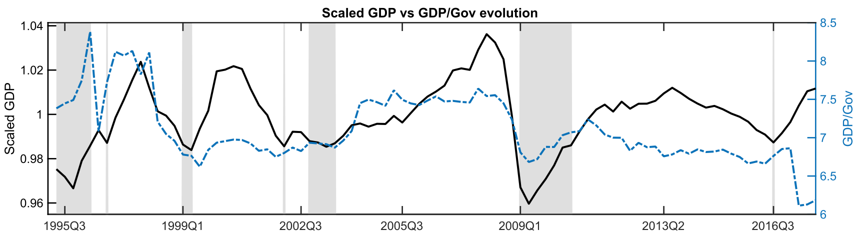

FIGURE 4. Typical EM vs GDP/Gov ratio evolution.

over time, a proper computation of the fiscal multipliers in EMs must address these problems. Otherwise, the estimated multipliers would be potentially biased.

4. RESULTS

To report the results, we focus on the panel—or the weighted average—estimates of the coefficient of the model. The histories for the panel are gathered using the median of the posterior distribution of each idiosyncratic threshold, and the implied country-specific histories are pooled. We follow this strategy to avoid idiosyncratic histories of a certain regime being incidentally selected by the panel statistic and used in the other regime.[14] The results, however, are robust to the choice of the threshold points, although with slightly larger credible intervals. Finally, as in Ilzetzki et al. (2013), the results are based on a parsimonious version of the model with one lag. In Section 5, we perform various robustness analyses. In particular, we show that the results are qualitatively similar when the model is estimated with four lags.

4.1. Panel Analysis

The panels (a) to (d) in Figures 5 and 6 present the nonlinear IRFs for a shock to government spending identified by the BP recursive scheme in each regime. The blue-dashed lines are the responses in normal times, and the red-dotted lines are the responses during bad times. The results displayed in panel (a) suggest that a government spending shock to EMs is a short-lived process in both regimes, with highly similar dynamics and persistence in the responses. Thus, the

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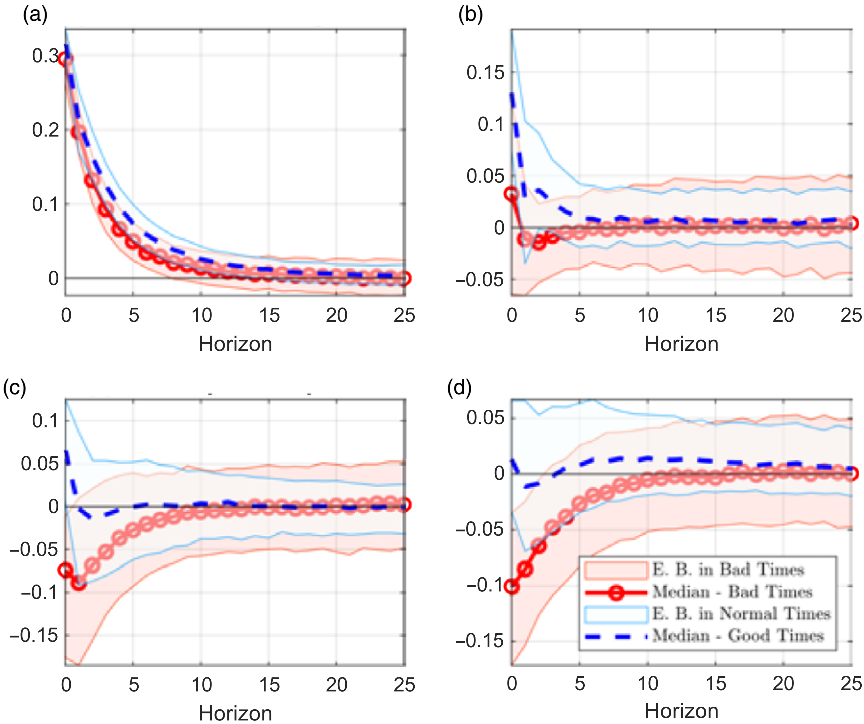

FIGURE 5. Nonlinear impulse responses from a shock to government spending—Error Band (E.B.): 68%. (a) Government spending shocks. (b) GDP responses. (c) Consumption responses. (d) Investment responses.

between-responses show no clear presence of nonlinearities. This finding constitutes the first difference from the nonlinear dynamics of government shocks compared with AEs, where the government spending shocks are typically persistent in both regimes and sometimes present a hump-shaped pattern (Auerbach and Gorodnichenko (2012a), Owyang et al. (2013)).

The presence of nonlinear effects in the transmission of government spending shocks can be inferred by examining panel (b) of Figure 5. In normal times, GDP responds positively to government stimulus. However, in bad times, the median response is close to zero, with the confidence interval including the positive and negative values with non-negligible probability. At first glance, this is a suggestion that governments in EMs are unlikely to stimulate the private sector during slack times successfully.

To further investigate this point, panels (c) and (d) show the responses of both private consumption and investment. In normal times, consumption increases after an unexpected increase in government spending. By contrast, in bad times, the median response of the consumption to a government spending shock is negative, with a hump-shaped behavior. A nonlinear, state-dependent pattern

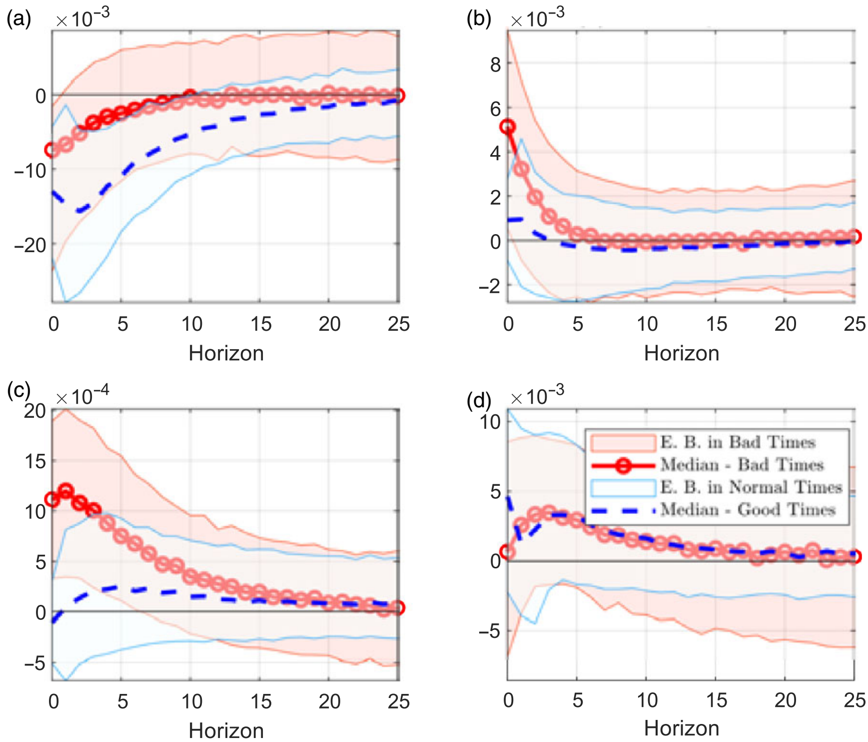

FIGURE 6. Nonlinear impulse responses from a shock to government spending—Error Band (E.B.): 68%. (a) TB responses. (b) RER responses. (c) RIR responses. (d) Spillover effects.

is also found in the investment responses between the regimes (panel (d)). In normal times, a positive government spending shock may not stimulate investment, although there is no clear evidence for "crowding-out" effects. However, in bad times, the expansionary shock tends to crowd-out private investment. Thus, private consumption and investment responses exhibit quite different patterns between regimes, but both respond negatively to the government stimuli during crises. Together, the between-responses of the household consumption and investment constitute the first piece of (weak) evidence that explains the presence of nonlinear responses of GDP between the two regimes in EMs.

Next, we analyze the potentially different effects of government spending shocks in good and bad times in the TB, RER, and RIR. For the TB, we find that the median responses are quite similar, with the government spending shock worsening the current country position. These results are presented in panel (a) in Figure 6. Interestingly, the persistence of the shocks in normal times is substantially more pronounced than in bad times. Thus, for the TB, the main difference seems to be related to the dynamics of the variable, but not to the sign of the impact of the shock in each regime. For the RER, the difference between regimes

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is clearer (panel (b), Figure 6). In the bad regime, the government spending shock may increase the relative price of domestic goods with high probability. Such an effect, however, is less likely to occur in the normal regime because the response of the RER is indistinguishable from zero.[15] Together, the pieces of evidence reported in panels (a) and (b) suggest that government spending shocks may affect the external sector of the emerging economy in a nonlinear fashion. In particular, the differences in the TB and RER responses, if they exist, seem more related to the magnitude and persistence, whereas the private macrovariables are likely to have differences even in the signs of the responses between regimes.

Panel (c) of Figure 6 presents perhaps the most important source to understand the differences in the between-responses of the private variables. While in normal times the RIR is unlikely to be affected by the spending shock in a statistical sense, in bad times, government spending shocks may trigger an increase in the cost of borrowing with a persistent pattern.[16] This response coincides with the negative responses from consumption in bad times and can justify the negative response of investment during bad times. These pieces of evidence suggest that, for emerging countries, spending shocks in bad times may magnify the incentives of private agents to reduce consumption and investment. We are aware, however, that our identification scheme cannot be used to disentangle the main drivers that explains such results. On one hand, the private sector may reduce the demand for investment and consumption goods due to the higher cost of borrowing. On the other hand, a higher risk of sovereign default strengths may lead agents to postpone consumption (precautionary motive) and investments. However, this second channel would generate a more immediate negative response from private consumption because the precautionary behavior is forward-looking by nature.

Finally, we discuss the results presented in Figure 6 while considering the results of the literature for AEs. First, our results suggest that government spending may induce a worsening in the TB of emerging economies both in good and bad times. Monacelli and Perotti (2010) and Ravn et al. (2012)—to cite a few—provided evidence from linear VARs that such effect is also a feature of the data from AEs. Second, in normal times, prices in EMs are less responsive than in bad times, as expected. Third, we observe a positive correlation between private consumption and the RER, a relation reported as a salient feature of AEs by Monacelli and Perotti (2010) and Ravn et al. (2012).[17] In EMs, however, such correlation disappears or becomes negative in a bad regime. This result contrasts with those findings from Miyamoto et al. (2019), who found that increases in government purchases cause the RER to depreciate and decrease consumption in advanced countries, whereas government purchase shocks may lead to real appreciation coupled with increased consumption in DCs. Fourth, there is a negative correlation between private consumption and RIR in bad times, whereas in good times, this correlation seems to be weak.

4.1.1. Implied multipliers. We follow Ilzetzki et al. (2013) by computing the present-value multipliers similar to Mountford and Uhlig (2009), but without

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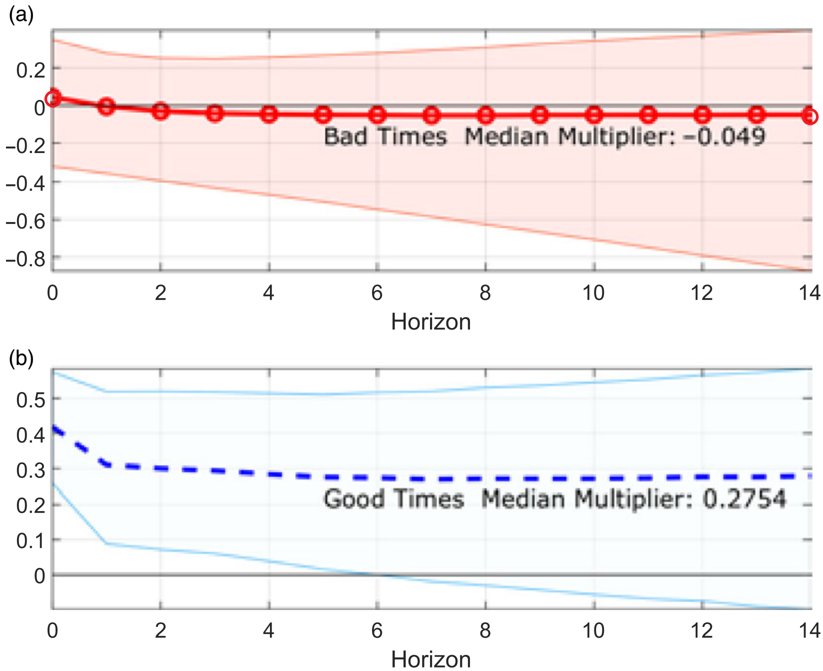

FIGURE 7. GDP multipliers—Error Band: 68%. (a) Cumulative spending multiplier in Bad Times: GDP. (b) Cumulative spending multiplier in Normal Times: GDP.

using the *ex post* conversion factors—the sample average Y/G ratio—to convert the estimated elasticities into multipliers. As shown by Ramey and Zubairy (2018), such conversion factors may induce upward bias into the state-dependent multiplier estimates in some cases, mainly because of the time-varying property of the mean Y/G ratio. Because we found this ratio to be quite heterogeneous within our panel data and, moreover, considerably volatile in some countries in the sample, we prefer the Gordon and Krenn (2010) *ex ante* transformation. For a variable of interest, v, we define the present-value multiplier at time T as

$$\text{Present-Value Multiplier}_v(T) = \frac{\sum_{t=0}^{T}(1+r)^{-t}\Delta v_t}{\sum_{t=0}^{T}(1+r)^{-t}\Delta g_t}. \quad (9)$$

Following Ilzetzki et al. (2013), we compute r by using the median over the sample of an estimated RIR. Because we are interested in a typical EM, we proxy r by an interest rate variable charged from a "typical" emerging economy. It is calculated by applying the method by Schmitt-Grohé and Uribe (2016), but we use the Emerging Market Bond Index Global (EMBIG).[18] The resulting annual interest rate over the sample is 1.06, or on a quarterly basis $r = 1.015$.[19]

The implied multipliers for the GDP, private consumption, and investment are displayed in Figures 7, 8, and 9, respectively. We find that the government spending multiplier on GDP depends to a significant degree on the state of the business

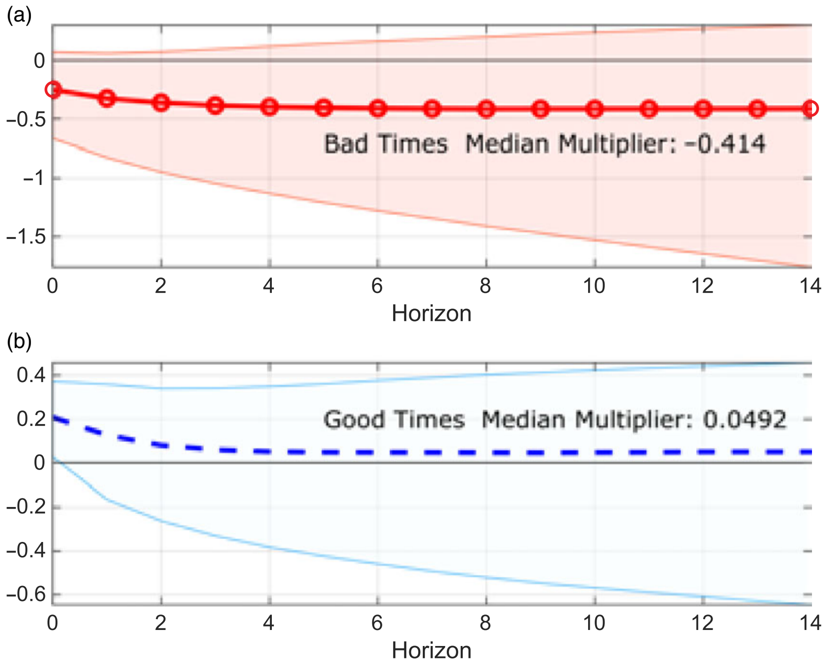

FIGURE 8. Consumption multipliers. (a) Cumulative spending multiplier in Bad Times: Consumption. (b) Cumulative spending multiplier in Normal Times: Consumption.

cycle. In bad times, the multiplier is indistinguishable from zero even in the period of impact, and in normal times, the median multiplier is slightly higher than 0.4 at impact and can reach 0.275 in the long run. Thus, the typical EM in our sample is likely to have multipliers less than 1, unconditionally.

We also find evidence for state-dependent multipliers for consumption. In bad times, we observe a high probability of a negative multiplier in the short run. In the long run, however, the value zero is always included in the confidence interval. Thus, we find at least weak evidence that government spending may substitute private consumption in bad times. By contrast, in normal times, the multiplier is positive at least in the very short run, with zero being inside the confidence interval from the second quarter. Thus, in normal times, government spending seems to complement private consumption at least in the very short run.

For investment, the multiplier associated with bad times is approximately −0.39 at impact and can be −0.43 in the long run. In good times, however, the multiplier is always indistinguishable from zero.

4.2. Contractionary Government Spending Shocks

Having analyzed the effects of a positive government spending shock, we now analyze the effects of an unpredicted reduction in government spending during

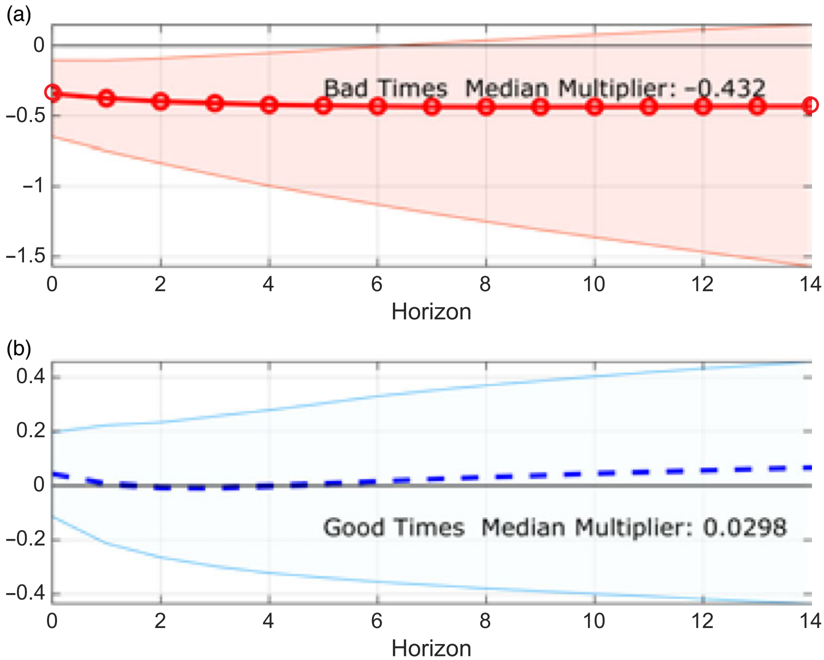

FIGURE 9. Investment multipliers. (a) Cumulative spending multiplier in Bad Times: Investment. (b) Cumulative spending multiplier in Normal Times: Investment.

boom and bust times. Such an analysis is of interest because in a nonlinear context the responses of the variables in the system to negative shocks are not necessarily symmetrical to their responses to positive shocks. Thus, we address the following issues: (i) whether contractionary government spending policies have different effects depending on the state of the economy, and (ii) whether contractionary policies have asymmetrical effects compared with expansionary policies. These questions are critical because our previous empirical analyses may suggest that the government should reduce spending during slump times. However, in a nonlinear framework, such a conclusion might be premature.

The estimated multipliers are plotted in Figures 10, 11, and 12, and the associated IRFs are expressed in Figure C.1 in Appendix C.1. In general, we find that contractionary government spending shocks have quite symmetrical effects relative to the positive shock case. These results suggest that a “contractionary” government spending policy may have expansionary effects whenever the emerging economy is undergoing a turbulent period.

5. ROBUSTNESS ANALYSIS

In this section, we perform different exercises to verify whether our results are sensitive to the specification adopted. First, we add more lags to the VAR model.

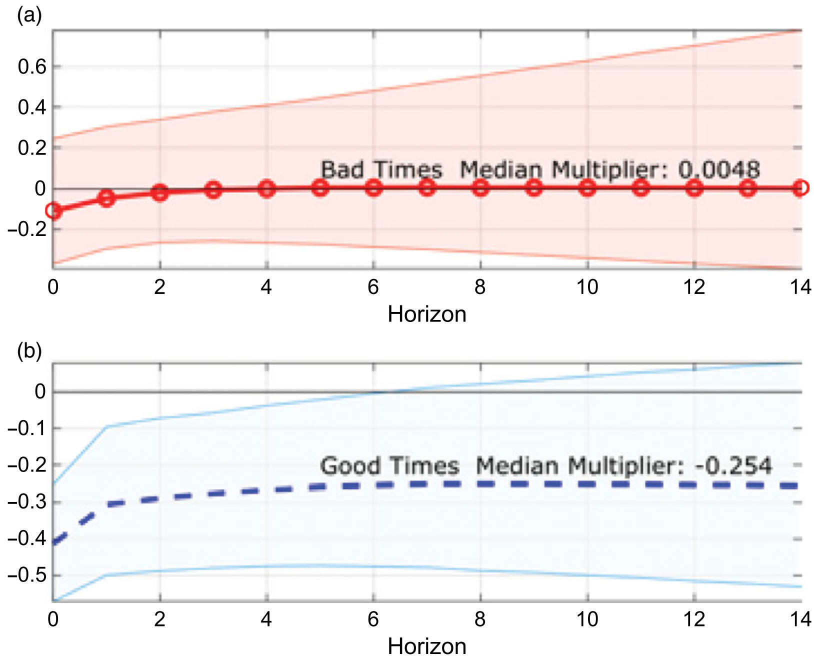

FIGURE 10. GDP multipliers for a negative government spending shock. (a) Cumulative spending multiplier in Bad Times: GDP. (b) Cumulative spending multiplier in Normal Times: GDP.

Second, we compute the potential GDP using two additional methods. Third, we use other switching variables to capture the financial stress and the level of uncertainty in EMs.[20] Notably, such robustness analyses have the potential to provide insights into the forces behind our results too. Finally, because all trend estimation techniques used in the paper result in smooth potential GDP—and one may expect large changes in the potential GDP in EMs due to, for example, a large productivity shock—we check for the robustness of our findings by using macrovariables in quarterly growth rates, while employing a measure of financial stress as a switching variable.

5.1. Adding More Lags to VAR

To check whether the nonlinear effects reported previously are dependent on the small lag structure of the model, Figure D.1 presents the results using the BPT-VAR with order 4. Although the new IRFs are clearly affected by the inclusion of more lags, the conclusions are essentially in line with those findings obtained using the parsimonious version of the model with only one lag.[21]

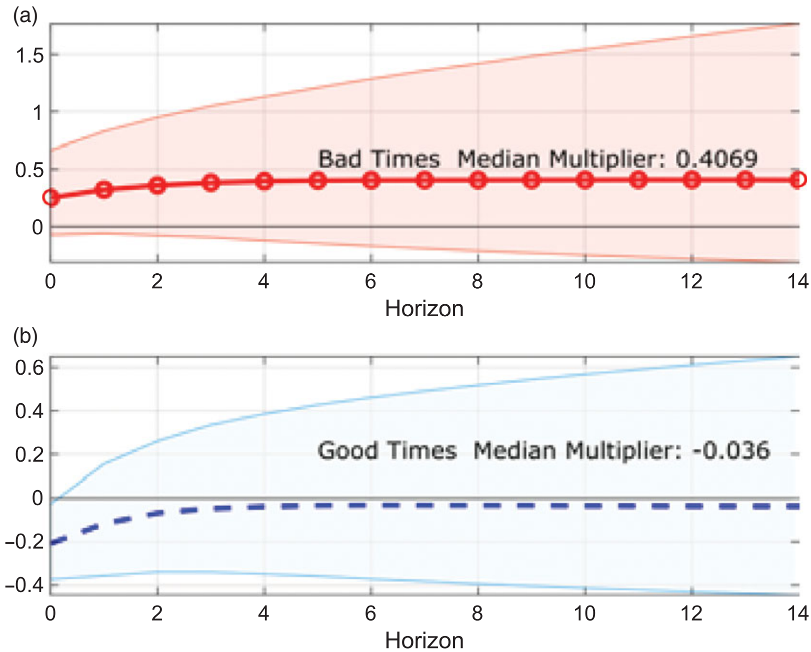

FIGURE 11. Consumption multipliers for a negative government spending shock. (a) Cumulative spending multiplier in Bad Times: Consumption. (b) Cumulative spending multiplier in Normal Times: Consumption.

5.2. Changing the Method to Compute Potential GDP

A natural concern for our econometric strategy is whether the results are a by-product of the estimation method that we used to compute the potential GDP (a 6th-degree polynomial). To investigate this possibility, we estimate potential GDP by using the HP-Filter and a 5th-degree polynomial.[22] Figures D.2 and D.3 (Figures D.4 and D.5) in the appendix present the impulse response from a shock on government spending and the respective multipliers when the potential GDP is estimated using the HP-Filter (a 5th-degree polynomial).

For the case based on the HP-Filter, the only substantial difference is the response of investment. In such a case, the responses are similar between regimes and indistinguishable from zero. The GDP and consumption multipliers differ between regimes and are in line with our baseline model results in Section 4. When the polynomial of the 5th order is employed to estimate the potential GDP, the results are similar to those findings obtained by using the 6th-degree polynomial in Section 4. Thus, although the results for investment seem to depend on the method used to estimate the potential GDP, the results for GDP and consumption are robust to such choice.

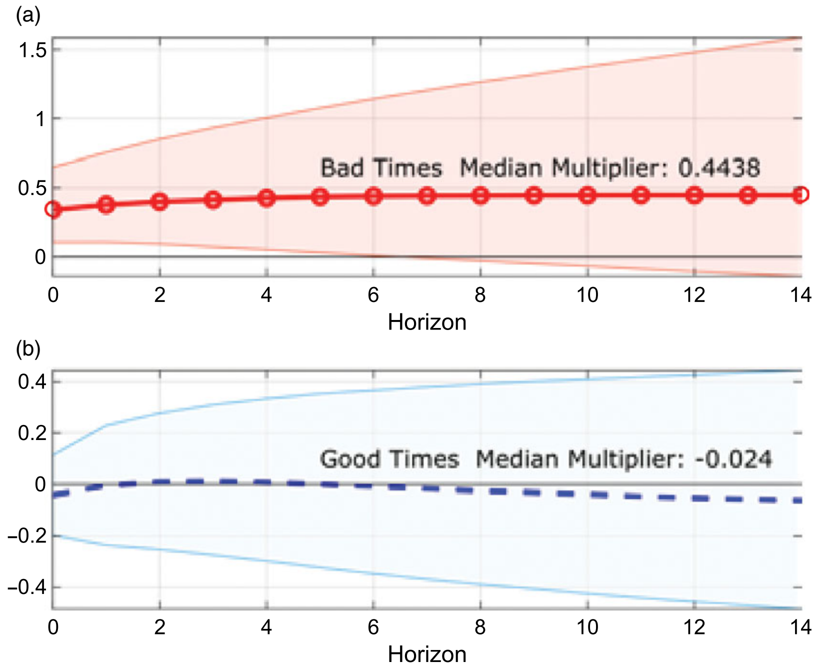

FIGURE 12. Investment multipliers for a negative government spending shock. (a) Cumulative spending multiplier in Bad Times: Investment. (b) Cumulative spending multiplier in Normal Times: Investment.

5.3. Accounting for Financial Stress and Uncertainty

As we have argued throughout the paper, EMs are prone to high uncertainty and financial distress during bad times. For this reason, we make two modifications in our baseline model to investigate how the impulse responses and government spending multipliers depend on financial stress and uncertainty in EMs. First, we remove our measure of RIR because it depends on EMBI+, which is likely to be related to both uncertainty and financial instability in EMs (see, e.g., Balakrishnan et al. (2011)). However, for each country in our sample, we add a measure of financial conditions and a measure of uncertainty in the VAR. Second, instead of using the scaled GDP, we employ other regime-switching variables to capture the financial conditions and the uncertainty in EMs. These analyses are very useful to provide insights into the reasons behind the lower multipliers in bad times in Section 4.

The financial instability indicator is proxied by an updated version of the financial stress index (FSI) estimated by Soave (2020).[23] For each country in the sample, we estimate a time-varying factor augmented VAR (TVP-FAVAR) composed by financial and macroeconomic variables. The financial variables are the five sub-indices proposed by Balakrishnan et al. (2011), which are defined to capture financial stress from different financial markets. These indices are a banking sector stress index, a foreign market pressure index, two equity volatility measures, and a measure of sovereign debt stress (EMBI+). The FSI is given by the dynamic common factor from the aforementioned sub-indices. The country's macroeconomic variables are GDP growth and inflation. Notably, the macrovariables have the role to purge the FSI from macroeconomic shocks, which allows the interpretation that FSI expresses financial shocks.[24]

Our uncertainty measure is also calculated from the data. For each country in the sample, we estimate a time-varying AR(4) model with stochastic volatility in the error term, given by

$$growth_t = \mu_t + \sum_{k=1}^{4} \rho_{t,k} growth_{t-k} + \epsilon_t \sqrt{\ln(h_t)}. \quad \mathbf{(10)}$$

We assume that the parameters, $C_t = [\mu_t, \rho_{t,1}, \ldots, \rho_{t,4}]'$, evolve as random walks, such that

$$C_t = C_{t-1} + e_t,$$

where $e_t \sim N(0, Q)$, and the variance of the error term h_t evolves through the following process:

$$\ln h_t = \ln h_{t-1} + \upsilon_t,$$

where $\upsilon_t \sim N(0, V)$. The idiosyncratic models are estimated using the Kalman Filter and Carter and Kohn (1994)'s algorithm. The scales Q and V are set using OLS (ordinary least squares) estimates from training samples given by the first 30 observations for each country, but we do not drop such observations from the estimation procedure. After all, our uncertainty measure is merely the implied stochastic volatility from the model (10) for each country in our sample.

To better estimate the parameters, we use all real GDP data available for each country in our sample (see Table A.3 in the appendix). However, because of convergence problems or the very unreasonable estimates for Bulgaria, Hungary, Peru, and South Africa, we compute the uncertainty measure by using quarterly changes in their monthly industrial production instead, converting to quarterly data by taking the mean value in each quarter.[25]

Figure D.6 in the appendix presents the estimated transitions that use each switching variable for our "typical EM."

5.3.1. FSI as switching variable. Figure D.7 in the appendix presents the nonlinear IRFs when the FSI is used as an indicator of good and bad times. Loosely, the results are qualitatively in line with those obtained from the BPT-VAR based on the scaled GDP. Notably, GDP may respond positively after the government spending shock during financial distress; however, the present-value multiplier, presented in Figure D.8, is not indistinguishable from zero over the horizon, as we

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found by using the scaled GDP as the switching variable. Moreover, during financial distress, consumption may not decrease, contrasting with the previous result. A possible reason for these differences is that not all financial crisis episodes in EMs are followed by a large fall in GDP. In fact, the mean correlation between the FSI and the scale GDP in our sample is −0.185. Notably, "bad times," as indicated by a relatively high FSI, are associated with worse financial conditions (panel (f), Figure D.7) after a government spending shock, and uncertainty is unlikely to respond to a government shock in both regimes.

5.3.2. Uncertainty measure as a switching variable. Nonlinear impulse responses associated with a shock to government spending during good times and bad (uncertain) times are shown in Figure D.9. Not surprisingly, results are quite similar to those found when the switching variable is the FSI because uncertain times are typically coupled with high financial instability in EMs—although not all financial stress periods come with high uncertainty in our sample. Thus, it is quite difficult to disentangle the financial frictions from the uncertainty channel. In this sense, we conclude that a more robust econometric strategy is necessary to understand the fiscal policy transmission in EMs. Moreover, there is a growing literature aiming to decompose uncertainty into different channels and arguing that uncertainty may be both an endogenous and an exogenous process and have channels associated with financial markets and expectations about future policies, for instance (see, e.g., Bloom (2009), Caggiano et al. (2015), Baker et al. (2016), Carriero and Marcellino (2018)). Although we recognize the importance of these channels in the fiscal transmission in EMs, a deeper investigation of such problems is out of the scope of this paper.

Meantime, it is worth mentioning that government spending shocks during times of financial stress seem to be more related to worsening financial conditions than higher uncertainty (panels (f) and (h), Figure D.7). By contrast, while expansionary government spending shocks in uncertain times may also result in bad financial conditions, the increase in uncertainty is much larger compared with periods of financial distress (panel (h), Figure D.7; panel (h), Figure D.9). We omit the multipliers under times of uncertainty but report that they are very close to those obtained when the switching variable is the FSI.

5.3.3. Variables in growth rates. Finally, Figure D.10 presents the nonlinear impulse responses to a government spending shock with macrovariables in quarterly growth rates. Results are qualitatively in line with those from the previous specifications, despite some differences in the dynamics of prices. Given the estimates, similar to Ferraresi et al. (2015) and Chian Koh (2017), we compute the multipliers obtained when the variables are defined in growth rates as

$$\text{Present-Value Multiplier}_{v,s}(T) = \frac{\sum_{t=0}^{T}(1+r)^{-t}\Delta v_{t,s}}{\sum_{t=0}^{T}(1+r)^{-t}\Delta g_{t,s}} / \left(\overline{g/v_s}\right), \quad \textbf{(11)}$$

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where $\overline{g/v}_s$ is the mean ratio between government spending and variable v in the state s.[26] Such multipliers are presented in Figure D.11. For the GDP, the multiplier is larger than in other configurations in good times, approximately 0.68. However, it is indistinguishable from zero in bad times, as in the previous specifications. For consumption and investment, no systematic differences are observed between regimes in the long run. Thus, expansionary government spending policy seems unable to stimulate private aggregates in both regimes.

Thus, we conclude that the main result of the paper, that the government spending multiplier in EMs is smaller during bad times compared with good times, is robust to a variety of specifications. Especially, multipliers in EMs are always below one, irrespective of the regime. These pieces of evidence contrast the evidence found for AEs in the recent literature, namely, that multipliers are larger and above one in recessions. Our results indicate that such differences arise because government spending shocks during turbulent times in EMs are likely to worsen financial conditions, driving interest rates to higher levels, an effect that has not been observed in AEs (see Auerbach and Gorodnichenko (2017)).

6. CONCLUSION

This paper attempts to shed some light on the ability of the government in emerging economies to stimulate the economy by means of government spending shocks in good times and bad times. For a panel of 17 countries, we find that the effects of government spending shocks may result in different responses between the two regimes. Notably, in a bad regime, private sector variables may respond negatively to positive government spending shocks, in a strikingly different fashion from the responses in good times. In such a regime, instead, we find both a positive response for private consumption, and that investment seems to be uncorrelated with government spending shocks. Moreover, prices (the RER and RIR) are unlikely to respond to a positive government spending shock in typical times. By contrast, in bad times, unanticipated shocks on government purchases may induce a currency devaluation coupled with an increase in the interest rate.

Based on our benchmark set-up, we find that the regime-dependent government spending multipliers over GDP are substantially less than the unit during normal times (below 0.5 at the median) both in the short and long run, whereas it can be zero during crises. For consumption, the multiplier can be positive in the short term in normal times but it is likely to be negative in turbulent times. For the investment, in normal times, the multiplier is indistinguishable from zero and can be negative during crises in both short and long run. Together, the results of this paper cast doubt on the ability of the government of emerging economies to stimulate economic recovery in bad times by using expansionary government spending policies.

NOTES

1. Such channels may operate under rational expectations. See, for example, Quaghebeur (2019) and Evans and Honkapohja (2007) for fiscal policy transmission under learning mechanism.

2. For the USA, Ramey and Zubairy (2018) find evidence for higher multipliers in slack times only when the interest rate is close to the zero lower bound, in line with Ngo (2019).

3. Frankel et al. (2013) provided evidence that some EMs have recently "graduated."

4. We focus on EMs due to the lack of data and especially because pooling data from EMs and DCs may be an unsuitable choice because of the significant differences in the business cycle properties of these two groups of countries (see, e.g., Uribe and Schmitt-Grohé (2017), Chapter 1).

5. We acknowledge an abuse of terminology because our method actually separates "bad times vs not bad times." Our labeled "good times" comprise periods of "good times" and "not bad times." We thank the associated editor for pointing out this problem.

6. As shown by Ramey and Zubairy (2018), ignoring the endogenous transitions in the nonlinear impulse responses may result in an upward bias in the estimated multipliers.

7. We set l by requiring that each country have at least four data-points in the bad regime. The upper bound u is set with a value close but below 1, 0.999.

8. Table A.2 in the appendix presents the details regarding how we constructed the real interest series for each country in the sample.

9. Ramey and Zubairy (2018) argued that the common practice in the empirical literature of converting the estimated elasticities into multipliers can be misleading in nonlinear models such as the one considered in this paper. The authors suggest using the Gordon and Krenn (2010) transformation by scaling all NIPA variables by the potential GDP because such transformation accounts for the time-varying nature of the average ratio GDP/Government Spending. Indeed, we present evidence in a subsequent section that this ratio shows particularly high volatility in a typical emerging economy in our sample, suggesting that the standard means of calculating the multipliers would imply misleading estimations.

10. Ramey and Zubairy (2018) also estimated a Threshold VAR for the USA without controlling for tax policy. See also Ramey (2019).

11. Indeed, Caldara and Kamps (2017) highlighted that a VAR extended to include price variables in the spirit of Giannone and Reichlin (2006) can imply an estimated government spending multiplier for the USA that is very similar to those estimated through an identification scheme based on a Proxy VAR.

12. Ruisi (2018) and Mumtaz et al. (2018) have used a similar strategy to construct the histories to compute the nonlinear impulse responses. Here, we are concerned only with summarizing the information in the sample in the simplest form.

13. Throughout the paper, we use the term "between-responses" to refer to a comparison between results in each state of nature.

14. We adopt this procedure because we found a relative degree of heterogeneity—compared to the T-VAR coefficients—in the idiosyncratic threshold.

15. The result for normal times echoes those found in Ilzetzki et al. (2013) in a linear context.

16. Such results contrast with the findings from Auerbach and Gorodnichenko (2017), who found that the rising in costs of borrowing are quite small is AEs, and are in line with the findings from Huidrom et al. (2019), who found that country-spreads are likely to grow up in periods of high government debt in a panel with both AEs and EMs. Moreover, the results are in line with the cost channel associated with government spending as discussed by Abo-Zaid (2020).

17. Ravn et al. (2012) demonstrated that such an effect can be rationalized by means of a New-Keynesian model.

18. See the notes for Table A.2 in the Appendix.

19. Notably, the average interest rates may be unsuitable in our context of EMs because the RIRs may be a function of the economy state, potentially much larger in "bad times." We thank an anonymous referee for pointing out this weakness. However, in this perspective, the multipliers in "bad

times" can be overestimated. As seen later, this reinforces the conclusion that the government's stimulus in these periods can be unsuccessful.

20. We acknowledge that changing the switching variable may lead to very different results because we will be comparing our preferred switching variable—the scaled GDP—with variables of different degrees of persistence.

21. The maximum number of lags is truncated at 4 for two main reasons: (i) increasing the parameter space makes the associated computational burden rise exponentially; and (ii) to avoid countries being excluded from the sample for not having sufficient observations during crisis times.

22. We also employ the standard 2nd-degree polynomial model to estimate the potential GDP for the emerging countries in our sample; however, this method led to highly unreasonable and counter-intuitive GDP gaps for many cases. Thus, we did not proceed with such a method, especially because it is a particular case of the higher-order polynomials used.

23. FSI data are available upon request.

24. We refer the reader to Balakrishnan et al. (2011) for details on the construction of each sub-index and Soave (2020) for details on data and estimation procedure.

25. Because some estimated stochastic volatility for some countries present a negative linear trend from late 1990s to recent years, we apply a simple linear filter so that the estimated variables could be used as switching variables.

26. The average regime-dependent ratios in the sample during bad times and good times are, respectively, 6.878 and 6.995 for Y/G, 4.268 and 4.334 for C/G, and 1.454 and 1.483 for I/G, where Y stands for GDP, C stands for consumption, I stands for investment, and G is the government spending, all measured in local, constant price currency.

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APPENDIX A

A.1. DATA APPENDIX

TABLE A.1. Macroeconomic variables: Sources and spans

Country	Variables	Time span	Source	Country	Variables	Time span	Source
Argentina	GDP Final Households Consumption Investment Final Government Spending Trade Balance	1994Q4–2017Q1	IFS Data	Mexico	GDP Final Households Consumption Investment Final Government Spending Trade Balance	1994Q4–2017Q4	OECDstats
Brazil	GDP Final Households Consumption Investment Final Government Spending Trade Balance	1996Q1–2017Q4	IBGE	Peru	GDP Final Households Consumption Investment Final Government Spending Trade Balance	1997Q1–2017Q1	IFS Data
Bulgaria	GDP Final Households Consumption Investment Final Government Spending Trade Balance	1997Q4–2016Q1	OECDstats	Philippines	GDP Final Households Consumption Investment Final Government Spending Trade Balance	1994Q4–2017Q4	IFS Data
Chile	GDP Final Households Consumption Investment Final Government Spending Trade Balance	1999Q2–2017Q4	IFS Data	Poland	GDP Final Households Consumption Investment Final Government Spending Trade Balance	1995Q4–2017Q1	OECDstats
Colombia	GDP Final Households Consumption Investment Final Government Spending Trade Balance	1997Q1–2017Q1	DANE	Russia	GDP Final Households Consumption Investment Final Government Spending Trade Balance	1998Q1–2017Q4	IFS Data

TABLE A.1. Macroeconomic variables: Sources and spans

Country	Variables	Time span	Source	Country	Variables	Time span	Source
Croatia	GDP Final Households Consumption Investment Final Government Spending Trade Balance	1997Q4–2017Q1	OECDstats	South Africa	GDP Final Households Consumption Investment Final Government Spending Trade Balance	1994Q4–2017Q3	IFS Data
Ecuador	GDP Final Households Consumption Investment Final Government Spending Trade Balance	1995Q1–2017Q3	IFS Data	Thailand	GDP Final Households Consumption Investment Final Government Spending Trade Balance	1997Q4-2017Q3	IFS Data
Hungry	GDP Final Households Consumption Investment Final Government Spending Trade Balance	1999Q1–2017Q4	IFS Data	Turkey	GDP Final Households Consumption Investment Final Government Spending Trade Balance	1998Q1–2017Q1	IFS Data
Malaysia	GDP Final Households Consumption Investment Final Government Spending Trade Balance	1996Q4–2017Q1	IFS Data				

Notes: Trade Balance is defined as (Exports - Imports)/GDP. Variables are seasonally adjusted by the X-12-ARIMA seasonal filter.

TABLE A.2. Price variables: Construction and sources

Variable	Construction	Source	Countries
Real Exchange Rate (RER)	–	BIS	All
Real Interest Rate (RIR)	Expected Inflation	FRED	USA
	International Interest Rate	FRED	USA
	CPI Inflation	FRED	USA
	Country Spread: EMBI+	GEM	All
	Country Spread: CDS	Datastream	Croatia

Notes: Initial observations for the RIR for Argentina, Mexico, and the Philippines are from Neumeyer and Perri (2005). For the rest of the sample, the country-specific RIR data are estimated by following Schmitt-Grohé and Uribe (2016), given by the sum of the Emerging Markets Bond Index Spread, as calculated by J.P. Morgan, and the 3-month US Treasury Bill, deflated by an estimated (AR(4)) expected dollar inflation (proxied by the CPI inflation). Variables are seasonally adjusted by the X-12-ARIMA seasonal filter.

TABLE A.3. Data used to construct our uncertainty measure

Country	Variables	Time span	Source
Argentina	Real GDP	1981Q1–2019Q1	GEM
Brazil	Real GDP	1990Q1–2019Q2	GEM
Bulgaria	Industrial production	1995M03–2019M07	GEM
Chile	Real GDP	1996Q1–2019Q2	GEM
Colombia	Real GDP	1994Q1–2019Q2	DANE and GEM
Croatia	Real GDP	1997Q1–2019Q2	IFS
Ecuador	Real GDP	1990Q1–2019Q1	GEM
Hungry	Real GDP	1995Q1–2019Q2	GEM
Malaysia	Real GDP	1994Q1–2019Q2	IFS
Mexico	Real GDP	1981Q1–2019Q2	GEM
Peru	Industrial production	1991M01–2019M06	GEM
Philippines	Real GDP	1981Q1–2019Q2	GEM
Poland	Industrial production	1991M01–2019M06	GEM
Russia	Real GDP	1995Q1–2019Q2	GEM
South Africa	Industrial production	1991M01–2019M06	GEM
Thailand	Real GDP	1993Q1–2019Q2	GEM
Turkey	Real GDP	1981Q1–2019Q2	GEM

Note: Industrial production is used to calculate quarterly growth rates of industrial production in Bulgaria, Peru, Poland, and South Africa.

APPENDIX B

B.1. BAYESIAN ESTIMATION

B.1.1. Computing the BPT-VAR. Following Chen and Lee (1995), we interpret the nonlinear system as a change-point problem and estimate the parameters using a

Metropolis-Within-Gibb sampling scheme. Let $\Phi_c^r = \{\boldsymbol{\beta}_c^r, \boldsymbol{\gamma}_c^r, \bar{\boldsymbol{\beta}}^r\}$ be a vector containing the VAR parameters in regime r for country c. The conditional posterior probability function of $\mathcal{Y}_c^*$ is

$$p(\mathcal{Y}_c^* | \boldsymbol{\Phi_c^1}, \boldsymbol{\Phi_c^2}, \boldsymbol{\Sigma_c^1}, \boldsymbol{\Sigma_c^2}, d_c, \lambda^1, \lambda^2, \mathbf{Y}_c) \propto \prod_{j=1}^{r} |\Sigma_c^j|^{T_c^{(j)}/2} \times \exp\left\{-\frac{1}{2}[\mathbf{u_c}^{(j)}]'(\Sigma_c^j \otimes \mathbf{I}_{Tj})[\mathbf{u_c}^{(j)}]\right\}, \tag{B1}$$

where $\mathbf{u_c}^{(j)} = \mathbf{y}_c - (\mathbf{I}_m \otimes \mathbf{X}_c)\beta_c^j - (\mathbf{I}_m \otimes \mathbf{Z}_c)\gamma_c^j$. The joint posterior of the parameters conditioning on a specific regime is proportional to

$$p(\boldsymbol{\beta}_c^r, \boldsymbol{\gamma}_c^r, \bar{\boldsymbol{\beta}}^r, \Sigma_c^r, \lambda_r, \mathcal{Y}_c^*, d_c | \mathbf{Y}_c) \propto p(\boldsymbol{\beta}_c^r, \boldsymbol{\gamma}_c^r, \bar{\boldsymbol{\beta}}^r, \Sigma_c^r, \lambda_r, \mathcal{Y}_c^*, d_c) \cdot p(\mathbf{Y} | \boldsymbol{\beta}_c^r, \bar{\boldsymbol{\beta}}^r, \Sigma_c^r, \lambda_r, \mathcal{Y}_c^*, d_c).$$

For each country c, the conditional posterior probability of d_c is a multinomial distribution with probability given by:

$$p(d_c | \boldsymbol{\Phi_c^1}, \boldsymbol{\Phi_c^2}, \boldsymbol{\Sigma_c^1}, \boldsymbol{\Sigma_c^2}, d_c, \lambda^1, \lambda^2, \mathbf{Y}_c) = \frac{L(\mathbf{y}_c | d_c, \Theta/d_c)}{\sum_{d_c=1}^{D_c} L(\mathbf{y}_c | d_c, \Theta/d_c)},$$

where $L(\cdot)$ denotes the likelihood function and Θ is the set of all parameters in the model,

$$\Theta = \left\{\{\boldsymbol{\beta}_c^1, \boldsymbol{\beta}_c^2, \boldsymbol{\gamma}_c^1, \boldsymbol{\gamma}_c^2, \boldsymbol{\Sigma}_c^1, \boldsymbol{\Sigma}_c^2, \mathcal{Y}_c^*, d_c\}_{c=1}^C, \bar{\boldsymbol{\beta}}^1, \bar{\boldsymbol{\beta}}^2, \bar{\boldsymbol{\Sigma}}^1, \bar{\boldsymbol{\Sigma}}^2, \lambda^1, \lambda^2, \omega, \bar{\mathcal{Y}}^*\right\}.$$

B.1.2. Bayesian estimation: Metropolis-Within-Gibbs Algorithm. The algorithm starts with individual OLS estimations of linear-VARs, keeping $\boldsymbol{\Sigma}_c$, $\boldsymbol{\Lambda_c}$, and $\boldsymbol{\beta_c}$, the starting values $\bar{\boldsymbol{\beta}} = \frac{1}{C}\sum_{c=1}^{C} \boldsymbol{\beta}_c^{ols}$ and $\bar{\boldsymbol{\Sigma}} = \frac{1}{C}\sum_{c=1}^{C} \boldsymbol{\Sigma}_c^{ols}$, and the initial conjectures for the remainder parameters. The Gibbs sampling with a Metropolis step is performed as follows:

1. Draw using $p(\omega | \Theta/\omega, \mathbf{Y})$

$$\omega | \Theta/\omega, \mathbf{Y} \sim IG_2\left(s_0 + \sum_{c=1}^{C}\left[\mathcal{Y}_c^* - \bar{\mathcal{Y}}^*\right]' \boldsymbol{\Omega}_c^{-1}\left[\mathcal{Y}_c^* - \bar{\mathcal{Y}}^*\right], v_0 + C\right).$$

2. Draw using $p(\lambda_r | \Theta/\lambda_r, \mathbf{Y})$, for regime r, where

$$\lambda_r | \Theta/\omega, \mathbf{Y} \sim IG_2\left(s_0 + \sum_{c=1}^{C}\left[\boldsymbol{\beta}_c^r - \bar{\boldsymbol{\beta}}^r\right]' \boldsymbol{\Lambda}_c^{-1}\left[\boldsymbol{\beta}_c^r - \bar{\boldsymbol{\beta}}^r\right], v_0 + (C \times K)\right).$$

3. Draw from $p(\bar{\boldsymbol{\Sigma}}^r | \Theta/\bar{\boldsymbol{\Sigma}}^r, \mathbf{y}_c)$, where

$$p(\bar{\boldsymbol{\Sigma}}^r | \Theta/\bar{\boldsymbol{\Sigma}}^r, \mathbf{y}_c) \propto W\left(\left[\sum_{1}^{C}(\boldsymbol{\Sigma}_c^r)^{-1}\right]^{-1}, C\kappa\right),$$

where κ is the degrees of freedom.

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4. Draw from $p(\bar{\mathcal{Y}}^{*}|\Theta/\bar{\mathcal{Y}}^{*}, \mathbf{y}_c)$, where

$$\tilde{\mathbf{\Omega}} = \left(\frac{1}{\omega}\sum_{c=1}^{C}\mathbf{\Omega}_c^{-1}\right)^{-1}$$

$$\bar{\mathcal{Y}}^{*}|\Theta/\bar{\mathcal{Y}}^{*}, \mathcal{Y}_c^{*} \sim N(\tilde{\mathcal{Y}}^{*}, \tilde{\mathbf{\Omega}})$$

$$\tilde{\mathcal{Y}}^{*} = \left(\frac{1}{\omega}\sum_{c=1}^{C}\mathbf{\Omega}_c^{-1}\right)^{-1}\left(\frac{1}{\omega}\sum_{c=1}^{C}\mathbf{\Omega}_c^{-1}\mathcal{Y}_c^{*}\right)^{-1}.$$

5. Draw using $p(\bar{\boldsymbol{\beta}}_r|\Theta/\bar{\boldsymbol{\beta}}_r, \mathbf{Y})$, where

$$\bar{\boldsymbol{\beta}}_r|\Theta/\bar{\boldsymbol{\beta}}_r, \mathbf{Y} \sim N(\bar{\bar{\boldsymbol{\beta}}}_r, \mathbf{\Lambda}^{r,1})$$

$$\bar{\bar{\boldsymbol{\beta}}}_r = \left(\frac{1}{\lambda_r}\sum_{c=1}^{C}(\mathbf{\Lambda}_c)^{-1} + \mathbf{\Lambda}_0{}^{-1}\right)^{-1}\left(\frac{1}{\lambda_r}\sum_{c=1}^{C}(\mathbf{\Lambda}_c)^{-1}\boldsymbol{\beta}_c + \mathbf{\Lambda}_0{}^{-1}\boldsymbol{\beta}_0\right)$$

$$\mathbf{\Lambda}^{r,1} = \left(\frac{1}{\lambda_r}\sum_{c=1}^{C}(\mathbf{\Lambda}_c)^{-1} + \mathbf{\Lambda}_0{}^{-1}\right)^{-1}.$$

6. Draw using $p(\boldsymbol{\beta}_c^r|\Theta/\boldsymbol{\beta}_c^r, \mathbf{y}_c)$, and check for stability. Otherwise, discard it, where

$$\boldsymbol{\beta}_r|\Theta/\boldsymbol{\gamma}_r, \mathbf{y}_c \sim N(\bar{\boldsymbol{\beta}}_c^r, \mathbf{\Lambda}^{r,2})$$

$$\bar{\boldsymbol{\beta}}_c^r = \left((\mathbf{\Sigma}_c^r)^{-1} \otimes \boldsymbol{X}_c{}'\boldsymbol{X}_c + (\mathbf{\Lambda}^{r,2})^{-1}\right)^{-1}\left(\boldsymbol{I} \otimes \boldsymbol{X}_c{}'\right)$$

$$\left((\mathbf{\Sigma}_c^r)^{-1} \otimes \boldsymbol{I})(\boldsymbol{y}_c - (\boldsymbol{I} \otimes \mathbf{Z}_c))\boldsymbol{\gamma}_c^r + (\lambda_r\mathbf{\Lambda}_c)^{-1}\bar{\boldsymbol{\beta}}^{\boldsymbol{r}}\right)$$

$$\mathbf{\Lambda}^{r,2} = \left((\mathbf{\Sigma}_c^r)^{-1} \otimes \boldsymbol{X}_c{}'\boldsymbol{X}_c + (\lambda_r\mathbf{\Lambda}_c)^{-1}\right)^{-1}.$$

7. Draw using $p(\boldsymbol{\gamma}_r|\Theta/\boldsymbol{\gamma}_r, \mathbf{y}_c)$, where

$$\boldsymbol{\gamma}_r|\Theta/\boldsymbol{\gamma}_r, \mathbf{y}_c \sim N(\bar{\boldsymbol{\gamma}}_c^r, \mathbf{\Lambda}^{r,3})$$

$$\bar{\boldsymbol{\gamma}}_c^r = \left((\mathbf{\Sigma}_c^r)^{-1} \otimes \mathbf{Z}_c{}'\mathbf{Z}_c\right)^{-1}\left((\mathbf{\Sigma}_c^r)^{-1} \otimes \mathbf{Z}_c{}'\right)\left(\boldsymbol{y}_c - (\boldsymbol{I} \otimes \boldsymbol{X}_c)\boldsymbol{\beta}_c^r\right)$$

$$\mathbf{\Lambda}^{r,3} = \left((\mathbf{\Sigma}_c^r)^{-1} \otimes \mathbf{Z}_c{}'\mathbf{Z}_c\right)^{-1}.$$

8. Draw using $p(\Sigma_c^r|\Theta/\Sigma_c^r, \mathbf{y}_c)$, where

$$\Sigma_c^r|\Theta/\Sigma_c^r, \mathbf{y}_c \propto \mathrm{IW}\left((\boldsymbol{u}_c^r)'(\boldsymbol{u}_c^r) + \bar{\mathbf{\Sigma}}^r, T_c^r + \kappa\right).$$

9. Draw using $p(\mathcal{Y}_c^{*}|\Theta/\mathcal{Y}_c^{*}, \mathbf{y}_c)$ using a random walk Metropolis–Hastings algorithm together with the prior (8) and the country-specific joint likelihood. The posterior distribution is a truncated normal in which the drawing values of $\mathcal{Y}_c^{*}$ are restricted so that there will be at least four observations in the bad regime, and the economy will not be in the good regime (i.e., $\mathcal{Y}_c^{*} < 1$, given our definition). Otherwise, discard the draw. The prior variance, $\mathbf{\Omega}_c$, is tuned so that the idiosyncratic acceptance rate lies between 0.2 and 0.4.

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10. Draw using $p(d_c|\Theta/d_c, \mathbf{y}_c)$ from a discrete distribution, with candidates $d_c = 1, 2, 3, 4$. The algorithm is provided by Chen and Lee (1995).
11. Repeat steps 6–10 for $c = 1, \ldots, C$.
12. Repeat steps 2–11 for $r = 1, 2$.

We run the sampler with 1,000,000 draws, discarding the first 100,000 to minimize the effects of the initial values, and saving every 50-th draw for inference.

B.1.3. Nonlinear impulse responses. To capture the nonlinear nature of the TVARs, we use the nonlinear (generalized) impulse response (GIRF) proposed by Koop et al. (1996), defined as

$$GIRF_y(h, \varepsilon_t, \mathcal{H}_{t-1}) = E[Y_{t+h}|\varepsilon_t, \mathcal{H}_{t-1}] - E[Y_{t+h}|\mathcal{H}_{t-1}], \quad \textbf{(B2)}$$

where h is the length of the simulation horizon, and $\mathcal{H}_{t-1}$ is the history in period t. The GIRFs are defined so that the regime can change over the horizon.

APPENDIX C

C.1. NONLINEAR IRFS FOR A NEGATIVE GOVERNMENT SPENDING SHOCK

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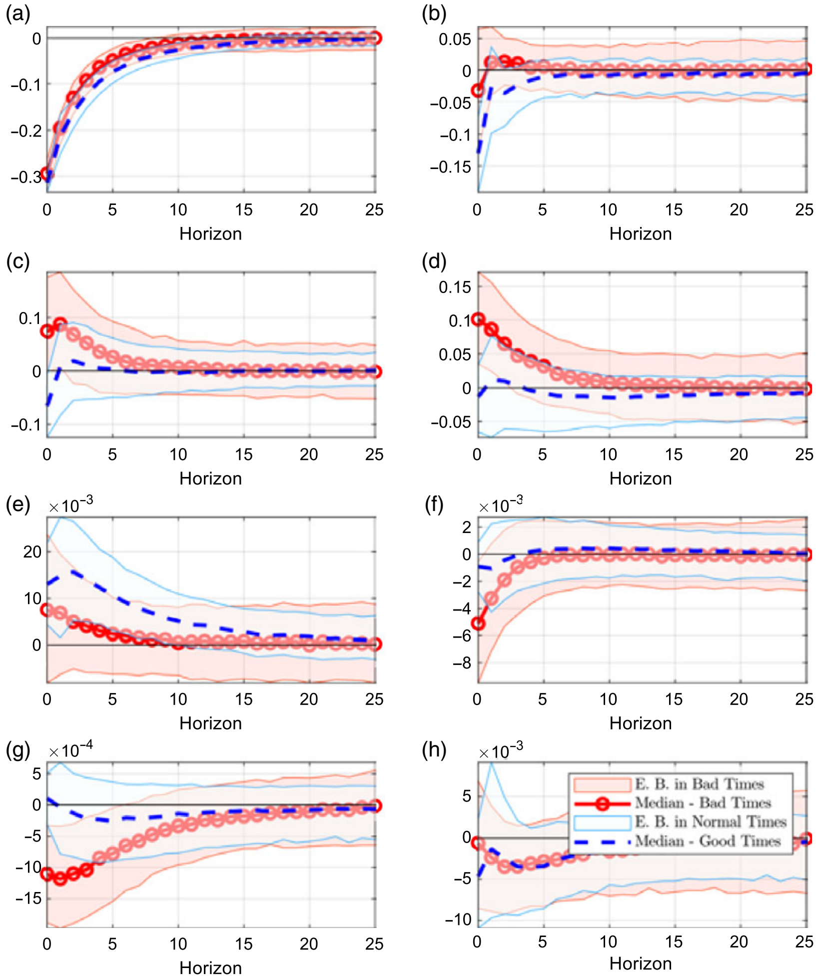

FIGURE C.1. Nonlinear impulse responses from a negative government spending shock. (a) Government spending shocks. (b) GDP responses. (c) Consumption responses. (d) Investment responses. (e) TB responses. (f) RER responses. (g) RIR responses. (h) Spillover effects.

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APPENDIX D

D.1. ROBUST EXERCISES

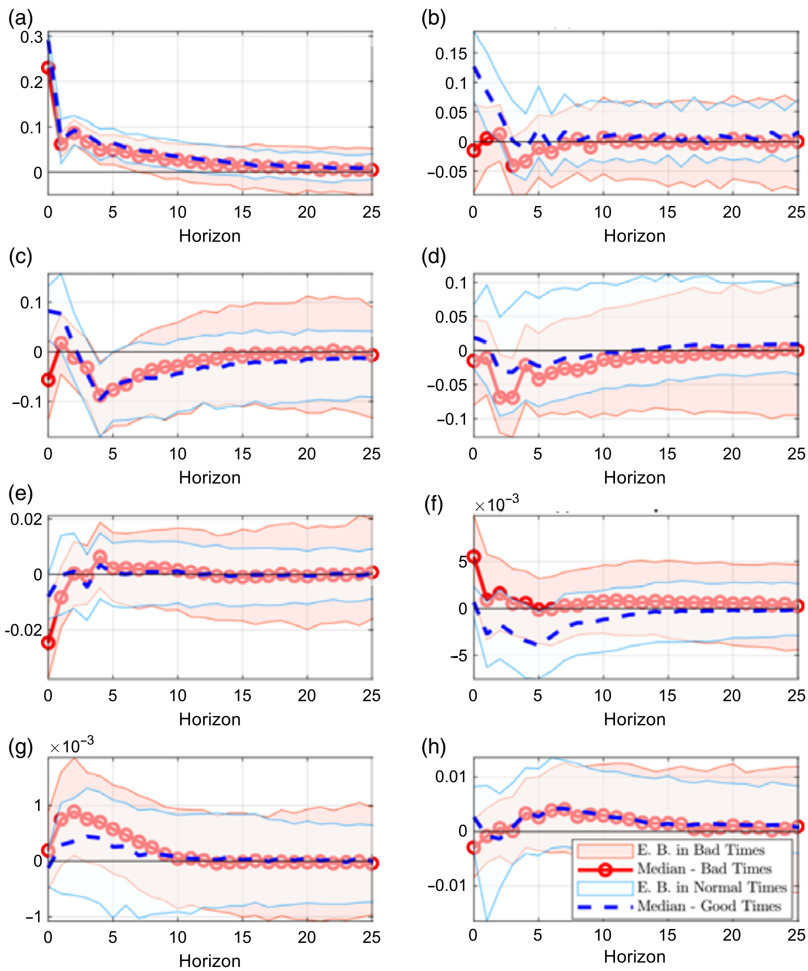

FIGURE D.1. Nonlinear impulse responses in the BPT-VAR with 4 lags. (a) Government spending shocks. (b) GDP responses. (c) Consumption responses. (d) Investment responses. (e) TB responses. (f) RER responses. (g) RIR responses. (h) Spillover effects.

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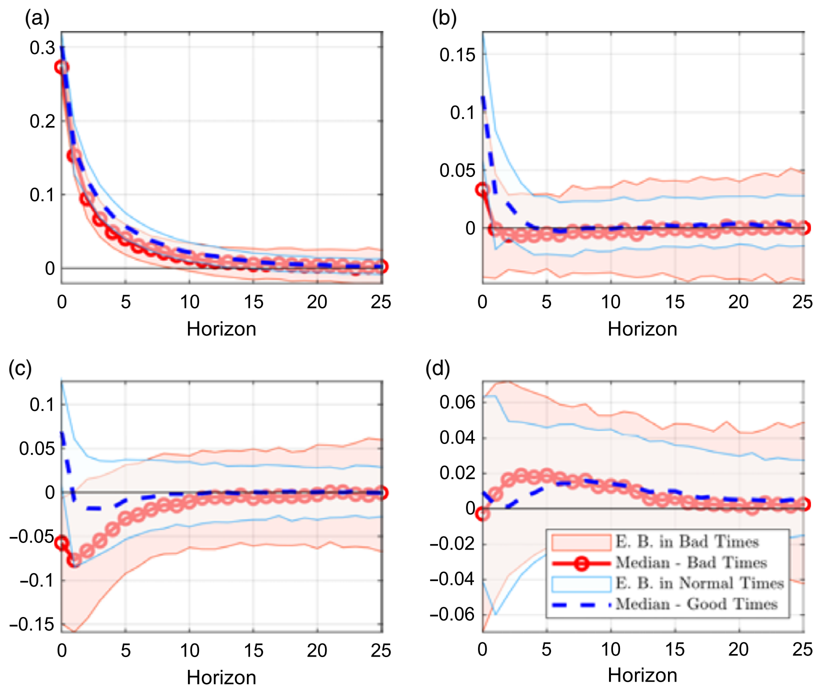

FIGURE D.2. Nonlinear impulse responses from a shock to government spending—HP-Filter. (a) Government spending shocks. (b) GDP responses. (c) Consumption responses. (d) Investment responses.

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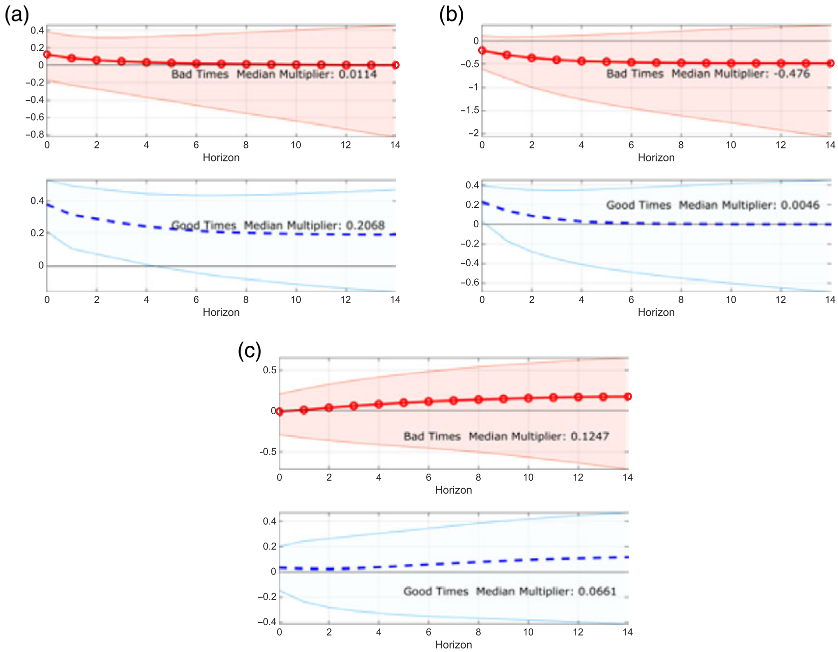

FIGURE D.3. Multipliers using HP-filter. (a) GDP multipliers using HP-filter. (b) Consumption multipliers using HP-filter. (c) Investment multipliers using HP-filter.

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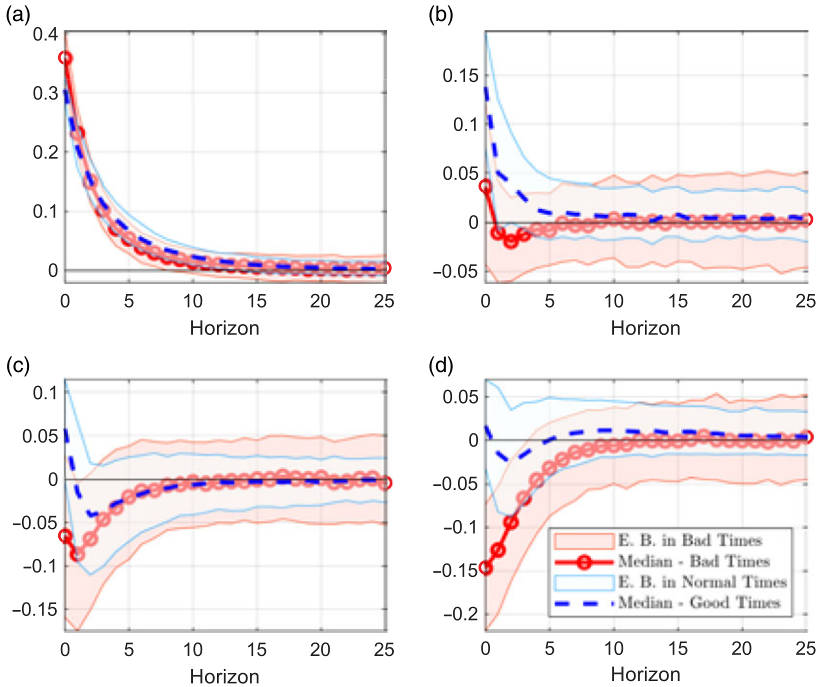

FIGURE D.4. Nonlinear impulse responses from a shock to government spending—5th-degree filter. (a) Government spending shocks. (b) GDP responses. (c) Consumption responses. (d) Investment responses.

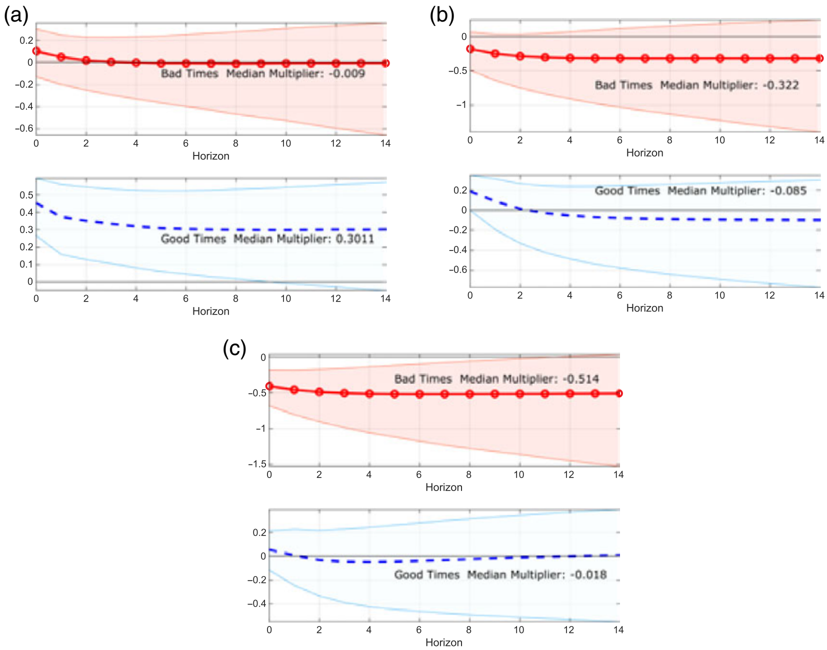

FIGURE D.5. Multipliers using a 5th-degree filter. (a) GDP multipliers using a 5th-degree filter. (b) Consumption multipliers using a 5th-degree filter. (c) Investment multipliers using a 5th-degree filter.

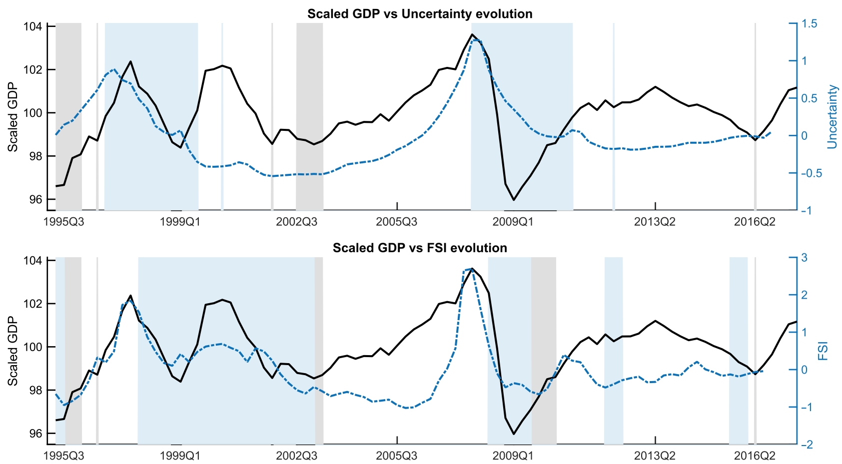

FIGURE D.6. Regime switching implied by different transition variables in the "typical" EM. Gray-shaded area is the "bad regime" when the switching variable is the scaled GDP. Blue-shaded area is "bad regime" labeled by the uncertainty measure or the FSI.

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D.2. FSI AS A SWITCHING VARIABLE

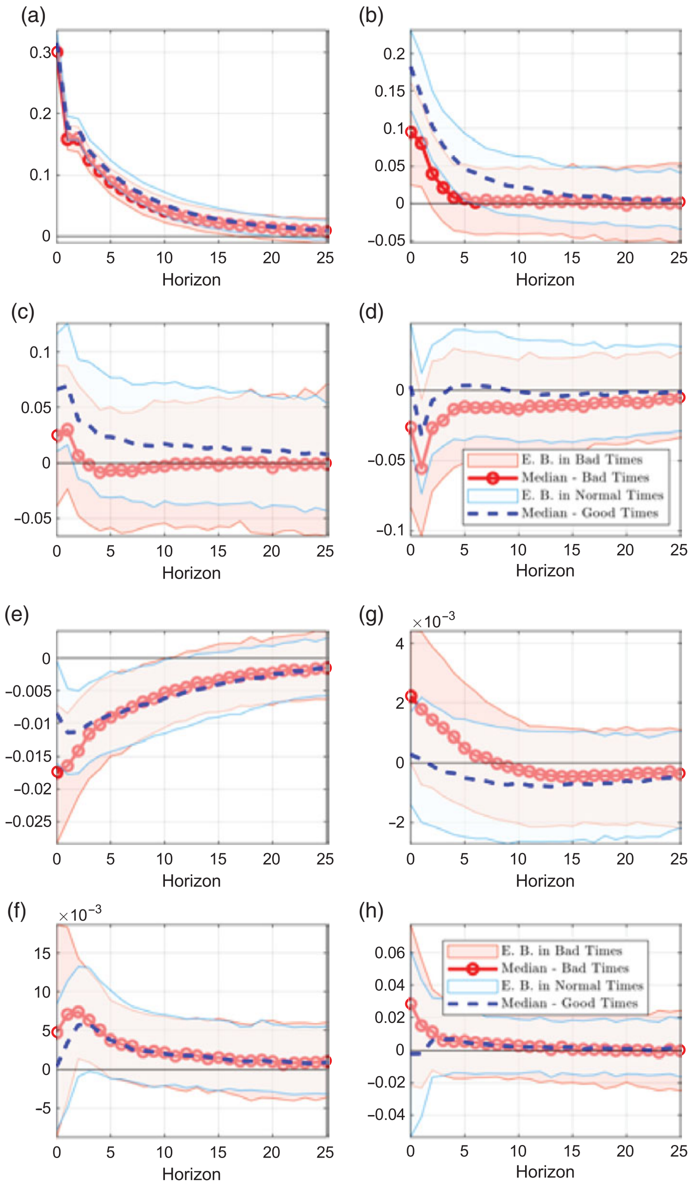

FIGURE D.7. Nonlinear impulse responses from a shock to government spending from the BTP-VAR. Switching variable: FSI—Error Band (E.B.): 68%. (a) Government spending shocks. (b) GDP responses. (c) Consumption responses. (d) Investment responses. (e) TB responses. (f) RER responses. (g) FSI responses. (h) Uncertainty responses.

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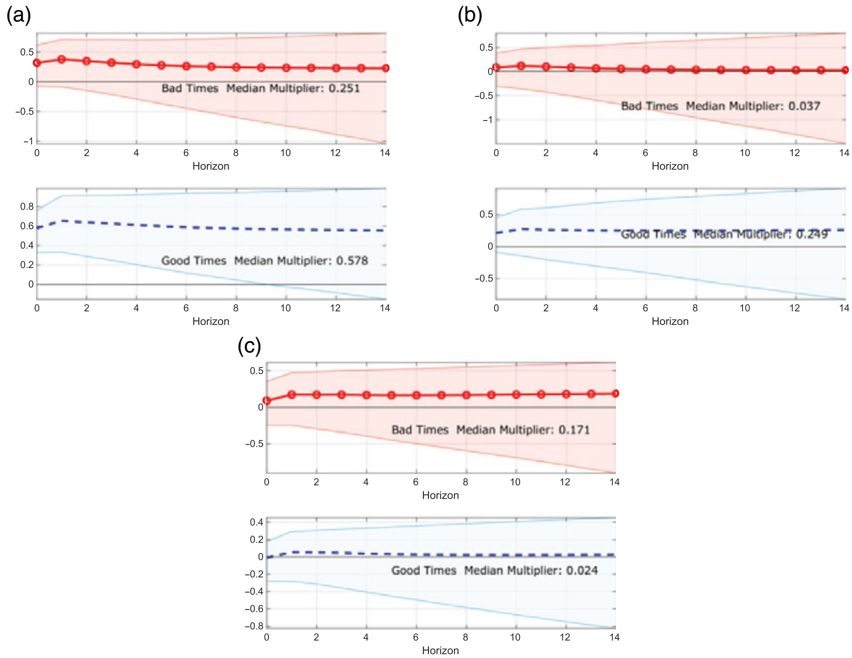

FIGURE D.8. Implied multipliers when the switching variable is the FSI—Error Band (E.B.): 68%.

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D.3. UNCERTAINTY MEASURE AS SWITCHING VARIABLE

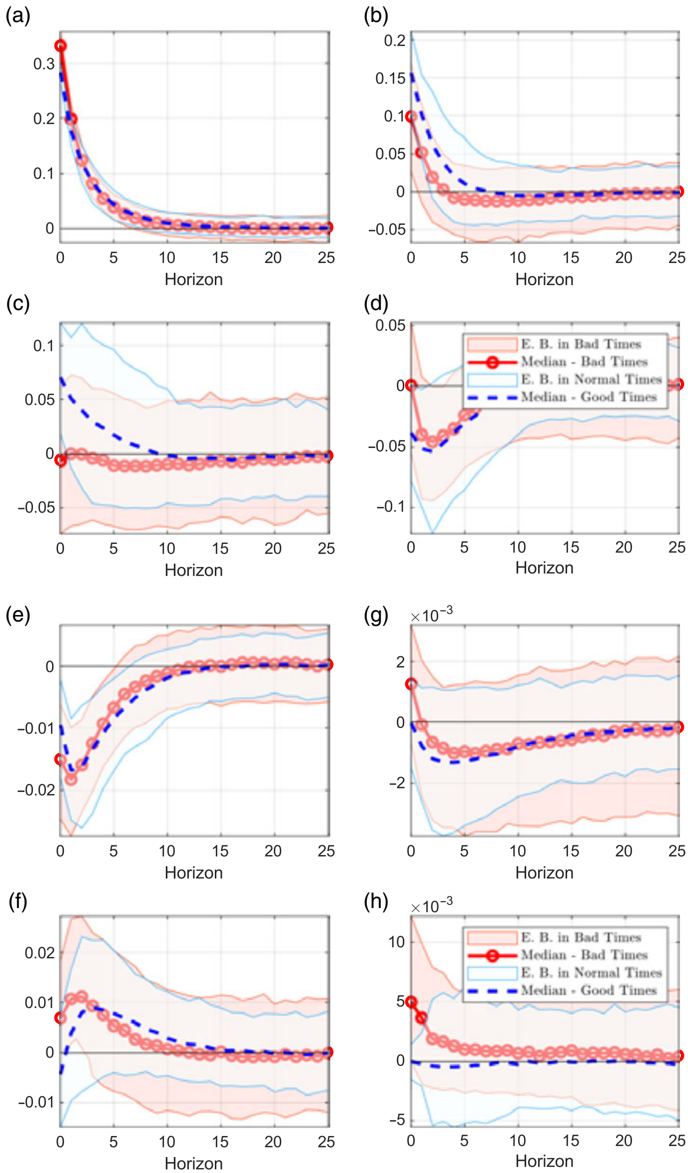

FIGURE D.9. Nonlinear impulse responses from a shock to government spending from the BTP-VAR. Switching variable: Uncertainty measure—Error Band (E.B.): 68%. (a) Government spending shocks. (b) GDP responses. (c) Consumption responses. (d) Investment responses. (e) TB responses. (f) RER responses. (g) FSI responses. (h) Uncertainty responses.

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D.4. GROWTH RATES

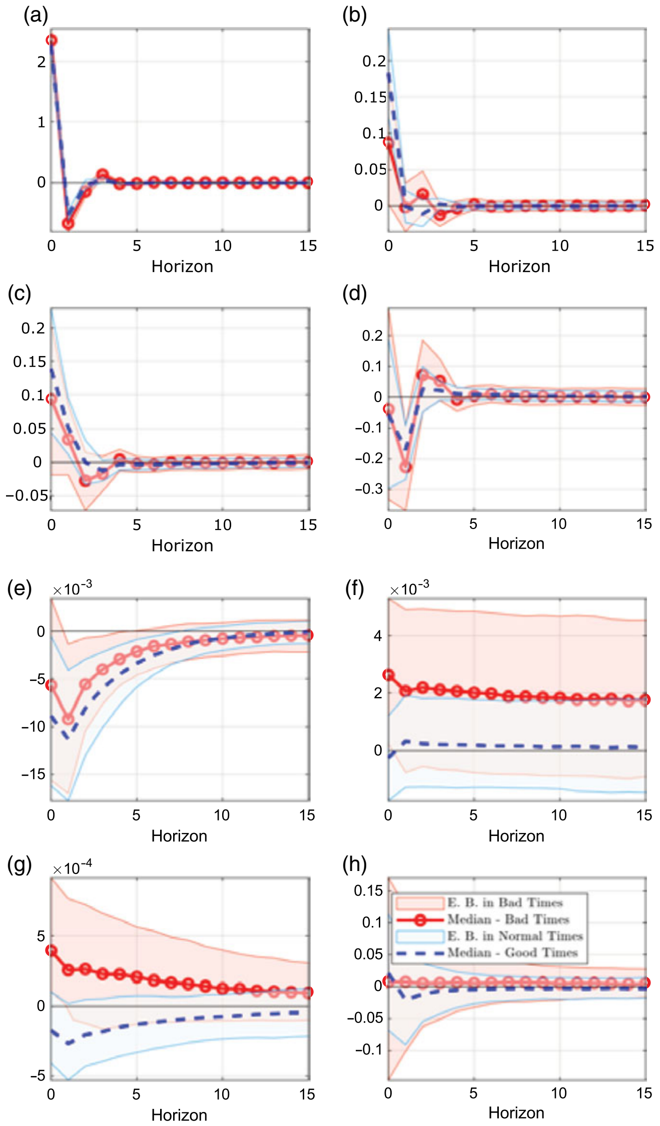

FIGURE D.10. Nonlinear impulse responses from a shock to government spending from the BTP-VAR. Macrovariables in growth rates. Switching variable: FSI—Error Band (E.B.): 68%. (a) Government spending shocks. (b) GDP responses. (c) Consumption responses. (d) Investment responses. (e) TB responses. (f) RER responses. (g) FSI responses. (h) Spillover effects.

https://doi.org/10.1017/S136510052000036X Published online by Cambridge University Press

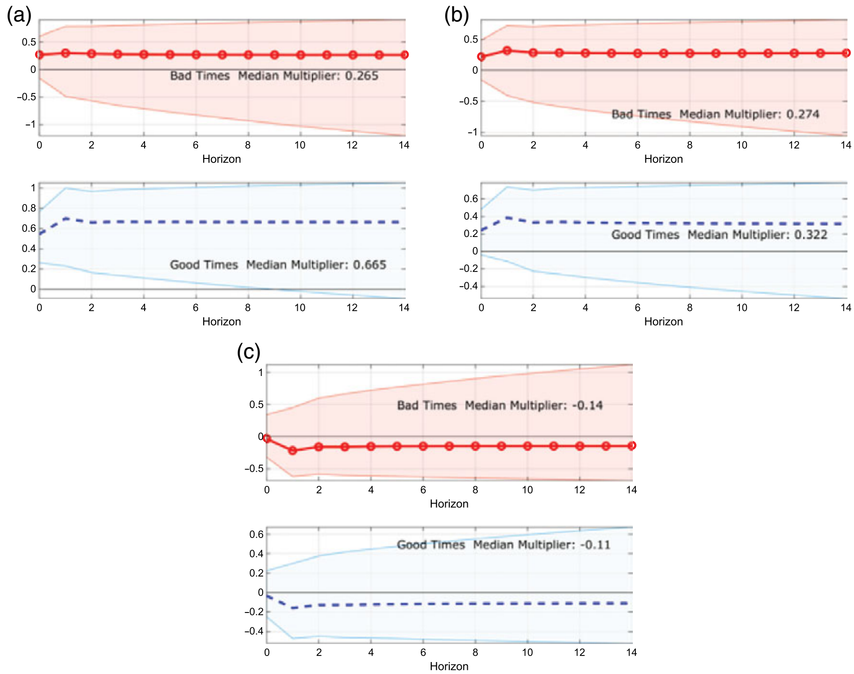

FIGURE D.11. Implied multipliers when macrovariables are measured in growth rates and the switching variable is the FSI—Error Band (E.B.): 68%.

https://doi.org/10.1017/S136510052000036X Published online by Cambridge University Press