ALI ALICHI
International Monetary Fund, United States

IPPEI SHIBATA
International Monetary Fund, United States

KADIR TANYERI
International Monetary Fund, United States

Fiscal Policy Multipliers in Small States

ABSTRACT This paper estimates fiscal policy multipliers for small states using two distinct models: an empirical forecast error model with data from twenty-three small states across the world, and a dynamic stochastic general equilibrium (DSGE) model calibrated to a hypothetical small state's economy. We find that, in the short term, multipliers for government consumption and investment in small states are both about 0.4, on average, for empirical and DSGE baseline results, and they are affected by imports as a share of GDP, the level of government debt, and the economy's position in the business cycle, among other factors. In the medium to long run, while fiscal policy using government consumption is ineffective, government investment has a multiplier of about 0.7, on average, for empirical and DSGE baseline results. These results are robust to different model specifications and characteristics of small states. Inability to affect GDP using government consumption could be frustrating for policymakers when an expansionary policy is needed but encouraging when they consider fiscal consolidation.

JEL Codes: E62, C3

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The International Monetary Fund (IMF) defines thirty-four developing member countries with populations of fewer than 1.5 million to be small states.[1] These small states are spread across Africa, Asia, the Caribbean, and Europe. Small states are characterized by limited economic scale, including small populations, narrow production bases, and limited opportunities for diversification. A small population base implies low demand for services and

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1. The definition of small states in this paper follows IMF (2017). This definition differs slightly from the World Bank's definition of small states, which includes fifty countries that have a population of 1.5 million or fewer or are members of the Small States Forum—a high-level meeting of policymakers hosted by the World Bank during the IMF-World Bank Annual Meetings (World Bank, 2016). For more information, see World Bank in Small States: Overview (www.worldbank.org/en/country/smallstates/overview).

limited interest from international investors in the country. Some small states struggle with geographic remoteness and are also more prone to experience the effects of climate change and natural disasters.

Many small states have had large overall fiscal deficits over the past three decades. As a percentage of gross domestic product (GDP), average government expenditures in these countries have been increasing over time, diverging from government tax revenues, which have increased only slightly (IMF, 2018b). Following the global financial crisis of 2008–09, government deficits in small states have remained high in response to various exogenous shocks, including commodity price increases, natural disasters, and exchange rate depreciations. The increase in government spending has been mostly in current government spending, while capital spending has remained modest (IMF, 2018b). Low investment content would have lasting negative effects on the economy.

For many small states, fiscal consolidation is necessary to put public finances on a sustainable path and open fiscal space to confront future adverse economic shocks. However, the first question that policymakers usually ask when considering fiscal consolidation is how it would affect GDP growth. This paper provides an answer to this question by estimating fiscal policy multipliers—the impact of fiscal policy on GDP—for small states.

The high import share of GDP in small states points to possibly lower fiscal multipliers than in the case of larger developing and advanced economies. This could be because small states are generally more open than larger economies. In a standard textbook Mundell-Fleming model, the fiscal multiplier in a more open economy would be lower because part of the increase in aggregate demand that is boosted by fiscal policy would be spent on imports, reducing net exports. Empirical evidence on larger countries supports this conjecture. Ilzetzki, Mendoza, and Végh (2013) show that fiscal multipliers in open economies are indeed smaller than in closed economies.

Higher government debt levels of small states also point to possibly lower multipliers than other countries.[2] While the literature is very thin on small states, Ilzetzki, Mendoza, and Végh (2013) show for larger countries that fiscal

2. Average gross (external) debt for small states in 2018 was 58.7 (53.9) percent of GDP, whereas larger developing economies had average gross (external) debt of 53.2 (47.8) percent. There are several reasons why small states might have a high level of debt, including their exposure to natural disasters, vulnerability to external shocks, and shallow financial systems.

multipliers in high-debt economies are negative (while those of low-debt economies are positive). This is because for countries with high government debt levels, an increase in government spending could signal fiscal tightening in the near future and dampen the fiscal multiplier impact.

The main contribution of this paper is to estimate fiscal policy multipliers in small states using two distinct models: an empirical model, which we argue is more reliable than prior ones, and an open economy dynamic stochastic general equilibrium (DSGE) model. The empirical model uses the forecast error and a local projection method, as in Jordà (2005), to estimate the causal impact of a change in government consumption or government investment on GDP—namely, fiscal multipliers.[3] The DSGE model in this paper is the IMF global integrated monetary and fiscal (GIMF) model, which we calibrate to a hypothetical small open economy. The results suggest that in the short term, which we define as two years from the initial shock (with 0 being the initial impact year), the government consumption multiplier (on the level of GDP) is about 0.3 using our empirical model and about 0.6 using our GIMF model (average of 0.4, over the two models). Short-term government investment multipliers are estimated at 0.1 using our empirical model, and 0.7 using our GIMF model (average of 0.4). In the medium term (defined in this paper as three to four years), the government consumption multipliers are around zero, while the government investment multipliers are around 0.7, on average, in both the empirical and GIMF models. Sensitivity analysis shows that the GIMF multipliers could be smaller or larger depending on many factors, including imports as a share of GDP, the level of government debt, and the economy's position in the business cycle.

3. Owing to a lack of data, we are not able to separate government consumption and transfers for most small states in our sample. Therefore, in our empirical work (only), we use the concept of government current primary spending, which is total government spending minus investment and interest expenses—in other words, government consumption plus transfers. In our GIMF simulations, we separate government consumption and transfers. We do not estimate tax multipliers in our empirical model, since tax revenues are known to be highly endogenous to the conditions of the economy, and even our forecast error methods cannot account for the endogeneity issues in tax revenues (Furceri and others, 2018). This is because tax reforms and other discretionary changes to taxes are very infrequent in all countries. In most years, most of the changes in tax/GDP are due to automatic stabilizers built into the tax systems. On the other hand, discretionary fiscal spending decisions change almost every year in almost all countries, for example, in the context of annual budget processes. Moreover, the portion of spending that is affected by automatic stabilizers (such as the social protection portion) is generally a small part of the total spending.

Our findings of small government consumption multipliers and relatively large government investment multipliers in small states in the medium term are both in line with the existing literature. For example, Gonzalez-Garcia, Lemus, and Mrkaic (2013), Guy and Belgrave (2012), and Narita (2014) find similar results for a group of Caribbean countries using a structural vector autoregression (SVAR) and a dynamic panel framework. There is also a vast literature on estimating fiscal multipliers for larger countries. However, while there are many similarities in terms of methodology, the results of this strand of literature are of limited use for small states, given the aforementioned characteristics of these countries.

Our empirical approach has many advantages over previous studies for small states, making our multiplier estimates more reliable. Relative to the previous studies, this paper (1) has a larger sample size; (2) estimates flexible nonlinear fiscal multipliers via a local projection method; (3) does not rely on interpolating quarterly data from annual series; (4) mitigates, via a forecast error approach, the anticipation or foresight problem, in which agents change their behavior in anticipation of future changes in fiscal variables; (5) estimates state-dependent fiscal multipliers (expansion versus consolidation and boom versus recession); and (6) estimates fiscal multipliers for government consumption and investment separately (see our literature review below and the detailed explanation of the advantages of our empirical approach).[4]

The rest of the paper is organized as follows. The next section reviews the empirical model employed in this study. Subsequently we describe the data and present empirical results. After describing the GIMF model used in this study, we present the results from the GIMF model and compare the results with other studies. The final section concludes.

Empirical Model: The Forecast Error Approach

Our empirical model uses the forecast error approach. The idea behind this approach is that the forecast captures agents' anticipation of fiscal actions, and the deviation of reality from that forecast—that is, the forecast error—plausibly captures an unanticipated increase or decrease in government spending.

4. This anticipation or foresight problem could be severe when estimating fiscal multipliers using annual rather than quarterly data.

Identification of Fiscal Shocks Using WEO Vintage Data

For the fiscal variables and shocks, we use vintage data from past issues of the IMF's October publication of the *World Economic Outlook* (WEO), following Furceri and Li (2017). In the WEO, macroeconomic variables are reported at an annual frequency for IMF member countries, and forecasts are made by IMF staff for the projection years. In the October WEO, forecasts for that year are made based on all the information that is available to the IMF country teams. Forecast errors are constructed from government consumption and government investment, as a percentage of GDP. We calculate the unanticipated fiscal variable shock, $\text{FShock}^k_{j,t}$, as the difference between the actual and forecast fiscal variables:

$$\text{FShock}^k_{j,t} = f^{k,Actual}_{j,t} - f^{k,Forecast}_{j,t}, \tag{1}$$

where $f^k_{j,t} \equiv F^k_{j,t}/Y_{j,t-1}$ is a fiscal variable ($F^k_{j,t}$) of type $k \in \{I, C\}$ as a percentage of the previous year's GDP ($Y_{j,t-1}$). The fiscal variable is either actual ($f^{k,Actual}_{j,t}$), calculated based on the October WEO for the following year, or forecast ($f^{k,Forecast}_{j,t}$), calculated based on the October WEO for the current year. For instance, the *forecast* of fiscal spending for 2015 is taken from the fiscal variable in the October 2015 WEO, and the *actual* fiscal variable is taken from the fiscal variable in the October 2016 WEO, for the year 2015.[5]

The unanticipated fiscal variable shock is the difference between the actual and the forecast fiscal variable, where the latter is based on the information set as of the October WEO of the current year. This mitigates the anticipation effect, in which agents in the economy change their consumption and investment behavior based on the news about future fiscal policies for the rest of the year.

5. This formulation of a fiscal shock, FShock, is the difference in the level of the fiscal variable divided by the previous year's GDP. It is analogous to the shock used by Furceri and Li (2017) because:

$$\begin{aligned}\text{FShock}^k_{j,t} &= \left(f^{k,Actual}_{j,t} - f^{k,Forecast}_{j,t}\right) = \frac{F^{k,Actual}_{j,t}}{Y_{j,t-1}} - \frac{F^{k,Forecast}_{j,t}}{Y_{j,t-1}} \\ &= \frac{F^{k,Actual}_{j,t} - F^k_{j,t-1}}{Y_{j,t-1}} - \frac{F^{k,Forecast}_{j,t} - F^k_{j,t-1}}{Y_{j,t-1}} \\ &= \frac{\Delta F^{k,Actual}_{j,t}}{Y_{j,t-1}} - \frac{\Delta F^{k,Forecast}_{j,t}}{Y_{j,t-1}}.\end{aligned}$$

This is because whatever agents in the economy have anticipated, given the information set as of October, is already embedded in the forecast of fiscal variables.

By using the forecast of fiscal variables in the October WEO of the same year, we also lower the endogenous response of fiscal policy to the state of the economy in annual data. While the government could still change government consumption or investment in response to the state of the economy, our framework imposes the same assumption used by Blanchard and Perotti (2002), in that fiscal variables do not correspond contemporaneously to the state of the economy within the final quarter of the year (that is, between October and December). Since policymakers in many small states generally have access to fewer timely indicators to learn about the state of the economy than in larger economies, this timing assumption can be even more plausible in small states than in larger countries.

While our framework lowers endogeneity, it does not fully remove it. Government spending in many small states could respond to the state of the economy, for instance, by cutting spending in response to lower tax revenues arising from slow growth. However, as a check, we control for tax revenues and find that our results are robust.

Our forecast error approach employs the local projection method following Jordà (2005), in a similar spirit to Auerbach and Gorodnichenko (2013). The growth impacts of fiscal shocks are estimated using the following baseline specification:

$$(2) \qquad y_{j,t+h,t-1} = \alpha_j^h + \gamma_y^h + \beta_I^h \text{FShock}_{j,t}^I + \beta_C^h \text{FShock}_{j,t}^C + \delta^h \mathbf{X}_{j,t} + \varepsilon_{I,t}^h,$$

where $y_{j,t+h,t-1}$ is the GDP growth rate between year $t-1$ and $t+h$ for country j; α_j is a country-specific fixed effect capturing factors that are time invariant; γ_t is the time fixed effect capturing global factors (for example, commodity price movements) that affect a country's growth in year t; $\text{FShock}_{j,t}^I$ and $\text{FShock}_{j,t}^C$ are the unanticipated fiscal variable shocks as a percentage of GDP for government investment and government consumption, respectively; and $\mathbf{X}_{i,t}$ is the set of control variables, including two lags of the GDP growth rate, two lags of each fiscal variable (in levels) as a percentage of GDP, the cumulative future fiscal variable shocks between years $t+1$ and $t+h$ (that is, $\sum_{l=1}^{h} \text{FShock}_{j,t+l}^k$ for each type $k \in \{I, C\}$), and a natural disaster variable that captures the damages due to natural disasters as a percentage of GDP.[6]

6. In our baseline specification, the fiscal variables are divided by the previous year's GDP. However, the results are robust to a specification in which the fiscal variables are divided by the current year's GDP.

We include the cumulative future fiscal variable shocks occurring within the forecast horizon between t and $t + h$, $\sum_{l=1}^{h} \text{FShock}_{j,t+l}^{k}$, to avoid the biases pointed out by Teulings and Zubanov (2014).

Data

We use annual data for 1990–2017 from the IMF's *World Economic Outlook* (WEO) database. Since our local projection method uses two lags and four leads, our effective sample for estimation is from 1992 to 2013. Moreover, the panel is unbalanced due to the unavailability of data on fiscal variables for some periods for most countries. For our main empirical analysis, our small state sample is based on the IMF definition of small states (thirty-four countries). We further limit our sample by excluding some countries based on (1) insufficient data, (2) unreliable data (for example, negative government investment as a percentage of GDP), or (3) extremely large variance in government investment shocks, government consumption shocks, or GDP growth rates.[7] These restrictions reduce the number of small states for our empirical work to twenty-three, consisting of five countries from Africa, six from Asia, eleven from the Caribbean, and one from Europe (see table A1 in the online appendix).[8]

We use the October 2018 WEO to calculate the real GDP growth rate based on the real GDP series, *ngdp_r*. This is to avoid any possible measurement errors that may arise from data revision and updates of the compilation methodology. We then use the vintage IMF WEO database to calculate relevant variables. Government investment uses the series *gcek* prior to 2010 and

7. Based on the first two elimination criteria, East Timor, Maldives, Nauru, Palau, and Saint Lucia were excluded from the sample. For the third elimination criterion, non-Caribbean countries were dropped from the sample if (a) a standard deviation of government investment was above 15 percent of GDP or (b) a standard deviation of government consumption was higher than 20 percent of GDP. For Caribbean countries, observations were eliminated from the regression sample by putting outlier dummies if government investment shock was outside (–10, 10) percent of GDP or government consumption shock was outside (–15, 20) percent of GDP. These thresholds were calculated to include the ninety-eighth percentile of the respective variables. These outliers could reflect measurement errors and possible data revisions of government statistics or of the WEOs. Based on the third elimination criterion, Djibouti, Kiribati, Samoa, São Tomé and Príncipe, Tuvalu, and Vanuatu were eliminated. The paper's results are robust to large variations in these thresholds (not reported).

8. Supplementary material for this paper is available online at http://economia.lacea.org/contents.htm.

ggaan_t after 2010. Government consumption uses the current expenditure series *gcec* prior to 2000; thereafter it is total general government expense, *gge*, less interest payments, *ggei*.[9] Natural disaster damage data were obtained from EM-DAT.

Empirical Results

The empirical results show that government consumption has a small but positive impact on growth only in the short term, with almost no effect on growth over the medium term. Figure 1 (panel A) plots the baseline impacts of government consumption on GDP from equation 2. An increase in government consumption by 1.0 percent of GDP would increase output by about 0.3 percent on impact, which peaks in the following year at around 0.4. Over time, the impact of an increase in government consumption on the level of GDP decreases to zero. In other words, a dollar spent on government consumption will increase GDP by around 30 cents on impact and 40 cents in the second year, but it does not have a prolonged impact. Thus, government consumption has only a small and short-term impact on GDP.

On the other hand, government investment has a small effect on GDP at impact but a relatively large medium-term effect (figure 1, panel B). The effect of government investment on GDP rises gradually to around 0.2 percent of GDP in the second year and to around 0.9 percent in the fourth year. In other words, a dollar spent on investment increases GDP by 20 cents in the second year and by about 90 cents in the fourth year.[10]

Expansion versus Consolidation

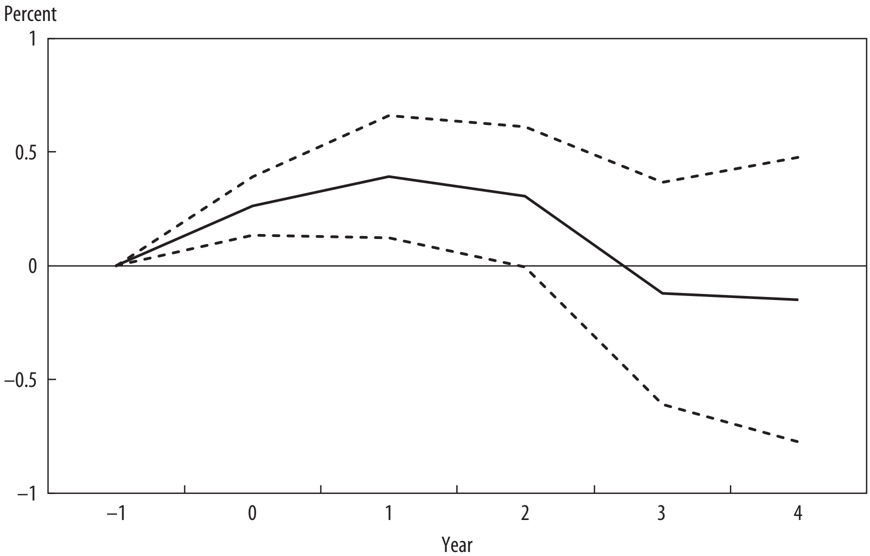
In this section, we investigate whether government spending has asymmetric effects on growth, depending on episodes of fiscal expansion or consolidation. In the local projection framework, this can be easily done by separating fiscal

9. As mentioned earlier, in the empirical part (only), government consumption is defined as government primary spending, which is government consumption plus transfers.

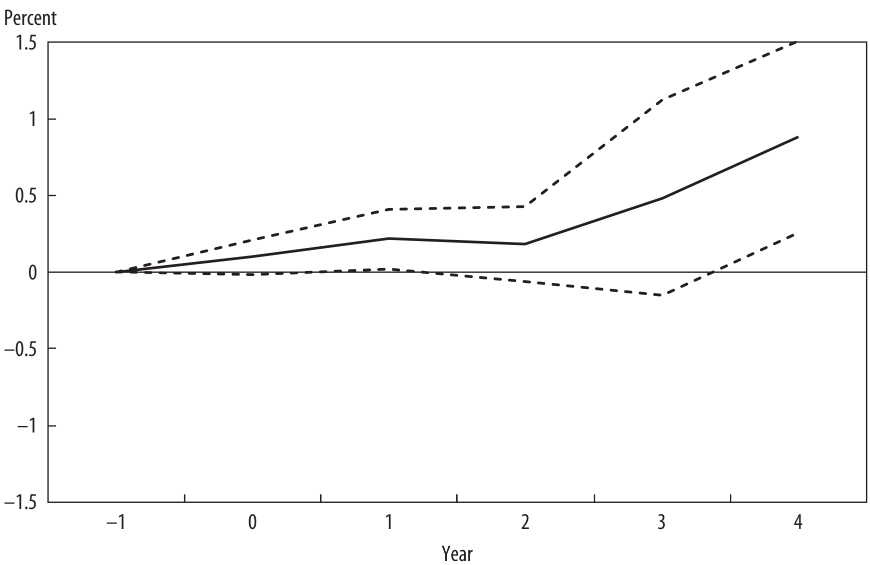
10. In our exercise, we do not calculate multipliers (as in Ramey and Zubairy, 2018) by dividing the cumulative changes in output by the cumulative change in the fiscal variable. We instead control future fiscal shocks in our regression and estimate the impact on GDP from the initial fiscal shock. Our fiscal multipliers are defined on the level of GDP in each period. We see this approach as more straightforward for calculating cumulative effects. We follow this definition throughout the paper, in both our empirical and GIMF models.

FIGURE 1. Empirical Results

A. Government consumption



B. Government investment



Source: Authors' estimates.

Note: The figures show the response of GDP to a positive shock in government consumption and government investment equivalent to 1 percent of GDP, together with the 90 percent confidence intervals.

TABLE 1. Consolidation versus Expansion and Recession versus Boom

Fiscal multiplier	*Baseline* *(1)*	*Consolidation* *(2)*	*Expansion* *(3)*	*Recession* *(4)*	*Boom* *(5)*
Government consumption					
Impact	0.265***	0.392**	0.101	0.598***	0.059
	(0.079)	(0.212)	(0.190)	(0.257)	(0.180)
Peak	0.393***	0.842***	–0.139	0.793*	0.110
	(0.163)	(0.354)	(0.239)	(0.487)	(0.356)
Government investment					
Impact	0.0973	–0.0889	0.264***	0.814***	–0.414**
	(0.068)	(0.154)	(0.124)	(0.312)	(0.217)
Peak	0.882***	0.541	1.064***	1.537***	1.201**
	(0.380)	(0.770)	(0.421)	(0.701)	(0.652)

Source: Authors' estimates.
* $p < 0.125$; ** $p < 0.10$; *** $p < 0.05$.
Note: Standard errors clustered at the country level are in parentheses.

shocks into positive (expansionary) and negative (consolidation) episodes. We extend the specification in equation 1 as follows:

$$(3) \qquad y_{j,t+h,t-1} = \alpha_j^h + \gamma_t^h + \beta_I^{h,Exp}\text{FShock}_{j,t}^{I,Exp} + \beta_C^{h,Exp}\text{FShock}_{j,t}^{C,Exp} + \beta_I^{h,Cons}\text{FShock}_{j,t}^{I,Cons} + \beta_C^{h,Cons}\text{FShock}_{j,t}^{C,Cons} + \delta^h\mathbf{X}_{j,t} + \varepsilon_{I,t}^h,$$

where $\text{FShock}_{j,t}^{k,Exp}$ contains only positive (expansionary) fiscal shocks, defined as in equation 2, and $\text{FShock}_{j,t}^{k,Cons}$ contains only negative (consolidation) fiscal shocks and is set to be zero otherwise.[11]

We find that the government's consumption multiplier is smaller for expansion episodes than for consolidation episodes (see table 1). This is consistent with the idea that an increase in government consumption, which would often result in an increase in public debt, may signal that fiscal tightening will happen in the near future, thus constraining the impact of fiscal expansion (Ilzetzki, Mendoza, and Végh, 2013). When a government increases its consumption, it does not boost GDP by much, either at impact or in the medium term.

11. As we divide the sample into two cases, the precision of the estimates becomes much weaker. To circumvent this problem, we also check the results for expansion versus consolidation and recession versus boom when we increase our sample size by extending our definition of small states to follow the World Bank's definition. This increases the sample from twenty-three to thirty-four countries. The results hold qualitatively true (see table A4 in the online appendix).

On the other hand, when the government reduces its consumption, it has a negative impact of around 0.4 percent on GDP at impact and 0.8 at the peak after one year.

Recession versus Boom

Similarly, we also investigate whether fiscal multipliers are larger in recessions than booms. We follow Auerbach and Gorodnichenko (2013) and modify equation 1 as follows:

$$(4) \quad y_{j,t+h,t-1} = \alpha_j^h + \gamma_t^h + \beta_I^{h,Recession} G(z_{it}) \text{FShock}_{j,t}^I + \beta_C^{h,Recession} G(z_{it}) \text{FShock}_{j,t}^C + \beta_I^{h,Boom} \left[1 - G(z_{it})\right] FShock_{j,t}^I + \beta_I^{h,Boom} \left[1 - G(z_{it})\right] \text{FShock}_{j,t}^C + \delta^h \mathbf{X}_{j,t} + \varepsilon_{I,t}^h,$$

where $G(z_{it}) = \exp(-\gamma z_{it})/[1 + \exp(-\gamma z_{it})]$, $\gamma > 0$, is a smooth transition function to give weights of the degree of recession for observations; and z_{it} is an indicator for the business cycle (in this case, the GDP growth rate) normalized to have zero mean and unit variance.[12]

Similar to previous studies (for example, Auerbach and Gorodnichenko, 2013), we find that both consumption and investment have a larger multiplier during recessions than booms (see table 1). For instance, while the government's consumption has a multiplier of 0.6 on impact during recessions, it does not have any notable effect on GDP during booms. In addition, while government investment has a large fiscal multiplier during recessions at around 0.8 on impact during recessions, it has a negative fiscal multiplier during booms.

Robustness Checks

We conducted a battery of robustness checks, including estimating equation 2 using just country fixed and time fixed effects; adding lagged variables, natural disasters, and future fiscal shocks; controlling for the terms of trade, net exports, government tax, and government revenue; and running separate regressions for government consumption and government investment (see table A3 in the

12. As in Aurbach and Gorodnichenko (2013), we set $\gamma = 1.5$. The results are robust to alternative values of γ.

online appendix). The results are robust to all these changes. The results are also robust to changes in control variables, such as a lag of the annual change in the actual fiscal variable (as in Auerbach and Gorodnichenko, 2013), lags of fiscal shocks, or combinations of these lagged fiscal variables. We also find that the results are robust to threshold values for classifying outliers, using trend GDP instead of actual GDP to divide variables, and using the previous year's WEO data (instead of the current year's) to obtain the fiscal variable forecast to construct fiscal variable shocks.

For robustness checks, we also conducted our analysis for small states based on the World Bank's definition (table A4 in the online appendix). After we perform the exclusion procedure described above, the sample includes thirty-four of the fifty small states under this definition, including ten countries in Africa, seven in Asia, twelve in the Caribbean, and five in Europe (see table A2 in the online appendix). Based on this sample, we find that the impact multiplier was 0.2 for government consumption, compared with the baseline multipliers of 0.3. For government investment, we find five-year multipliers of 0.6 for the larger sample, versus the baseline multipliers of 0.9. The five-year multipliers for government consumption and the impact multipliers for government investment are not statistically different from zero for either sample.

We also estimated multipliers for expansions and recessions for initially highly indebted countries (defined as having government debt of more than 70 percent of GDP), but the coefficients for these countries are similar to the baseline specification. This result should be viewed with caution, but it is not surprising, insofar as fourteen of the twenty-three countries in our sample are highly indebted. Our results using the DSGE model, discussed below, show that a higher level of government debt reduces fiscal multipliers.

Concerns for Monetary Policy

One may be concerned about potential omitted variables related to monetary policy (domestic and abroad). However, the majority of countries in our sample—all except Mauritius and Seychelles—do not have a floating exchange rate regime or an independent monetary policy (see table A1 for the exchange rate regimes in our sample). Furthermore, tests using the interest rate data for the limited subsample of eight countries for which data are available confirm that our fiscal shock measures are not correlated with interest rates in a statistically significant way. Finally, monetary policy abroad, such as U.S. monetary policy, is captured by our time fixed effects.

Comparison to Structural Vector Autoregression (SVAR)

Despite the caveats related to using structural vector autoregression (SVAR), which we discuss later, we performed regressions using this model and compared the results with our estimates based on the local projection method. Figure 2 shows the impulse responses to shocks in government consumption and investment from panel SVARs for different lags relative to our local projection method estimates. An SVAR with two-year lags mimics our local projection method in terms of the number of lags on the right-hand-side variables. An SVAR with four-year lags is shown to mimic four-year leads of our left-hand-side variable in the local projection method (namely, real GDP growth rates). Lag selection criterion prefers four-year lags over two-year lags for the SVAR estimates. We confirm that the SVAR results are generally within the 90 percent confidence interval of our local projection estimates and show similar patterns in responses to shocks in both government consumption and investment: the impact of government consumption shock is short-lived and dies out over the medium term, while the impact of a government investment shock has a larger impact in the long term.[13]

Summary of Empirical Results

The main results of our empirical portion are summarized in figure 3. Government consumption has a short-term impact multiplier of around 0.3 but a negligible medium-term impact on growth. In contrast, government investment has a small impact multiplier but a relatively large medium-term multiplier of around 0.9 on output.

DSGE Model: The Global Integrated Monetary and Fiscal Model (GIMF)

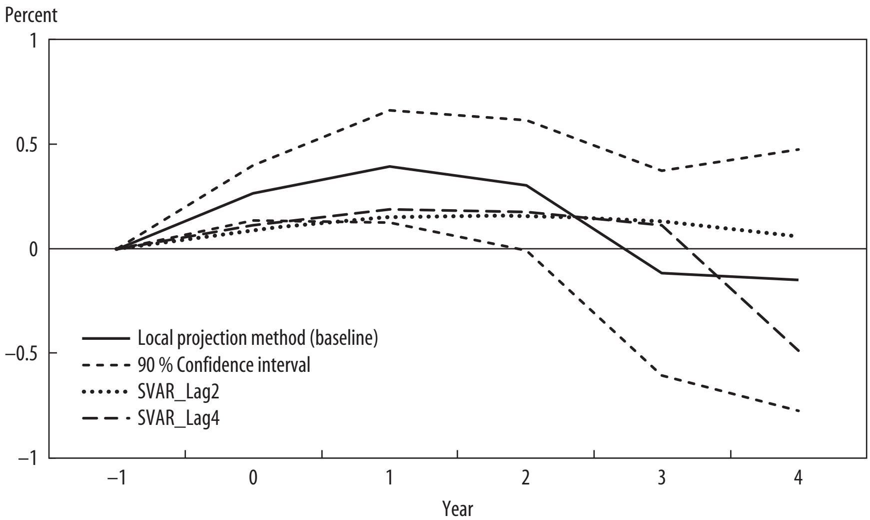
Our DSGE model is based on the IMF global integrated monetary and fiscal (GIMF) model.[14] This is an open economy model, in which Ricardian equivalence does not hold for various reasons. These include the model's feature

13. The fiscal multiplier estimates from SVAR and local projection methods are different even on impact ($h = 0$) for various reasons. The local projection method includes future fiscal shocks and government consumption and investment as a percentage of GDP instead of lagged fiscal shocks as in the SVAR. The local projection method also mechanically has a slightly shorter time dimension because its dependent variable is the real GDP growth rate up to the four-year horizon.

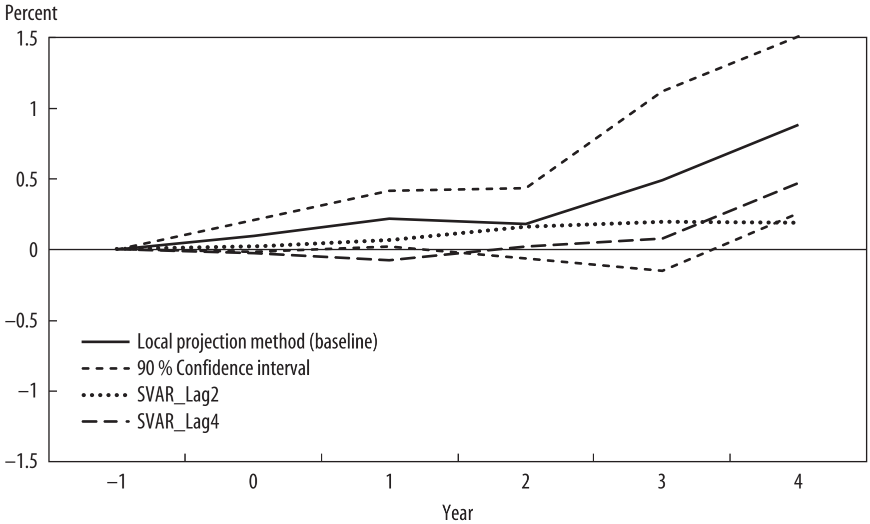
14. For detailed documentation on the structure of the model, see Kumhof and others (2010). Some explanations of the model are also borrowed from Leigh (2008).

FIGURE 2. SVAR Estimates

A. Government consumption



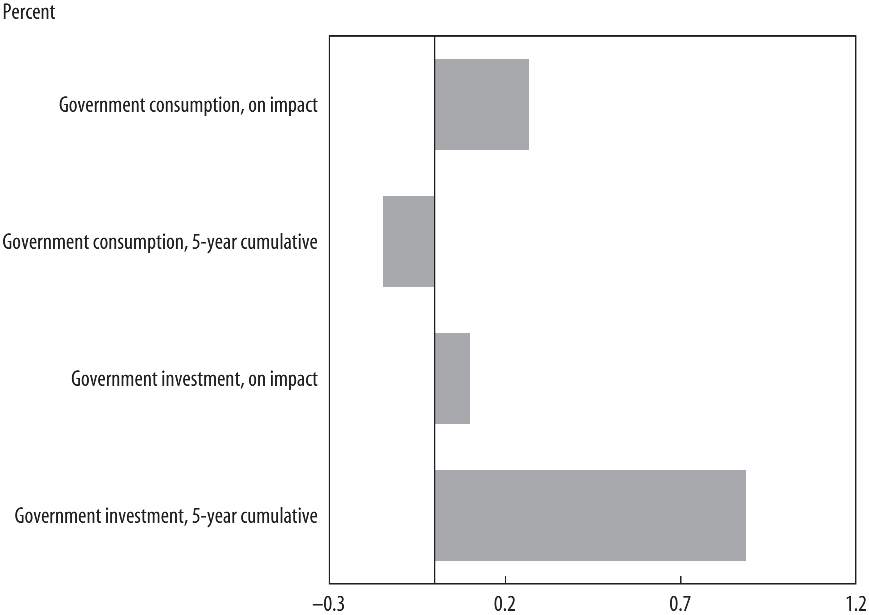
B. Government investment



Source: Authors' estimates.

Note: The figures show the response of GDP to a positive shock in government consumption and government investment equivalent to 1 percent of GDP, together with the 90 percent confidence intervals. SVAR_Lag2: panel SVAR with two lags. SVAR_Lag4: panel SVAR with four lags.

FIGURE 3. GDP Impact of Fiscal Expansion: Local Projection Method Results



Source: Authors' estimates.
Note: The figure shows the immediate and five-year cumulative effect on GDP of a fiscal expansion, equivalent to 1 percent of GDP, achieved through an increase in either consumption (government current primary spending) or investment.

of overlapping generations of agents with finite lifetimes, some of whom are also liquidity constrained. GIMF also has multiple real and nominal rigidities, including consumer habits that induce consumption persistence, investment adjustment costs that induce investment persistence, and import adjustment costs that induce spillover persistence from the policies of larger economies to the rest of the world.

GIMF relaxes the prevalent assumption in other DSGE models that all government spending is wasteful and does not contribute to aggregate supply. Instead, GIMF allows for productive public infrastructure spending that adds to the public capital stock and enhances the productivity of private factors of production.

The model's multiple non-Ricardian features, nominal and real rigidities, and fiscal and monetary policy reaction functions help produce plausible macroeconomic responses to changes in fiscal and monetary policy, as well as their spillover across economies. It is widely used to conduct policy analysis in IMF flagship publications.

Model

GIMF is a multicountry dynamic stochastic general equilibrium (DSGE) model with optimizing behavior by households and firms and full intertemporal stock-flow accounting. Frictions in the form of sticky prices and wages, real adjustment costs, and liquidity-constrained households, along with finite planning horizons for households, imply an important role in GIMF for monetary and fiscal policy in economic stabilization.

The assumption of finite horizons separates GIMF from standard monetary DSGE models and allows it to have well-defined steady states where countries can be long-run debtors or creditors. This allows users to study the transition from one steady state to another where fiscal policy and private saving behavior play a critical role in both the dynamics and long-run comparative statics.[15]

The non-Ricardian features of the model provide nonneutrality in both spending-based and revenue-based fiscal policy measures. In particular, fiscal policy can stimulate the level of economic activity in the short run, but sustained government deficits crowd out private investment and net foreign assets in the long run.[16] Sustained fiscal deficits in large economies can also lead to a higher world real interest rate, which is endogenous.

Asset markets are incomplete in the model. Government debt is only held domestically, in the form of nominal, noncontingent, one-period bonds denominated in domestic currency. The only assets traded internationally are nominal, noncontingent, one-period bonds denominated in U.S. dollars, which can be issued by the U.S. government and by private agents in any region. Firms are owned domestically. Equity is not traded in domestic financial markets; instead, households receive lump-sum dividend payments.

Firms employ capital and labor to produce tradable and nontradable intermediate goods. There is a financial sector à la Bernanke, Gertler, and Gilchrist (1999) that incorporates a procyclical financial accelerator, with the cost of external finance for firms rising with their indebtedness.

15. See Blanchard (1985) for the basic theoretical building blocks of such DSGE models and Kumhof and Laxton (2007, 2009a) for more detailed explanations of the fiscal policy implications of the GIMF model.

16. Coenen and others (2010) show that GIMF fiscal multipliers for temporary shocks are similar to standard monetary business cycle models, but GIMF can handle a much broader array of permanent shocks that can be used to study transitions from one steady state to another caused by permanent changes in the level of government debt.

GIMF is a multiregion model, encompassing the entire world economy, that explicitly models all the bilateral trade flows and their relative prices for each region, including exchange rates. The version used in this paper comprises three regions: a small state, the United States, and the rest of the world. The international linkages in the model allow the analysis of policy spillovers at the regional and global levels.

HOUSEHOLD SECTOR. There are two types of households, both of which consume goods and supply labor. First, there are households with overlapping generations (OLG) that optimize their borrowing and saving decisions over a twenty-year planning horizon. The first-order condition of their consumption-leisure choice sets their consumption relative to leisure proportional to the real disposable wage and the elasticity of labor supply. Second, there are liquidity-constrained households (LIQ), which do not save and have no access to credit. Both types of households pay direct taxes on labor income, indirect taxes on consumer spending, and a lump-sum tax.

Once we aggregate across households, we get the following condition:

$$\frac{c_t^{OLG}}{N(1-\psi)-l_t^{OLG}} = \frac{\eta^{OLG}}{(1-\eta^{OLG})} w_t \frac{(1-\tau_{L,t})}{(p_t^R - p_t^C \tau_{c,t})},$$

where c_t^{OLG} is the per capita consumption of OLG households, η^{OLG} is the share of consumption versus labor in utility, N is the number of countries in the model, ψ is the share of liquidity-constrained households, l_t^{OLG} is the labor supply, w_t is the real wage, $\tau_{L,t}$ is labor income tax, p_t^R is the relative price of retail goods, p_t^C is the relative marginal cost of retailors, and $\tau_{c,t}$ is a consumption tax.

OLG households save by acquiring domestic government bonds, international U.S. dollar bonds, and fixed-term deposits. They maximize their utility subject to their budget constraint. Aggregate consumption for these households is a function of financial wealth and the present discounted value of after-tax wage and investment income. The consumption of LIQ households is equal to their current net income. Therefore, by construction, their marginal propensity to consume out of current income is unity.[17] A high proportion of LIQ households in the population would imply large fiscal multipliers from temporary changes to taxes and transfer payments.

17. The liquidity-constrained consumers could also be interpreted more generally as hand-to-mouth consumers, which in other models are assumed to consume all of their income.

For OLG households with finite planning horizons, a tax cut has a short-run positive effect on output. When the cuts are matched with a tax increase in the future, to leave government debt unchanged in the long run, the short-run impact remains positive, as the change will tilt the time profile of consumption toward the present. In effect, OLG households discount future tax liabilities at a higher rate than the market rate of interest. Thus an increase in government debt today represents an increase in their wealth, because a share of the resulting higher taxes in the future is payable beyond their planning horizon. If the increase in government debt is permanent (that is, tax rates are assumed to rise sufficiently in the long run to stabilize the debt-to-GDP ratio by financing the higher interest burden), this will crowd out real private capital by raising real interest rates.[18]

Increases in the interest rate have a negative effect on consumption, mainly through the impact on the value of wealth. The intertemporal substitution effect from interest rate changes is moderate and has been calibrated to be consistent with the empirical evidence. The intertemporal elasticity of substitution determines the magnitude of the long-run crowding-out effects of government debt since it pins down how much real interest rates have to rise to encourage households to provide the required savings.

PRODUCTION SECTOR. Firms, which produce tradable and nontradable intermediate goods, are managed following the preferences of their owners, who are the finitely lived households. Therefore, firms also have finite planning horizons. The main substantive implication of this assumption is the presence of a substantial equity premium driven by impatience.[19] Firms are subject to nominal rigidities in price setting, as well as real adjustment costs in labor hiring and investment. Investment adjustment costs, $\Gamma_{I,t}$, are as follows:

$$\Gamma_{I,t} = \frac{\phi_{I,t}}{2}\left(\frac{I_t}{I_{t-1}} - g \bullet n\right)^2,$$

where $\phi_{I,t}$ is the adjustment cost parameter, I_t is investment, g is the gross technological growth rate, and n is the population growth rate.

18. For a more detailed description of the fiscal implications in GIMF, see Kumhof and Laxton (2007, 2009a, 2009b).

19. This feature would disappear if equity was assumed to be traded in financial markets. We find the assumption of myopic firm behavior, and the resulting equity premium, to be more plausible.

The first-order condition from the firms' investment decision making is captured by Tobin's q:

$$q_t = P_t^I + \left(\Gamma_{I,t} + I_t \frac{\partial \Gamma_{I,t}}{\partial I_t}\right) P_t^I - E_t \left\{ \tilde{F}_t^{t+1} I_{t+1} \frac{\partial \Gamma_{I,t+1}}{\partial I_t} P_{t+1}^I \right\},$$

where P_t^I is the price of investment and the rest of the right-hand side is the net adjustment cost, with $\Gamma_{I,t} + I_t(\partial\Gamma_{I,t}/\partial I_t)$ representing the marginal adjustment cost of investment in t and $E_t\{\tilde{F}_t^{t+1} I_{t+1}(\partial\Gamma_{I,t+1}/\partial I_t)P_{t+1}^I\}$ representing the resulting adjustment cost savings in $t + 1$ from investment in t. In the steady state, Tobin's q is equal to the price of investment. In the dynamics, investment accelerates when Tobin's q is higher than the price of investment (sticky prices).

Firms operate in monopolistically competitive markets, and thus goods' prices contain a markup over marginal cost. Exports are priced to the local destination market and imports are subject to quantity adjustment costs. There are also price adjustment costs, which lead to sticky prices.

Firms use public infrastructure (which is the government capital stock) as an input, in combination with tradable and nontradable intermediate goods. Therefore, government capital adds to the productivity of the economy.

Firms also pay capital income taxes to governments and wages and dividends to households.

Retained earnings are insufficient to fully finance investment, so firms must borrow from financial intermediaries. If earnings fall below the minimum required to make the contracted interest payments, the financial intermediaries take over the firm's capital stock, less any auditing and bankruptcy costs, and redistribute it back to their depositors (households).

FINANCIAL SECTOR. GIMF contains a limited menu of financial assets. Government debt consists of one-period bonds denominated in domestic currency. Banks offer households one-period fixed-term deposits, which become their source of funds for loans to firms. These financial assets, as well as ownership of firms, are not tradable across borders. OLG households may, however, issue or purchase tradable U.S. dollar-denominated securities.

Banks pay a market rate of return on deposits and charge a risk premium on loans. Because of the costs of bankruptcy (capital can only be liquidated at a discount), the lending rate includes an external financing premium, which varies directly with the debt-to-equity (leverage) ratio—the financial accelerator effect. Nonlinearities imply steep increases in the risk premium for large negative shocks to net worth.

INTERNATIONAL DIMENSIONS AND SPILLOVERS. All bilateral trade flows are explicitly modeled, as are the relative prices for each region, including exchange rates. These flows include the export and import of intermediate and final goods. They are calibrated in the steady state to match the flows observed in the recent data. International linkages are driven by the global saving and investment decisions, a by-product of consumers' finite horizons. This leads to uniquely defined current account balances and net foreign asset positions for each region. Since asset markets are incomplete, net foreign asset positions are represented by nominal noncontingent one-period bonds denominated in U.S. dollars. A risk-adjusted uncovered interest rate parity sets the return on holding domestic bonds equal to holding the international bond, accounting for exchange rate risk and any other risk premiums.

Because of the importance of risk premiums in emerging markets and their possible relationship with fiscal policy, the model includes an endogenous country-specific risk premium. In particular, the risk premium on the interest paid on domestic debt, denoted by ρ, enters the risk-adjusted uncovered interest parity (UIP) equation for foreign currency bonds as follows:

$$i_t = i_t^{RW} E_t \varepsilon_{t+1} \left(1 + \rho_t\right),$$

where i_t^{RW} is the gross nominal interest rate in the rest of the world, and ε_{t+1} denotes future gross nominal exchange rate depreciation.

The domestic risk premium ρ_t is assumed to have the following nonlinear form:

$$\rho_t = \delta_1 + \frac{\delta_2}{\left[\left(\text{DEBT}/\text{GDP}\right)^{\max} - \left(\text{DEBT}_t/\text{GDP}_t\right)\right]^{\delta_3}}.$$

If $\delta_2 = 0$, then the risk premium always equals the exogenous level δ_1, regardless of the level of the debt-to-GDP ratio (DEBT/GDP). If $\delta_2 > 0$, a decline in government debt reduces the risk premium. As the debt-to-GDP ratio rises toward its maximum level, the risk premium rises at an increasing rate. The assumption of an increasing slope is broadly consistent with empirical studies that find a positive linear relationship between the logarithm of the risk premium and the debt ratio, such as Arora and Cerisola (2001). The parameter $\delta_3 > 0$ determines the curvature of the risk premium function.

Along with the adjusted uncovered interest parity and long-term movements in the world real interest rate, the magnitude of international trade linkages is the main determinant of spillover effects from shocks in one region to other world regions.

FISCAL AND MONETARY POLICY. Fiscal policy is conducted using a variety of expenditure and tax instruments. Government spending may take the form of consumption or investment expenditure or lump sum transfers, to all households or targeted toward LIQ households. Revenues accrue from taxes on labor and corporate income, consumption taxes, and lump sum taxes. The model also allows for tariffs on imported goods to be a potential source of public revenue. Government investment augments public infrastructure, which depreciates at a constant rate over time.

The government determines how the fiscal balance-to-GDP ratio responds to excess tax revenue using a simple fiscal policy rule:

$$\frac{\text{FBAL}_t}{\text{GDP}_t} = \phi^* + d\left(\frac{\tau_t - \tau_t^*}{\text{GDP}_t}\right),$$

where FBAL/GDP is the fiscal balance-to-GDP ratio. If the response parameter $d = 0$, the fiscal balance is kept equal to ϕ^* at all times. For example, if $d = 0$ and the economy experiences an upswing, with actual tax revenue τ exceeding steady-state tax revenue τ^*, the fiscal balance remains unchanged, and the excess tax revenue is spent. Such a response corresponds to a balanced budget rule and is here defined as procyclical. A response of $d < 0$ would also qualify as procyclical. As the response parameter d increases in the positive range, a greater share of the excess tax revenue is saved. When $d = 1$, a 1 percent of GDP increase in excess tax revenue translates into a 1 percent increase in the fiscal balance, a response consistent with a structural balance rule. The rule can be implemented by adjusting taxes or spending. A response of $d > 1$ implies that a 1 percent of GDP increase in excess tax revenue induces an improvement in the fiscal balance of more than 1 percent of GDP; this is, for the purposes of this paper, defined as countercyclical.

The fiscal policy rule ensures long-run sustainability while allowing for short-run countercyclical policies. Changes in labor and capital income taxes or other taxes, transfers, or spending instruments provide instruments to put the rule into effect. First, the fiscal rule ensures that in the long run, the ratio of the government debt to GDP—and hence the deficit-to-GDP ratio—eventually converge to their target levels. This excludes the possibility of sovereign default, as well as the risk that out-of-control financing requirements of the government will override monetary policy. Second, the rule allows for countercyclical fiscal policy as it embodies automatic stabilizers.

When conducting monetary policy, the central bank in GIMF uses an inflation-forecast-based interest rate rule in the spirit of a Taylor rule. The central bank varies the gap between the actual policy rate and the long-run equilibrium rate to achieve a stable target rate of inflation over time. However, for this paper and the case of small states, where the nominal anchor is the exchange rate, there is no role for monetary policy, and this equation is not part of the model.

Calibration

The three-economy version of the GIMF used in the simulations has been calibrated to replicate key macroeconomic ratios such as external openness, tax collection and composition, fiscal spending patterns, and trade relationships among a hypothetical small state, the United States, and an aggregate of the rest of the small state's trading partners. The hypothetical small state is calibrated to broadly represent an average small state in terms of imports and government debt in percent of GDP. Its initial level for both imports and government debt is set at 61 percent of GDP, which is the 2017 average for the small states in the sample. Table 2 provides a summary of the calibration values for important parameters used in the baseline of this paper.

Each period corresponds to one year. The hypothetical small state is assumed to comprise 0.001 percent of world GDP and to have a steady-state annual real GDP growth rate of 1.5 percent and an inflation rate of 4 percent. The United States and the rest of the world are assumed to have a steady-state annual growth rate of 1.5 and an annual inflation rate of 2 percent. Population in all three regions is assumed to grow at 1 percent per year, and the real interest rate in the United States and the rest of the world is assumed to be 4 percent per year in the steady state. The structural parameters regarding household preferences and firm technology are set following Kumhof and Laxton (2007). In particular, the parameters that govern the degree of household myopia, a key non-Ricardian feature of the model, are calibrated as follows. Households in all three regions are assumed to have a planning horizon of fifteen years, a probability of death of 6.7 percent per year, and a decline in life-cycle worker productivity of 5 percent per year. Half of the small state's households are assumed to be liquidity constrained. This proportion is larger

TABLE 2. GIMF Baseline Calibration Values

Region and variable	*Calibrated value*
Small states	
Real GDP growth rate (percent; annual)	1.5
Inflation rate (percent; annual)	7.0
Real gross interest rate (percent; annual)	4.0
Population growth rate (percent; annual)	1.0
Share of liquidity-constrained agents (percent)	50.0
Imports (percent of GDP)	61.0
Fiscal ratios (percent of GDP)	
Government consumption to GDP	20.0
Public investment to GDP	4.7
Tax revenue to GDP	22.5
Consumption taxes	7.5
Capital taxes	4.0
Labor taxes	8.0
Lump sum taxes	3.0
Government debt	61.0
Labor shares (percent)	55.0
Labor shares, nontradables (percent)	60.0
World and the United States	
Investment share (percent)	17.2
Population share in the world: Small state (percent)[a]	0.0
Population share in the world: United States (percent)	23.0
Population share in the world: Rest of the world (percent)	77.0

Source: Authors' assumptions and estimates.

a. Population shares reflect the importance of trading partners from the perspective of small states and do not reflect the population shares of the region in the world per se.

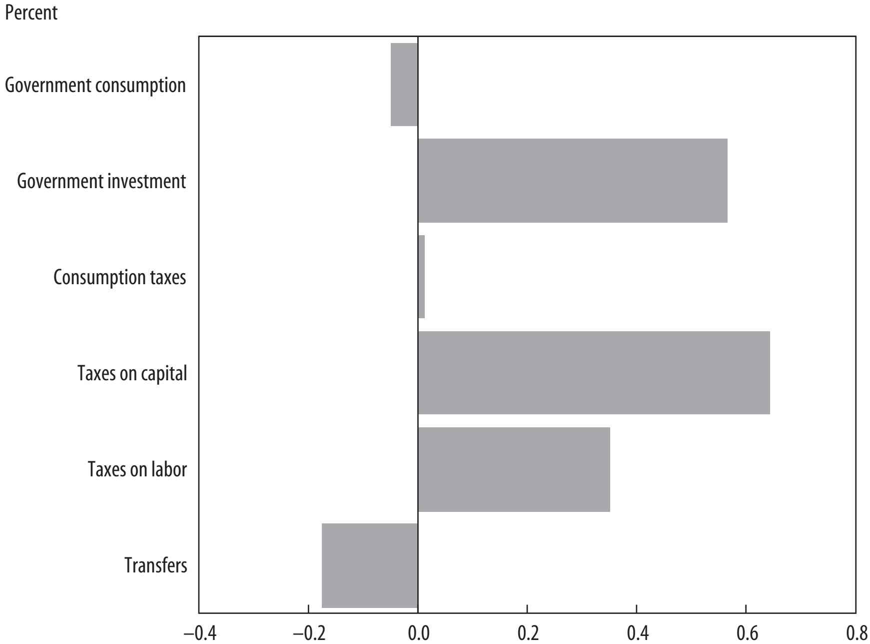
than the 33 percent that was assumed for the United States by Kumhof and Laxton (2007). Insofar as financial development is lower in small states than in the United States or other larger countries, a greater share of LIQ households in small states seems plausible.

The calibration of fiscal parameters, such as the ratios to GDP of government transfers, purchases of goods and services, and public investment, is broadly based on the averages of the small states.

GIMF Model Results

Our baseline multipliers are for public-debt-increasing shocks to fiscal policy variables that would increase the fiscal deficit permanently by 1 percent of GDP. The baseline assumes no monetary policy reaction to the fiscal shock

FIGURE 4. GDP Impact of Fiscal Expansion: GIMF Model Results



Source: Authors' estimates.
Note: The figure shows the five-year cumulative effect on GDP of a fiscal expansion, equivalent to 1 percent of GDP, achieved through an increase in consumption (government current primary spending), an increase in investment, a reduction in taxes, or an increase in transfers.

because most small states have either pegged exchange rates or an otherwise limited monetary policy.[20]

The five-year baseline fiscal multipliers are reported in figure 4. These are the effects of each shock on the level of GDP after five years. The government consumption multiplier is estimated at almost zero, meaning that after five years, the cumulative GDP effect of a fiscal expansion through increasing government consumption is almost zero. In other words, if the government of this small state expands its consumption such that its deficit is permanently higher by one percentage point of GDP, the economy would not enjoy any notable medium- or long-term effect of the policy on its GDP level. In contrast,

20. See tables A1 and A2 in the online appendix for the exchange rate classifications of our sample countries (from IMF, 2015).

TABLE 3. GDP Impact of Fiscal Expansion of 1 Percent of GDP: Time Profile
Percent; cumulative effect

	Year				
Variable	*0*	*1*	*2*	*3*	*4*
Government consumption	0.6	0.4	0.2	0.0	0.0
Government investment	0.7	0.6	0.5	0.5	0.6
Consumption taxes	0.4	0.3	0.2	0.1	0.0
Taxes on capital	0.5	0.6	0.5	0.5	0.6
Taxes on labor	0.3	0.4	0.4	0.4	0.4
Transfers	0.3	0.2	0.0	–0.1	–0.2

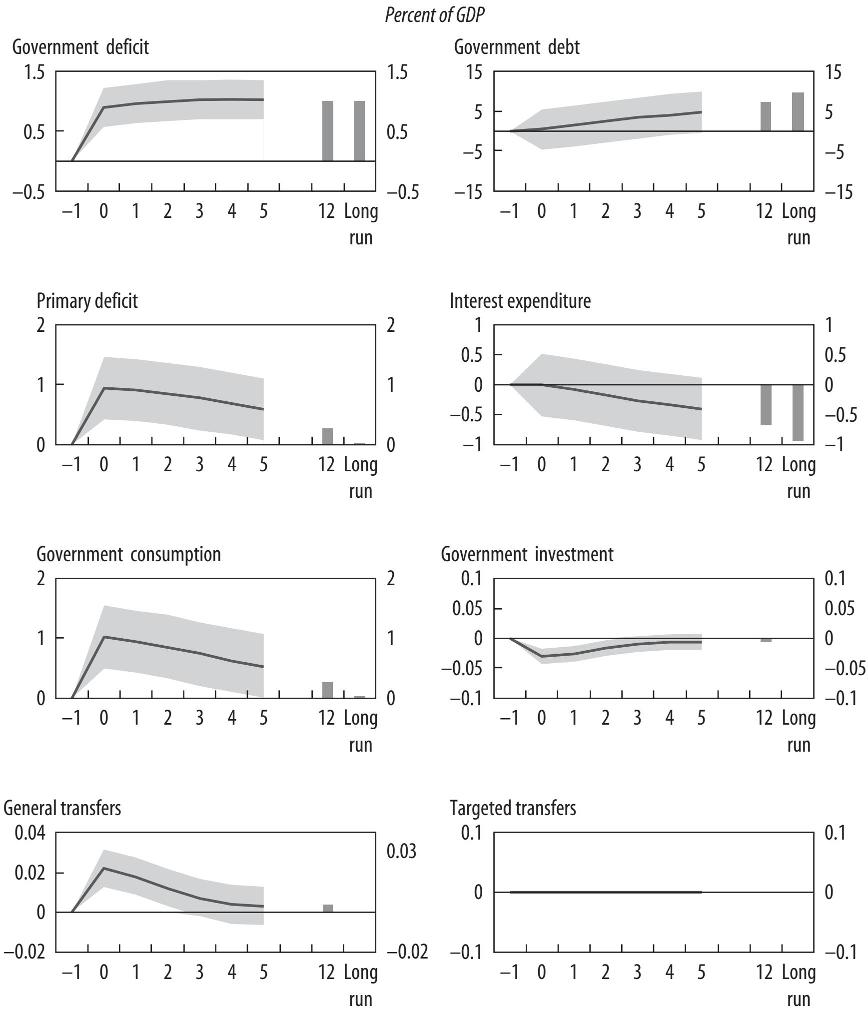
Source: Authors' estimates.

the five-year government investment multiplier is estimated at around 0.6. Thus, if the government increases its investment such that its deficit is permanently 1 percent of GDP higher, the economy will lose a cumulative 0.6 percent of its GDP over five years. Finally, five-year multipliers of expansion through reducing taxes range from about zero on consumption taxes to 0.4 on labor taxes and 0.6 on capital taxes.

Table 3 provides the path of multipliers from impact through five years. Multipliers are relatively larger at impact and decrease thereafter. In cases where fiscal expansion is achieved through the capital stock (that is, through government investment and taxes on capital), the multipliers increase over the medium term until they reach their steady-state levels. In the case of government consumption and consumption taxes, multipliers continue falling through the medium term and beyond until they reach zero. In the cases of labor taxes and transfers, the dynamics are much longer than the five-year horizon shown in table 3, but they also eventually reach zero (not shown).

To gain more insight into the baseline multipliers, we plot the dynamics of a set of important underlying fiscal and macroeconomic variables for a shock to government consumption (figures 5 and 6) and to government investment (figures 7 and 8). Figure 5 shows the government consumption shock and the resulting dynamics of fiscal ratios. As mentioned, the shock is calibrated to permanently increase the overall fiscal deficit by 1 percent of GDP, as graphed in panel A. The figure shows that government investment and transfers are virtually unchanged compared with the baseline. Insofar as the deficit is increased permanently, government debt rises on a declining trend compared with the baseline. This growth of government debt causes government interest expenditures to increase as well. Since the overall fiscal deficit is kept constant, the rising interest expenditures imply a deteriorating primary fiscal balance

FIGURE 5. Government Consumption: Fiscal Variables



Source: Authors' estimates.

Note: The figures show the response (deviation from steady state) of the different variables to a permanent expansion of government consumption equivalent to 1 percent of GDP. The long run is twenty years after the initial shock.

over time. This is a very important point for understanding the dynamics of the macroeconomic variables presented in figure 6, because the deteriorating primary fiscal balance acts similar to a stimulus for the economy.

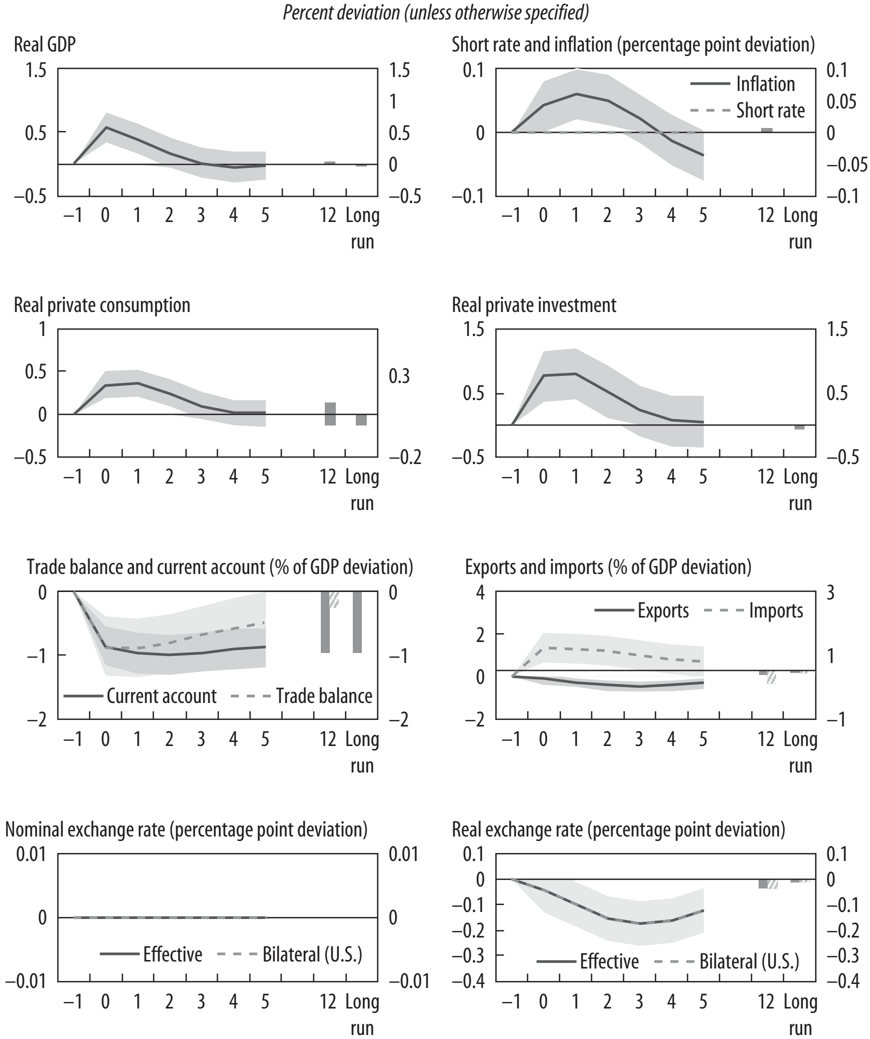
The first panel of figure 6 shows the evolution of real GDP. Because the shock was calibrated at a level to increase the deficit permanently by 1 percent of GDP, the resulting GDP path (relative to the steady state) can be interpreted as the fiscal multiplier path. This figure shows that the impact multiplier of a government consumption shock is about 0.6, but as time progresses, the multiplier shrinks, reaching zero after about four years. In the rest of this subsection, we describe the dynamics of various macroeconomic variables that are associated with this result, which are graphed in the remaining panels of the figure.

The positive government consumption shock causes private consumption and investment to increase at impact, as many consumers gain public jobs and many businesses obtain government contracts. However, as time goes by, private consumption and investment gradually return to their fundamental levels. This process is helped by the fact that the primary balance deteriorates after the impact. The expansion also leads to higher inflation and, with the nominal exchange rate broadly unchanged, results in a real exchange rate appreciation. This dampens exports somewhat and boosts imports. A larger boosting effect on imports is realized at impact because both government and private domestic demand expand. Over time, however, private demand deteriorates, so imports also partially decline.

Table 4 presents the contributions of different variables to growth. The first row shows the total impact on GDP (or the fiscal multiplier) over six years when the government expands its overall fiscal deficit by 1 percent of GDP through increased government consumption. Private consumption and investment also increase as a response to a positive government consumption shock. If there were no trade leakage, GDP would expand by around 1.3 percent. However, imports would also increase as a result of higher government and private demand. This trade leakage dampens the original impact of an increase in government consumption and brings down the overall GDP impact to around 0.6 percent. Over time, both consumption and investment decline, and the trade balance improves through an increase in exports and a decline in imports.

Figure 7 shows the government investment shock and the resulting dynamics of different fiscal variables. The shock is calibrated to permanently increase the overall fiscal deficit by 1 percent of GDP through government investment. Government investment is expanded, while government consumption

FIGURE 6. Government Consumption: Nonfiscal Macroeconomic Variables



Source: Authors' estimates.

Note: The figures show the response (deviation from steady state) of the different variables to a permanent expansion of government consumption equivalent to 1 percent of GDP. The long run is twenty years after the initial shock.

TABLE 4. Permanent Expansion of the Deficit by 1 percent of GDP using Higher Government Consumption

Percentage point contribution to GDP

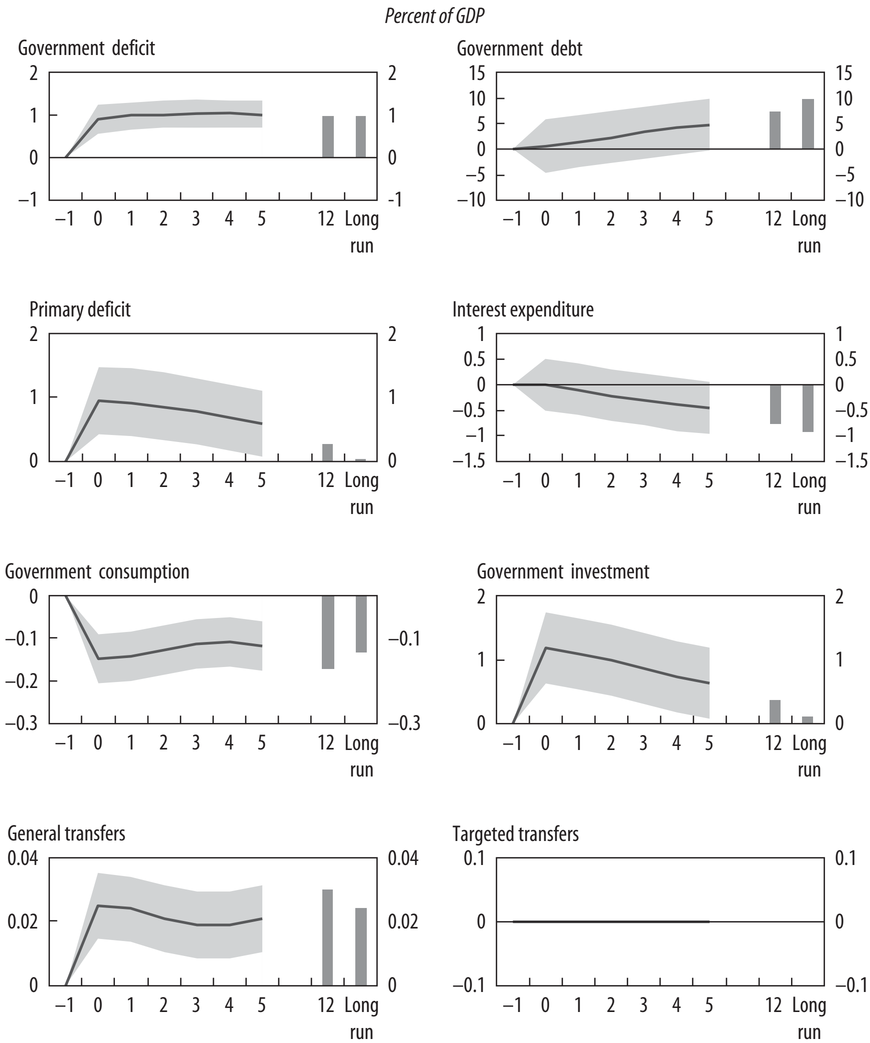
	Year				
Variable	*0*	*1*	*2*	*3*	*4*
Total impact on GDP	**0.6**	**0.4**	**0.2**	**0.0**	**0.0**
Private consumption	0.2	0.2	0.1	0.1	0.0
Private investment	0.1	0.1	0.1	0.0	0.0
Government spending	1.1	1.0	0.9	0.8	0.7
Government consumption	1.2	1.1	0.9	0.8	0.7
Government investment	0.0	0.0	0.0	0.0	0.0
Net exports	–0.9	–1.0	–1.0	–0.9	–0.7
Exports	–0.1	–0.2	–0.3	–0.3	–0.3
Imports	0.8	0.8	0.7	0.6	0.5

Source: Authors' estimates.

and transfers remain virtually unchanged through the steady state. Similar to the previous case of a decline in the overall fiscal balance through government consumption, government debt increases over time owing to a permanently higher fiscal deficit. Since the overall fiscal deficit is kept constant, the primary fiscal balance deteriorates over time with higher government debt.

Figure 8 plots the dynamics of macroeconomic variables in response to the permanent increase in the overall fiscal deficit by 1 percent of GDP. Given that the shock was calibrated at a level to increase the deficit permanently by 1 percent of GDP, the resulting GDP path (relative to the steady state) can be interpreted as the fiscal multiplier path. Similar to the case of government consumption, a 1 percent of GDP increase in the overall fiscal deficit positively affects private consumption and investment at impact, as many consumers gain public jobs and many businesses gain government contracts. Over time, both private consumption and investment decline, but they end up at higher steady-state levels because the positive effect of higher government investment is permanent. The expansion also increases inflation and appreciates the real exchange rate, which deteriorates the trade balance by dampening exports while boosting imports. Over time, private demand declines, and imports also partly decline. Unlike the case of government consumption, however, the increase in government investment also positively affects the capital stock in the economy and leads to higher production. Thus the increase in government investment has a more lasting impact on output.

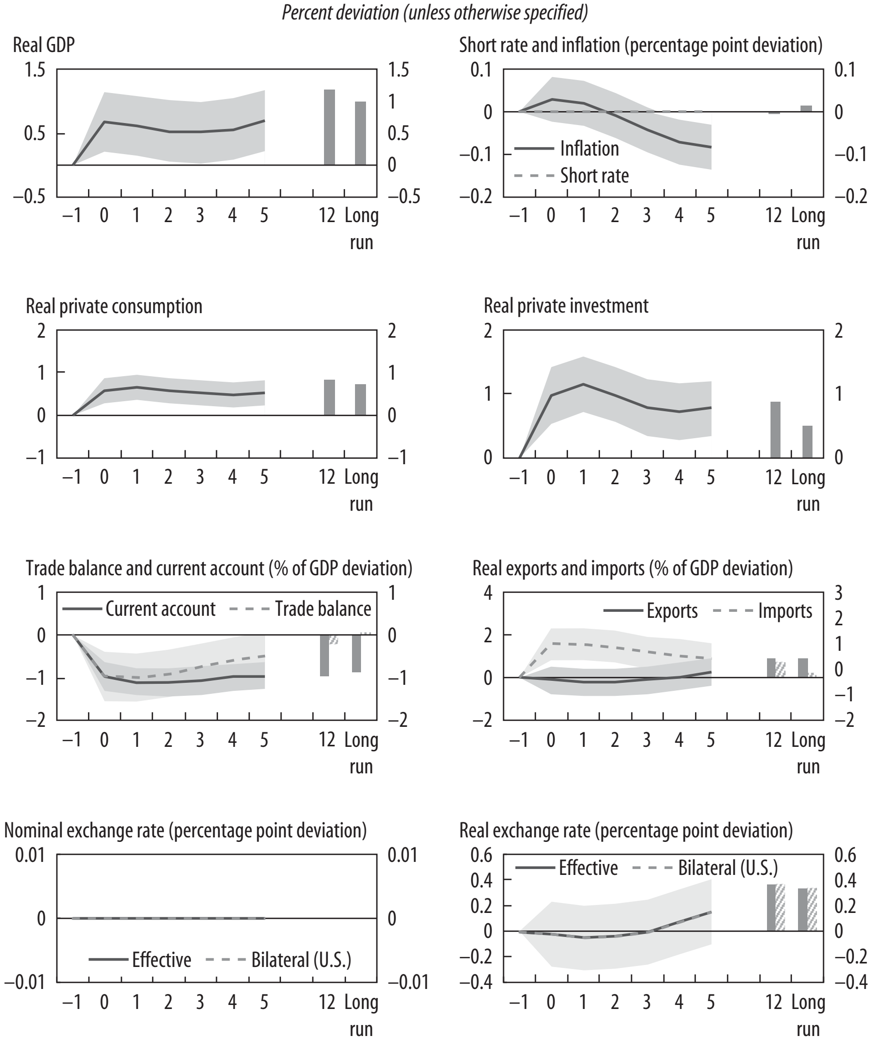
FIGURE 7. Government Investment: Fiscal Variables



Source: Authors' estimates.

Note: The figures show the response (deviation from steady state) of the different variables to a permanent expansion of government consumption equivalent to 1 percent of GDP. The long run is twenty years after the initial shock.

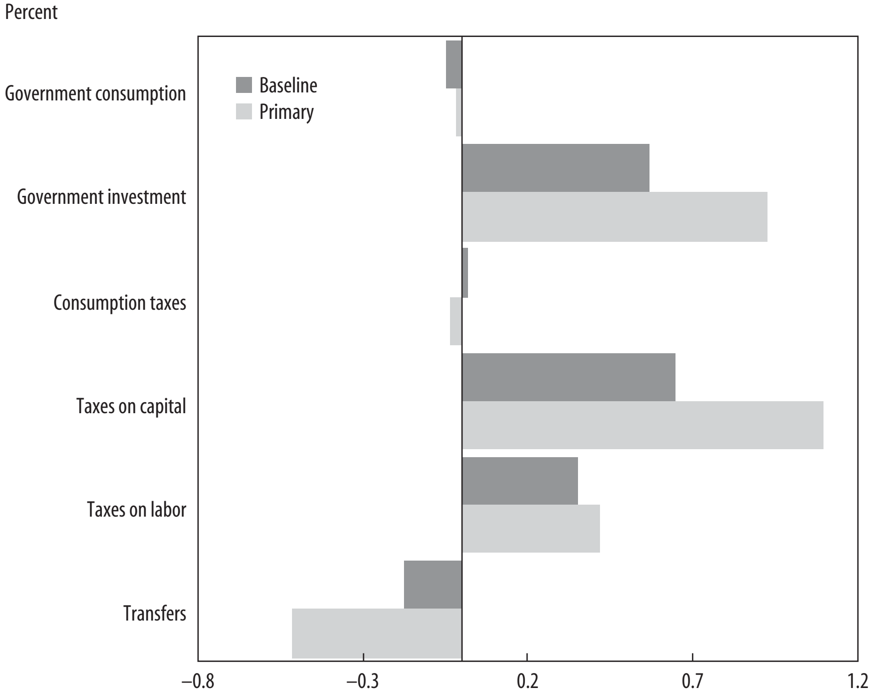
FIGURE 8. Government Investment: Nonfiscal Macroeconomic Variables



Source: Authors' estimates.

Note: The figures show the response (deviation from steady state) of the different variables to a permanent expansion of government consumption equivalent to 1 percent of GDP. The long run is twenty years after the initial shock.

FIGURE 9. Primary Deficit versus Baseline



Source: Authors' estimates.

Note: The figure shows the five-year cumulative effect on GDP of an increase in the overall deficit (baseline) versus an increase in the primary deficit (overall deficit minus interest), both equivalent to 1 percent of GDP, achieved through an increase in consumption (government current primary spending), an increase in investment, a reduction in taxes, or an increase in transfers.

In the very long term (well beyond our definition of twenty years for the long term), the output effect will return to zero as private investment is replaced by the increased public investment due to the permanent expansion.

Primary Balance Multipliers

In the baseline, the size of the policy shocks is always set such that they increase the overall deficit by 1 percent of GDP. In some cases, however, policymakers are interested in multipliers for a change in the primary deficit (that is, the overall deficit minus interest) by 1 percent of GDP. Figure 9 shows our models' results for these multipliers and compares them with the baseline multipliers.

As the figure shows, the primary balance multipliers are larger than the baseline multipliers. This is an intuitive result. With the expansion, government debt is on an upward path, which causes interest expenditures to increase over time. Baseline multipliers assume a constant overall deficit after the impact. Therefore, in the baseline, the primary deficit decreases over time to compensate for higher interest expenditures. In the case of primary multipliers, the primary deficit remains unchanged over time, at 1 percent of GDP higher than the steady state. This results in higher primary balance multipliers than the baseline.

Temporary Shock Multipliers

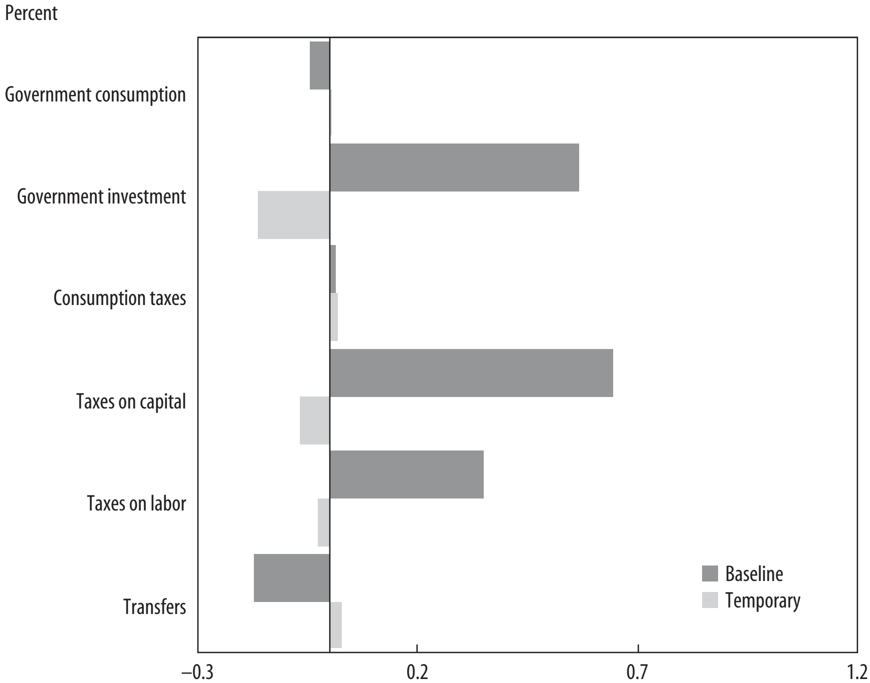
The baseline multipliers were estimated for a permanent expansion shock. In this subsection, we present the multipliers for a temporary expansion shock. In this exercise, fiscal policy variables are changed to increase the overall deficit in the first year by 1 percent of GDP, but the deficit returns back to the steady-state level in the following year. The overall deficit in all future years is kept unchanged relative to the steady state. Figure 10 shows the results and compares them with the baseline. Temporary multipliers are notably smaller than baseline multipliers. This is as expected because the present value of a temporary fiscal shock is much smaller than that of a permanent one with the same annual size. Also, some temporary multipliers are estimated with the wrong signs. This is because of various dynamics across variables in the model, and it is of little importance because of the very small size of the multipliers.

Multipliers following Natural Disasters

While our baseline GIMF estimation of fiscal multipliers in the previous sections has assumed that the small state starts at the steady state, in reality, many small states are often hit by natural disasters (such as hurricanes) that take them well out of their steady state. Following a natural disaster, fiscal policy is usually considered an important tool to bring the economy back toward its steady state. This section estimates fiscal multipliers after a natural disaster. We consider a natural disaster that destroys 10 percent of the country's GDP in the initial period, following which fiscal policy is implemented.

Figure 11 plots five-year cumulative GDP impacts of government consumption and investment in this post-natural-disaster economy. The fiscal stimulus from government consumption following a natural disaster is estimated to have a medium-term multiplier of close to 0.4. This is notably larger than in the baseline, which has a multiplier of almost zero. The medium-term government

FIGURE 10. Temporary Shock versus Baseline



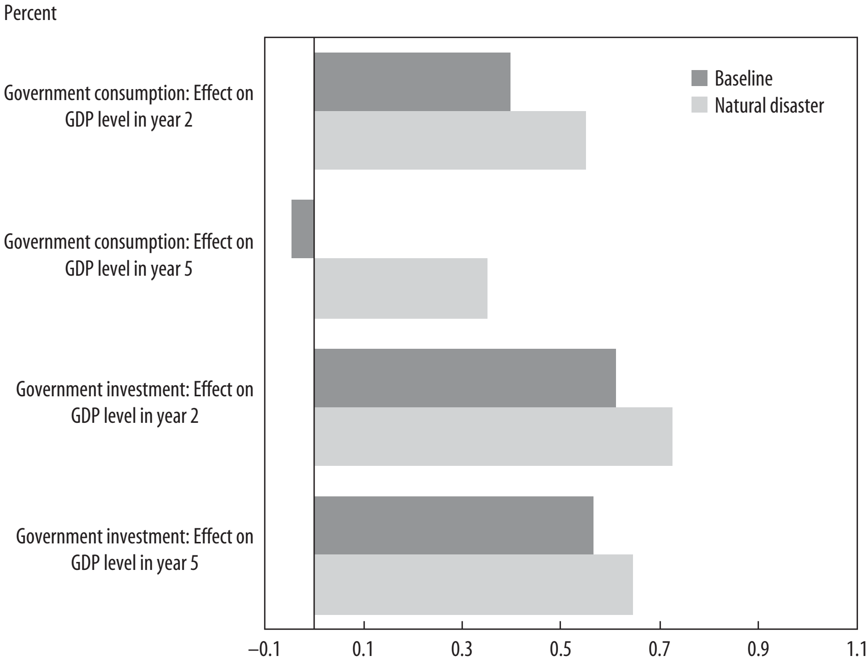
Source: Authors' estimates.

Note: The figure shows the five-year cumulative effect on GDP of a temporary expansion shock, in which the deficit returns back to the steady-state level in the following year, versus the baseline, both equivalent to 1 percent of GDP, achieved through an increase in consumption (government current primary spending), an increase in investment, a reduction in taxes, or an increase in transfers.

investment multiplier after a natural disaster is estimated at 0.7, slightly larger than the baseline. These results are intuitive because one expects to have larger multipliers when there is slack in the economy. The results are also consistent with our empirical results presented earlier, which found larger multipliers in recessions compared to booms.[21]

21. Our conclusions from the analysis of natural disasters may not be directly applicable to the COVID-19 pandemic owing to its differences from natural disasters. A natural disaster generally destroys physical capital but may not have a longlasting impact on consumer behavior. In contrast, a health disaster like the COVID-19 pandemic does not destroy existing physical capital in the economy, but it could have a longlasting impact on consumer behavior, such as a long-term decline in the demand for tourism. At the same time, the COVID-19 shock also entails important disruptions to the supply side (via lockdowns), which would suggest a more muted impact for fiscal policy at least in the containment phase.

FIGURE 11. Post-Natural Disaster versus Baseline



Source: Authors' estimates.
Note: The figure shows the five-year cumulative effect on GDP of a fiscal expansion following a natural disaster that destroys 10 percent of the country's GDP in the initial period, versus the baseline, both equivalent to 1 percent of GDP, achieved through an increase in consumption (government current primary spending), an increase in investment, a reduction in taxes, or an increase in transfers.

Sensitivity Analysis

The baseline and other previous sections were calibrated for a hypothetical small state with specific characteristics (table 2). Most notably, imports and government debt level of the baseline's small state were set at the average levels of all small states. Given the diversity of small states, in this section we provide a sensitivity analysis of the results with respect to three important country characteristics: the import share, the government debt level, and the share of LIQ households.

Figure 12 plots the GDP cost of fiscal consolidation in response to a 1 percent of GDP expansionary fiscal shock on government consumption, government investment, consumption tax, capital tax, labor tax, or transfers, both on impact and over a five-year horizon, for each of the three characteristics

FIGURE 12. Sensitivity Analysis

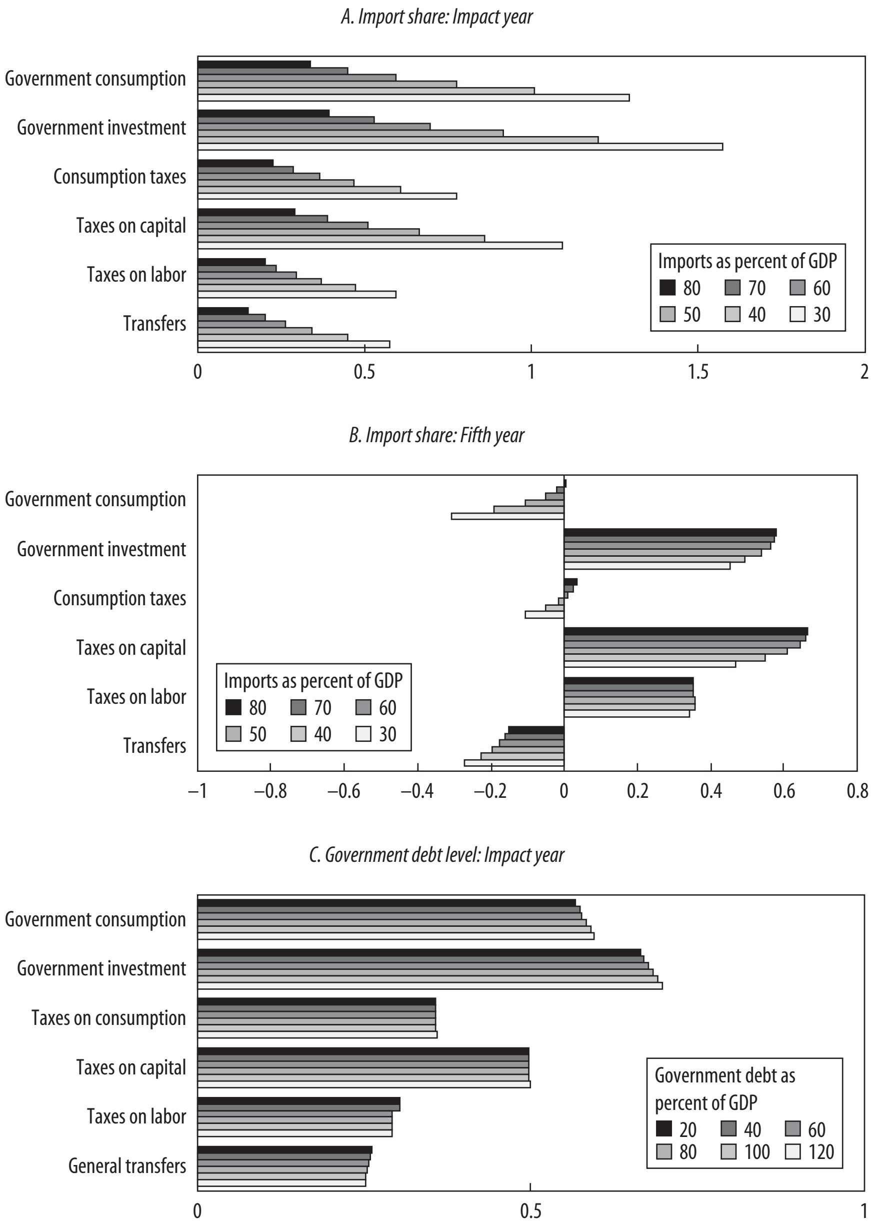
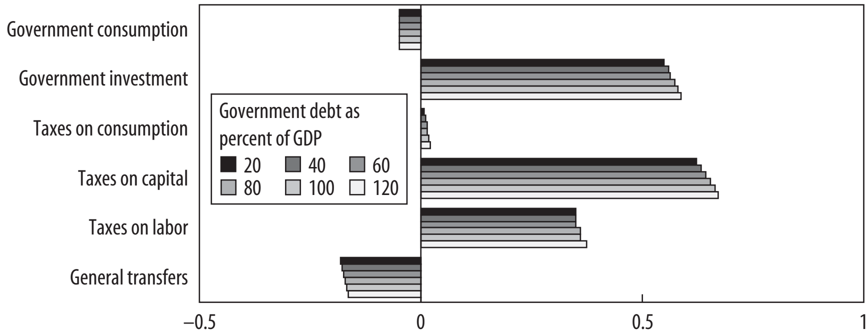
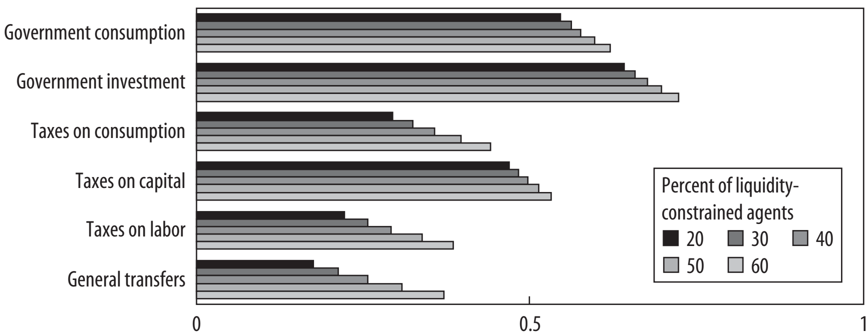


FIGURE 12. Sensitivity Analysis (*Continued*)

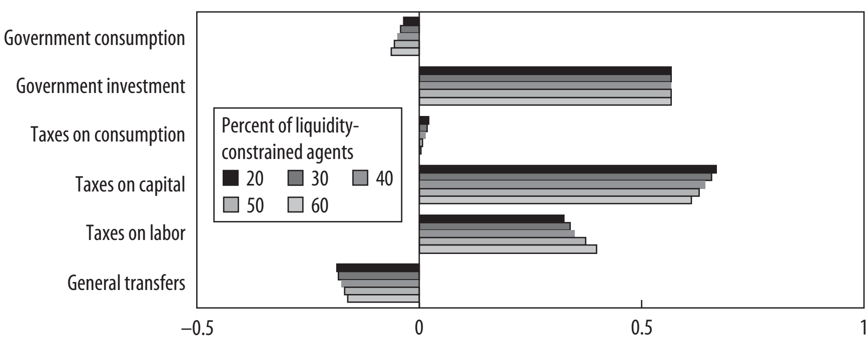
D. Government debt level: Fifth year



E. Share of liquidity-constrained households: Impact year



F. Share of liquidity-constrained households: Fifth year



Source: Authors' estimates.

Note: The figures show the one- and five-year cumulative effect on GDP of a fiscal expansion, equivalent to 1 percent of GDP, achieved through an increase in consumption (government current primary spending), an increase in investment, a reduction in taxes, or an increase in transfers, for different initial levels of the import share, government debt, and the share of liquidity-constrained households.

identified above. Panels A and B show a sensitivity analysis in which the import share is progressively raised from 30 to 80 percent of GDP. The higher the import share, the lower the fiscal multipliers, because the trade leakage is greater when import shares are higher. This holds for both on impact (one-year effect) and in the medium term (five-year effect).

Panels C and D of figure 12 plot the fiscal multipliers for different levels of government debt, ranging from 20 to 120 percent of GDP. The higher the government debt level, the higher the fiscal multipliers. This is because consolidation lowers the risk premium more for countries with higher debt levels and is thus more beneficial to those countries.

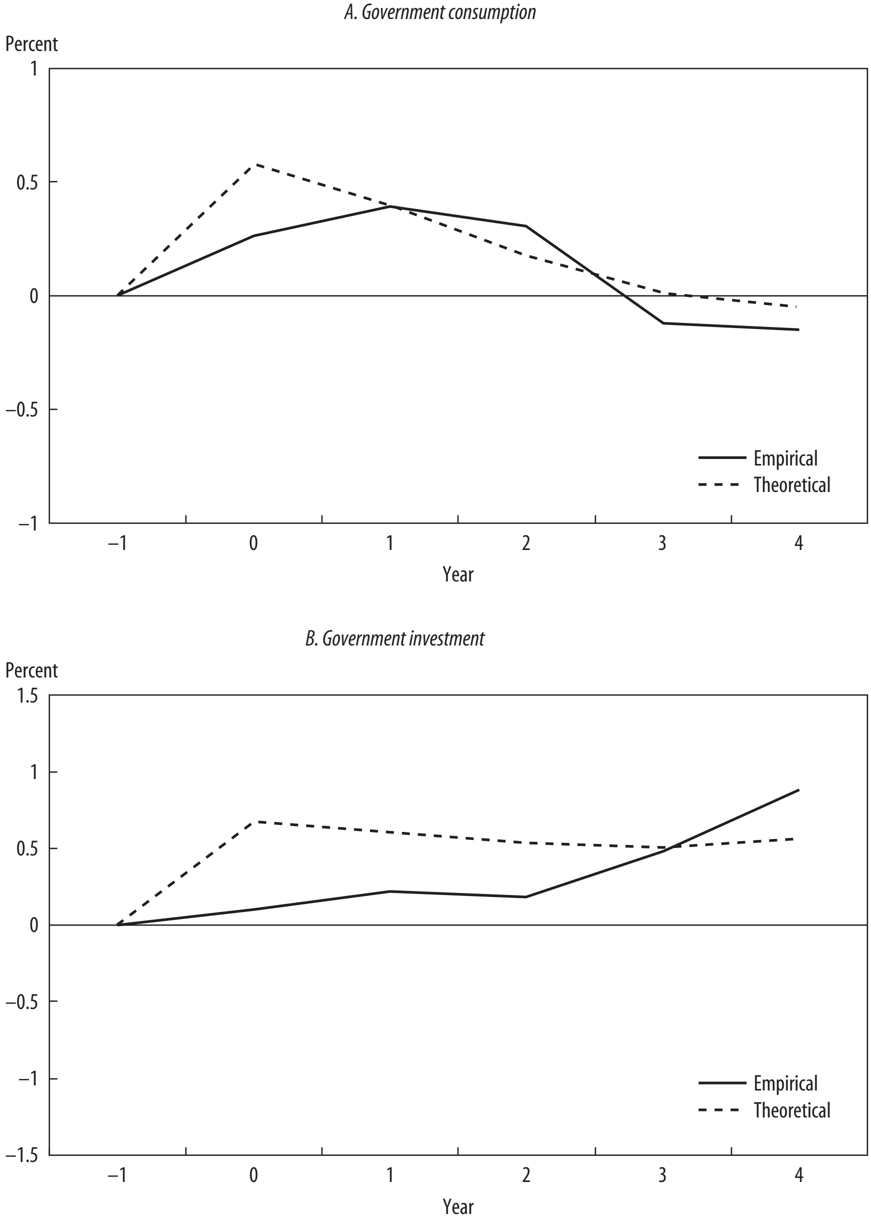
Lastly, panels E and F provide a sensitivity analysis for the share of LIQ households, with values between 20 and 60 percent of the population. Here again, the fiscal multipliers increase in step with the share of LIQ households. This reflects the fact that LIQ households have a hand-to-mouth consumption behavior and thus have a higher marginal propensity to consume, resulting in a larger fiscal multiplier.

Comparing Empirical and Theoretical Multipliers

In this subsection, we compare the impulse responses to government consumption and investment shocks from our empirical and theoretical (GIMF) models. Figure 13 plots the impulse responses of GDP to a 1 percent of GDP shock in government consumption and investment across the two models. The dynamics of government consumption are very similar between the empirical and GIMF models. In case of government investment, however, our GIMF model results suggest that the shock has a sizable immediate impact, whereas our empirical results indicate that it does not have an immediate impact.

The differences in the initial impact of government investment between the theoretical model and the empirical results are partly attributable to a potentially higher than average import share in government investment. As the sensitivity analysis in figure 12 shows, the higher the import share, the smaller the fiscal multiplier on impact. This is because an increase in GDP resulting from an increase in government spending is partly offset by a decline in net exports (that is, an increase in imports). In reality, government investment could have a higher import share than government consumption. That is, small states must import a large share of capital goods for government investment projects from abroad, whereas a relatively larger share of government consumption goods can be produced domestically. This disproportionately higher import share of government investment, in turn, results in a smaller

FIGURE 13. Empirical versus Theoretical Results



Source: Authors' estimates.

Note: The figures show the response (deviation from steady state) of GDP to a permanent expansion of government consumption and government investment equivalent to 1 percent of GDP under our empirical (local projection) and theoretical (GIMF) models.

fiscal multiplier on impact, as suggested by our empirical results. Additionally, over the medium term, government investment increases the government capital stock both in the model and in the data, which results in higher output, thus showing a similar high medium-term impact of government investment both in the model and in the empirical results.

Comparisons with Previous Studies

This section reviews the existing relevant studies and compares their results with ours. There are only a few existing contributions in the literature that estimate fiscal multipliers for small states. We categorize them based on their methodologies, namely, SVAR, narrative approach, and DSGE model. In this section, we briefly explain these methodologies and provide reasons why our forecast error methodology is more plausible for estimating fiscal multipliers for small states.

When an SVAR is used to identify government spending shocks, as in Blanchard and Perotti (2002), it is assumed that government spending does not respond to a change in GDP within the contemporaneous period (for example, quarter or year). Gonzalez-Garcia, Lemus, and Mrkaic (2013) estimate an SVAR with panel quarterly data interpolated from annual data for Eastern Caribbean Currency Union (ECCU) countries. They find that the fiscal multiplier for government consumption is not statistically significantly different from zero, while the fiscal multiplier for government investment is slightly less than 0.4 after one year. Using interpolated quarterly data for fourteen Caribbean countries between 1990 and 2011, Narita (2014) estimates an SVAR and finds that impact multipliers for government consumption are 0.1–0.2 on impact and 0.0–0.3 in the medium term. Guy and Belgrave (2012) employ an SVAR approach to estimate fiscal multipliers for government expenditure for four Caribbean countries by interpolating annual data into quarterly data between 1980 and 2008.[22] They find that the fiscal multipliers for government expenditures are very small after one year, at 0.1, and range from a small negative to 0.3 over a six-year period. Neither Guy and Palgrave (2012) nor Narita (2014) distinguish government consumption from government investment.

The second approach, known as the narrative approach, uses the news and budget documents to identify unexpected fiscal spending shocks by dropping

22. The four Caribbean countries in their study are Barbados, Guyana, Jamaica, and Trinidad and Tobago.

the incidences of government spending increases in response to current or prospective economic conditions (for example, David and Leigh, 2018; Romer and Romer, 2010). Data are not available for most small states to conduct this approach.

Finally, Dodzin and Bai (2016) calibrate a DSGE model for Palau and Kiribati and estimate an impact government consumption multiplier of around 0.5. To the best of our knowledge, this is the only existing study that uses a DSGE model to estimate multipliers for small states.

Key Advantages of Our Empirical Approach Compared to the Existing Empirical Literature

Our approach has a number of advantages over the previous literature on small states. First, the sample in our study is much larger than the sample used in previous studies for small states, with twenty-three countries based on the IMF definition of small states and thirty-four countries based on the World Bank's definition. In contrast, the previous studies cited above used four small states (Guy and Belgrave, 2012), eight ECCU countries (Gonzalez-Garcia, Lemus, and Mrkaic, 2013), and fourteen Caribbean countries (Narita, 2014).

Second, unlike the SVAR approach used in the majority of the previous studies, which imposes a recursive structure on responses to shocks, the local projection method in this paper allows nonlinear responses of GDP to changes in government spending. In essence, on impact (when horizon h is equal to 0), the effect is the same under an SVAR approach and a local projection method because at horizon 0, the GDP equation from a local projection method is a restricted version of the GDP equation from a recursive SVAR, where the lagged fiscal policy has no effect on contemporaneous GDP. The difference arises after the impact, where a local projection method allows a nonlinear response. Moreover, we augment the simple local projection method to avoid bias by including future fiscal shocks, as pointed out by Teulings and Zubanov (2014).

Third, our forecast error approach helps avoid potential measurement errors arising from interpolating annual data, which is the only data frequency available for many small states, into a quarterly frequency. Studies that use an SVAR interpolate annual data to obtain quarterly data (for example, Narita, 2014). Such an approach relies on how good the interpolation is. Given that many small states do not have official quarterly GDP statistics, the interpolation method could generate severe measurement errors. Under the forecast error method based on the October WEO of the same year, our identification assumption for estimating fiscal multipliers is similar to the assumption used for SVARs run for quarterly data, in which fiscal variables do not respond to the state of the economy within a quarter (October to December). As a result, we also mitigate endogeneity issues, which could have been severe if we had simply estimated fiscal multipliers at an annual frequency without using a forecast error approach.

Fourth, the forecast error method can dampen the anticipation effect of the fiscal variable. While this methodology relies on a similar timing assumption as an SVAR estimation based on quarterly data (for example, Blanchard and Perotti, 2002), the forecast error approach mitigates the anticipation problem in which agents respond by changing their consumption and investment behavior before the actual realization of changes in government spending. Previous studies that estimate fiscal multipliers for small states using an SVAR model do not account for the foresight problem.[23]

Fifth, this is the first paper to estimate state-dependent fiscal multipliers for small states (namely, expansion versus consolidation and boom versus recession). None of the aforementioned papers do so (Gonzalez-Garcia, Lemus, and Mrkaic, 2013; Guy and Palgrave, 2012; Narita, 2014). Unlike SVARs, the local projection method allows the estimation of state-dependent fiscal multipliers. Our empirical results suggest that fiscal multipliers are much larger during recessions and consolidations than during booms and expansions. This highlights the importance of considering state dependency (as shown in table 1).

Last, this paper estimates government consumption and investment separately. With the exception of Gonzalez-Garcia, Lemus, and Mrkaic (2013), the existing papers on small states do not distinguish between these two types of government spending (Guy and Palgrave, 2012; Narita, 2014). Given their significant difference in the short and medium terms, it is crucial to separately estimate fiscal multipliers for these two types of government spending.

Notwithstanding the different methodologies, our results are qualitatively consistent with those of the literature, but they are quantitatively different (see table A5 in the online appendix). Our empirical results suggest that government consumption has an impact multiplier of around 0.3 and has a negligible medium-term impact on growth. Our GIMF model estimates a slightly larger impact multiplier of around 0.6, but it also finds a negligible medium-term impact on growth. On the other hand, our empirical and GIMF results both

23. Forni and Gambetti (2016) overcome the foresight problem in an SVAR framework by including forecast variables for U.S. data. However, none of the previous studies on small states addresses this issue.

suggest that government investment has a larger medium-term growth impact than government consumption, with fiscal multipliers at around 0.7 on average. These fiscal multipliers are in line with the results from the existing studies that estimate fiscal multipliers for small states.

Studies Based on Larger Samples

Some studies use broader samples that also include a number of small states. The IMF Regional Economic Outlook (IMF, 2018a), for instance, estimates fiscal multipliers for countries in Latin America and the Caribbean using a narrative approach, SVAR, and forecasting error methods; the study finds fiscal multipliers of between 0.5 and 1.1. For the narrative approach, the study uses annual data for the sample of fourteen Latin American and Caribbean countries between 1989 and 2016, combined with the fiscal consolidation episodes from David and Leigh (2018).[24] Their SVAR approach estimates fiscal multipliers country by country using quarterly data from eight Latin American and Caribbean countries. Finally, their forecast error approach uses annual data since 1990 for the sample of nineteen Latin American and Caribbean countries. They separate government consumption and government investment and estimate that the respective fiscal multipliers are 0.2 and 0.6 on impact and 0.5 and 1.1 after a year. However, the sample includes the larger countries in Latin America, which have higher GDP per capita than the small states included in our results. Nevertheless, the results suggest that fiscal multipliers are higher for government investment than for government consumption.

Batini and others (2014) review fiscal multipliers from the exiting literature, including for low-income and emerging economies. They show that fiscal multipliers are generally low for low-income and emerging economies, at around 0.2 to 1.3, with most panel studies finding multipliers around 0.2–0.5 on impact. Thus our empirical results are generally in line with the previous literature using different methodologies and different sets of countries across the world.

Concluding Remarks

This paper has offered a fresh look at fiscal multipliers for small states. We find that, in small states, short-term multipliers of government consumption (consumption in the empirical model) and investment are both around 0.4,

24. Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Guatemala, Jamaica, Mexico, Paraguay, Peru, and Uruguay.

on average, for the empirical and DSGE baseline results. In the medium-long term, government consumption (current primary spending in the empirical model) has a fiscal multiplier of about zero, but government investment has an average multiplier of around 0.7.

These results are consistent with the view that while government consumption can affect GDP in the short term, it does not affect potential GDP in small states. On the other hand, government investment affects both short-term and potential GDP in small states. Tax multipliers are found to be larger than government consumption multipliers but smaller than government investment multipliers. These multipliers are state dependent, and they are generally larger during recessions and consolidations than during booms and expansions. This asymmetry occurs because expansionary fiscal policy, especially in small states with high government debt, results in higher risk premiums (for example, on interest rates), which in turn dampen the multipliers.

This paper has several policy implications for small states. Governments that need to embark on a consolidation path are advised to design the composition in favor of cutting government consumption without cutting investment spending, as much as feasible. In fact, governments may find a consolidation plan to be growth friendly if, within the overall consolidation envelope, it includes an expansion of government investment. For governments that intend to embark on an expansion, the short-term benefits of current spending and investment are not materially different, while the medium-term benefits of investment are considerably larger than those of current spending.

There are several caveats to this study. First, the results may be affected by how government spending is financed. While the GIMF model assumes fiscal policy is financed by surplus/deficit, the empirical part does not differentiate between financing sources for government spending. For instance, despite the strong growth implication of public investment spending, using debt financing to increase public investment may not be a desirable policy tool as the return on public investment may not be sufficiently high to offset the interest on domestic and external loans. Second, given the annual data, our forecast error approach mitigates but does not fully solve the foresight (anticipation) problem and endogeneity issues. Our approach still leaves room for anticipation effects and endogeneity problems within the quarter. Moreover, our forecast error approach is as reliable as the forecasts we use. Finally, this study does not consider the political difficulty and possible distributional impact of different fiscal policy instruments.

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