Sources of Borrowing and Fiscal Multipliers*

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Abstract

This paper finds that debt-financed fiscal multipliers vary depending on the location of the debt buyer. In a sample of 33 countries fiscal multipliers are larger when government purchases are financed by issuing debt to foreign investors (non-residents), compared to when they are financed by issuing debt to home investors (residents). In a theoretical model, the location of the government creditor produces these differential responses through the extent that private investment is crowded out. International capital mobility of the resident private sector decreases the difference between the two types of financing both in the model and in the data.

Keywords: Fiscal multipliers, structural vector autoregressions, sign restrictions, proxy-SVAR, investment crowding in, debt financing, small open-economy model

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1 Introduction

The question we attempt to answer in this paper is whether the transmission mechanism of a fiscal shock depends on the government's source of borrowing. Economic theory, but also our empirical investigation, suggests that a government spending shock can produce different effects on the real economy if it is financed with debt issued to home investors (residents) or debt issued to foreign investors (non-residents). These differences extend to the size of fiscal multipliers, which, in particular, are larger when government spending is financed with debt placed abroad.

The intuition for the story is the following: if the private sector is restricted in its external borrowing, then domestic government borrowing takes resources from the private sector that can no longer be invested. Instead, if the government borrows abroad, the government acquires resources from abroad so that domestic investment need not fall. Ultimately, this implies that the fiscal multiplier is larger when spending is financed with debt held abroad.

The severity of the private sector's external borrowing friction is key in determining whether domestic government borrowing will displace investment. If private foreign credit markets functioned perfectly, then purchases of government debt could be fully financed by private external borrowing and would avoid the displacement of investment.

Armed with this intuition, we inspect if the mechanism is present in the data. We study the effects of a government spending shock and develop a strategy for identifying whether it is financed with debt held by residents, or by non-residents. Our empirical procedure consists of estimating a structural vector autoregression (SVAR) for a panel of 33 advanced and emerging economies. Data availability on public debt and creditor location is readily available at a quarterly frequency from 1995:Q1. To disentangle the location of debt financing, we rely on standard timing restriction identification and complement it with a sign restriction on the movement of the ratio of domestic public debt to external public debt. In particular, both foreign- and home-debt-financed fiscal shocks contemporaneously affect government spending, output, consumption and investment. Additionally, a foreign- (home-) debt-financed fiscal shock decreases (increases) the ratio of domestic public debt to external public debt. Since the restrictions are placed on the contemporaneous responses of debt, this approach identifies *marginal* increases to finance government spending.

The SVAR confirms the intuition outlined. We find that investment is crowded in following a foreign-debt-financed spending shock and crowded out following a home-debt-financed spending

shock. This translates to an impact output multiplier that is 0.5 for a foreign shock and 0.2 for a home shock, in our baseline specification. In line with Blanchard and Perotti (2002); Fatas and Mihov (2001); Pappa (2009), among others, we find that consumption is always crowded in. Importantly, the difference in the responses of investment and output across the two shocks are statistically significant on impact and at longer horizons.

We also test the importance of the private external borrowing constraint in affecting the response of investment and the size of fiscal multipliers. We do so by employing the approach in Ilzetzki et al. (2013) and conditioning the panel on variables that proxy for private external financial market openness: i) real volatility, ii) the predominance of non-resident bank loans, and iii) the Chinn-Ito index of financial openness. The results verify that for sub-samples where private access to external finance is low (high), the difference of investment responses and output multipliers is greater (smaller).

We then focus on the US and exploit the informational content available from narrative evidence regarding announcements of exogenous government spending. We include the defense news series from Ramey and Zubairy (2018) directly into the SVAR by assigning to it the same sign restriction as on government spending. In a further step, we estimate a proxy-SVAR as in Mertens and Ravn (2013). We use the defense news series in the periods in which the change of the ratio of domestic public debt to external public debt is negative (positive), as a proxy for the foreign- (home-) debt-financed spending shock. This procedure combines the identification advantages of the proxy-SVAR framework, with the appealing features of the sign restriction methodology that enables pinning down the location of financing of government spending. Including such forward-looking variables also captures fiscal foresight on the part of the private sector.

Finally, we examine whether a canonical small open economy model (SOE) with government spending can confront the predictions from the empirical investigation. The different response of investment based on the location of financing also holds here. However, the statement related to the different size of *impact* output multipliers is not immediately ensuing. This derives simply from the fact that capital is pre-determined and takes time to build. As such, the impact response of output primarily depends on the impact response of labor. And agents in the economy will, in equilibrium, supply more labor when investment is crowded out because permanent income is lower and the negative wealth effect is larger. The foreign-debt-financed shock, however, becomes more

expansionary in subsequent periods when capital becomes productive.

On the policy front, our analysis can shed light on the effects of fiscal policies witnessed in recent years. For example, a change from financing government expenditures with external funds in favor of domestic funds could have contributed to the recession in the European periphery. Moreover, the fact that expansionary fiscal policy in Japan primarily relied on domestic financing may explain the only modest effects on aggregate demand.

Related Literature

Our work ties in with several branches of the fiscal policy literature, in particular the one documenting the state-dependence of fiscal multipliers.[1] Most related to our paper are the studies that distinguish between the financing of government spending. For example, Mountford and Uhlig (2009) focus on fiscal shocks associated with deficit-spending, deficit-financed tax cuts and a balanced budget spending expansion. Similarly, Canova and Pappa (2007) look at spending shocks financed by bond creation and those financed by distorting taxation.

However, there is no previous work looking into more detail at the subset of fiscal multipliers that are debt-financed. In previous iterations of this paper (Priftis and Zimic (2015, 2017)), we use the predictions of an economic model regarding movements of the current account to identify an SVAR using a combination of sign and magnitude restrictions on total external and total public debt. The current version exploits information from a recent data set on domestic and external public debt and identifies debt-financed spending shocks in a more direct manner. The results we have been obtaining throughout the life cycle of the paper have always been consistent with the intuition developed.

Recently, Broner et al. (2018) show that multipliers are increasing in the share of debt that is in the hands of foreigners. They do so by identifying spending shocks as in Ramey and Zubairy (2018) and Guajardo et al. (2014). Like us, they rely on the crowding in or out of private investment, but there are differences in terms of approach and quantitative predictions. Our identification captures the contemporaneous change in debt and therefore directly extracts the marginal absorption of newly issued debt. Differently, they proxy the marginal change in the composition of debt using the lagged

[1]For example, Christiano et al. (2011) and Miyamoto et al. (2018) show that fiscal multipliers are larger at the zero lower bound. Auerbach and Gorodnichenko (2013) show that multipliers are larger during recessions. However, Ramey and Zubairy (2018) challenge this using historical military spending data. Ilzetzki et al. (2013) find that fiscal multipliers depend on economic development, the exchange rate regime, trade openness, and public indebtedness. Basso and Rachedi (2018) show that fiscal multipliers depend on demographics.

average share. Their methodology is therefore similar to an interaction-VAR that we explore in Section 4.3.5. Second, we consider the effect of the private sector's borrowing constraint. As we show, this is crucial in generating a wedge between multipliers. Third, beside the US, they focus on a panel of 17 OECD countries using data at annual frequency. Our panel uses quarterly data and has a larger country dimension. In terms of quantitative predictions, we find multipliers to be in the range of 0.2 to 1.3, while their analysis predicts multipliers, which range from being negative to over 7.

From a theoretical perspective there are several works investigating the capacity of debt expansions to crowd investment in our out. Traum and Yang (2015) show that the response of investment depends on what policies generate the debt increase (capital/consumption taxes or government investment). Broner et al. (2014) also show that sovereign debt can crowd out investment in a model with creditor discrimination. Finally, our argument that domestic and foreign flows can have different domestic effectiveness is connected to Farhi and Werning (2017), who show that transfer multipliers are large when these are provided by foreigners.

2 Econometric Methodology

For the baseline empirical specification we construct an unbalanced panel with quarterly data from 1995:Q1 to 2016:Q4 for 33 advanced and emerging economies for the following variables: government consumption, output, private consumption, private investment, domestic public debt, and external public debt. For more information on data sources, see the online appendix.

2.1 Reduced form VAR

The objective is to estimate the following system of equations:

$$AY_{n,t} = \sum_{k=1}^{K} C_k Y_{n,t-k} + Bu_{n,t} \tag{2.1}$$

where $Y_{n,t}$ is a vector of endogenous variables for a given quarter t and country n. C_k is a matrix of the own- and cross-effects of the k^{th} lag of the variables on their current observations. B is a diagonal matrix so that u_t is a vector of orthogonal i.i.d. shocks to government consumption such that $Eu_{n,t} = 0$ and $E\left[u_{n,t}u_{n,t}^{'}\right] = I_n$. A is a matrix that allows for contemporaneous effects between

the endogenous variables in $Y_{n,t}$.

The baseline specification estimates the system in 2.1 in log differences using a panel OLS regression with country fixed effects. We employ four lags of the endogenous variables as proposed by the HQ criterion.[2] OLS provides an estimate for the matrices $A^{-1}C$, but additional identification assumptions are necessary to estimate the coefficients in A and B.

2.2 Identifying debt-financed fiscal shocks

We use the debt data to construct the *ratio* of domestic public debt to external public debt and introduce this into the SVAR. $Y_{n,t}$ contains the variables: *government consumption, ratio, output, private consumption, private investment.*

The availability of quarterly data allows us to employ standard timing restrictions, as in Blanchard and Perotti (2002) and Ilzetzki et al. (2013), to identify a (pure, location-free) government spending shock. The assumption is that the government's decision to change spending in response to a different macroeconomic environment takes more than a quarter. Timing restrictions, therefore, allow us to separate exogenous variation in government spending from systematic responses to macroeconomic conditions. To distinguish between a Foreign- and Home-government spending shock, we then employ sign restrictions on the response of the *ratio*. In particular, a Foreign shock decreases the ratio, while the Home shock increases it (see Table 1). Since the restrictions are placed on the contemporaneous increases of debt, this approach identifies *marginal* absorption in domestic or external debt to finance government spending.

In the set of models that are consistent with the data and sign restrictions, we select the model that maximizes the difference in the impact response of the ratio for the two shocks. This allows us to exactly identify the model and capture shocks that are as close as possible to the theoretical counterpart of a purely foreign- or purely home-financed spending shock.[3]

2.2.1 Fiscal multipliers

Following Ilzetzki et al. (2013)) we calculate the cumulative multiplier as $m_{t+s} = \sum_{q=t}^{t+s} \Delta X_q / \sum_{q=t}^{t+s} \Delta G_s \overline{X}/\overline{G}$, which measures the cumulative change of the endogenous variable X per unit of additional gov-

[2] We use country block bootstrap to take into account parameter uncertainty. Results are robust to using standard residual bootstrap.

[3] Retaining all models that are consistent with the sign restrictions does not qualitatively impact the results, except for standard error bands that become slightly wider as they also contain model uncertainty.

Table 1: Identification Restrictions

	Foreign shock	Home shock	3	4	5
Government spending	+	+	0	0	0
Ratio	-	+	0	0	0
Output				0	0
Consumption					0
Investment					

Notes: Rows denote the variables in the SVAR. Columns denote the identified shocks. "Foreign shock" refers to a foreign-debt-financed government spending shock. "Home shock" refers to a home-debt-financed government spending shock. Ratio is defined as domestic public debt to external public debt. 0 denotes no contemporaneous effect (timing restriction). Sign restrictions are imposed for 1 quarter.

ernment consumption G, from the impulse at time t, to the horizon s. $\left(\overline{X}/\overline{G}\right)$ is the sample average of the endogenous variable over government consumption.

3 Results

3.1 Foreign- and home-debt-financed government spending shocks

Figure 1 plots the cumulative fiscal multipliers following a 1% government spending shock. Table 1 reports the values at different horizons.[4]

[Insert Figure 1 and Table 1 here]

The main difference across the two ways of financing government spending relate to the response of investment. A foreign debt-financed spending shock produces a crowding in of investment (investment multiplier is 0.39 on impact). If spending is financed domestically, private investment is crowded out (-0.18 on impact). The differences in investment have implications for the size of the output multiplier. When spending is financed abroad, the impact multiplier is 0.53 and converges to a level of 1.65 after 3 years. On the other hand, if it is financed domestically, the impact output multiplier is 0.17 and only reaches a level of 1.03 after 3 years. In both cases, consumption is crowded in, reflecting the results of the empirical fiscal policy literature, for example, Blanchard and Perotti (2002); Fatas and Mihov (2001); Pappa (2009).

[4]The cumulative impulse response functions (IRFs) can be seen in the online appendix.

The bottom panel of Figure 1 plots the difference in cumulative multipliers, defined as Foreign-Home. The difference is positive and statistically significant on impact both for output and investment, while the positive difference in investment persists significantly. In the medium-run, the positive difference for output multipliers too becomes significant.

It is worth noting how the results relate to a standard exercise without debt variables, where government consumption is ordered first (see Figure 2). A government consumption shock produces the well-known effects of an increase in output, and a crowding in of private consumption. But, the response on private investment is close to being insignificant on impact and only turns positive in the medium-run. The result is in line with several studies, for example Fatas and Mihov (2001), who find insignificant responses on private investment, and Pappa (2009), who finds mixed effects depending on the sample employed. Investment is crowded out in the euro area, but in the US and Canada it is crowded in.

[Insert Figure 2 here]

The cumulative multiplier on output is 0.39 on impact, increases along the horizon and converges to a level of 1 after 3 years.[5] The multipliers in the SVAR with debt variables are lower when financed domestically (0.2) and higher when financed abroad (0.5). Taken together, the results suggest that conditioning on the location of debt-financing is important for understanding the transmission of fiscal shocks through private investment, and that a specification that abstracts from debt variables may be capturing a combination of the cases where debt composition matters.

3.2 Does private external borrowing matter?

Theory suggests that whether investment will be crowded out depends on the extent to which the private sector has access to external borrowing. Hence, we should observe a smaller difference in the impact responses of output for Home and Foreign shocks if external finance to the private sector is available.

In the spirit of Ilzetzki et al. (2013), we exploit the cross-section of the panel and condition it on country characteristics that proxy for the private sector's access to external financial markets. For each proxy, we split the panel into two groups: a sub-sample where private access to external finance

[5] In a bivariate VAR with government consumption and output, Ilzetzki et al. (2013) find an impact output multiplier of 0.37 in high-income countries, which in the long run reaches a level of 0.8.

is high (above the median), and another where private access to external finance is low (below the median). We consider the following three proxies of financial market openness: i) the variance of GDP, ii) the share of loans from non-resident banks to GDP, and iii) the Chinn-Ito index of financial openness.

Real volatility is associated with rising risk premia for both government bonds and private sector lending rates.[6] So, when volatility is high, access to external financing should be more constrained. In contrast, countries with more non-resident bank loans will have better access to external finance.[7] However, given that this variable is reported as a share of GDP, very advanced economies (e.g., US) are classified into the "low access" sub-sample. Finally, the Chinn-Ito index measures the degree of a country's capital market openness, with higher values reflecting greater openness (Chinn and Ito (2006)).

[Insert Table 2 here]

The results are summarized in Table 2. Besides cumulative multipliers, the table reports the empirical probability density function (PDF) of the difference in multipliers across the two shocks, Δ. The difference is defined as Foreign-Home and the empirical PDF is obtained by drawing from the simulated distribution of the models that satisfy the sign restrictions. Apart from the measure of loans from non-resident banks (% GDP), the difference in output and investment multipliers between a Foreign and a Home shock is smaller for countries with better private sector access to external markets. At the same time, investment is crowded in by more in the "low-access" sub-samples.

3.3 United States

3.3.1 Narrative series on defense news

The US provides a suitable platform to test alternative identification schemes by exploiting the available narrative evidence regarding announcements of exogenous government spending. We use the historical defense news series from Ramey and Zubairy (2018) as a proxy for the government spending shock. The series focuses on movements in government spending that are connected to political and military events, making them likely independent from the state of the economy. Given potential measurement problems that may arise with historical records, we can interpret this series as

[6] E.g., Pancrazi et al. (2015) show that public and private credit spreads are higher in "crisis times"

[7] Recent studies that make use of this measure, especially for emerging economies are Bandyopadhyay et al. (2012).

a proxy rather than a direct narrative observation. The additional informational content provided by the proxy however, will enable to more accurately identify the (pure, location-free) government spending shock. We add the defense news series in the SVAR and assign to it the same sign restrictions as to government spending (i.e., to increase).[8]

As can be seen in Figure 3 and Table 3, the results for the US are in line with those of the international panel. For investment, the Foreign shock leads to crowding in on impact while the Home shock leads to crowding out, with the difference being at 0.37 and statistically significant. In the medium run, the response of investment following a Foreign shock becomes negative. The fact that investment is crowded out in both cases in the US in the medium term is in line with Leeper et al. (2017), who find that investment is decisively crowded out in a regime of active monetary policy coupled with passive fiscal policy.

[Insert Figure 3 and Table 3 here]

Regarding the output multiplier, Table 3 shows that on impact, it stands at 1.29 when spending is financed abroad and at 0.92 when financed domestically, reaching a level of 1.45 and 0.6 after 3 years, respectively. Notably, the US multipliers are quantitatively larger than for the international panel and decisively above 1 for the Foreign shock. This can due to the fact that for government spending data, NIPA reports *total* government expenditures consisting of both consumption and investment. The fact that expenditures now include government investment suggests that the fiscal effects of government spending can be thought of as an upper bound. This is because government investment shocks are more expansionary because of their productivity-enhancing properties.

3.3.2 Proxy-SVAR with "poor man's sign restrictions"

To address possible additional endogeneity issues that may exist in the identification assumed so far, we also build on the proxy-SVAR procedure of Stock and Watson (2012) and Mertens and Ravn (2013). The method employs exogenous variations in defense news, which is included in the VAR system, as a proxy for government spending. Defense news is assumed to be correlated with government spending, but orthogonal to other structural shocks, constituting it an instrument for the reduced form residuals of the VAR.

[8]When we restrict our analysis to the US the horizon of available data becomes longer (1952:Q1). See the online appendix for data sources.

We use the defense news series in the periods in which the change in the ratio of domestic public debt to external public debt is negative (positive), as a proxy for the foreign- (home-) debt-financed spending shock. The mapping between this exercise and the baseline identification of Section 2.2 is natural. Exploiting the defense news series in this way can be interpreted as a loose form of sign restrictions ("poor man's sign restrictions" in the language of Jarocinski and Karadi (2018)). This procedure allows to combine the identification advantages of the proxy-SVAR framework, with the appealing features of the sign restriction methodology that enables pinning down the location of financing of government spending.

[Insert Figure 4 here]

Figure 4 shows the cumulative multipliers of the proxy-identified SVAR. For the foreign-debt-financed proxy, investment is crowded in significantly on impact and the impact response of output is positive. In contrast, for the home-debt-financed proxy, investment is crowded out on impact and in the medium-term, and the short-run response of output is negative. The cumulative multiplier for consumption follows the same dynamic.[9]

4 Robustness checks

We perform a battery of robustness checks related to different sub-samples, different VAR specifications, and different identification assumptions. Table 4 summarizes the difference in cumulative multipliers for all checks, while more detailed results can be found in the online appendix.

[Insert Table 4 here]

4.1 OECD countries and emerging economies

First, we test the baseline specification using different country groupings (OECD, emerging economies). The results carry over to the OECD subgroup with a difference in the impact response of output standing at 0.47, which is statistically significant. Moreover, investment is crowded in following a Foreign shock and crowded out following a Home shock. The difference stands at 0.57 and is statistically significant.

[9]The results of a location-free proxy-identified government spending shock (without poor man's sign restrictions), are similar to the reference SVAR without debt, with the exception of investment that is crowded in on impact but turns insignificant in the medium run (see Figures B.5 and B.6 in the online appendix).

Focusing on the emerging economies sub-sample, the results are weakened. The difference in the impact output multiplier is still positive, but this difference is not statistically significant. Investment is crowded in on impact following both shocks, but the impact response is greater for a Foreign shock. The result can potentially be a consequence of small sample size.[10] Alternatively, because of characteristics that are specific to emerging economies, such as exchange rate risk. Emerging economies typically borrow externally using foreign-currency-denominated debt.[11] If exchange rate risks are high, a possible depreciation of the currency of denomination relative to the domestic currency can negatively impact the economy and more than offset the expansionary effects of external financing that work through a crowding in of investment. In Section 4.3.3 we show that the currency-denomination of debt plays no role for the transmission of spending shocks.

4.2 Levels and no fixed effects

Second, we perform robustness checks with regards to the reduced form model: we re-estimate the baseline specification without country fixed effects and in levels. For the latter we experiment with a log specification as well as with a log specification using HP-filtered data. In all instances the results carry through, with the difference in output multipliers being insignificant on impact for the case of HP-filtered data.

4.3 Alternative identification schemes

4.3.1 Controlling for taxes

The baseline specification in Section 2.2 abstracts from the role of taxation in financing government spending. To ensure that the differences in multipliers are not driven by the response of taxes, here we include tax revenues as an additional variable in the SVAR, and experiment with two different identification assumptions. First, we impose zero restrictions on the impact response of tax revenues following both home- and foreign-debt-financed government spending shocks. Second, we order tax revenues last, implying that other variables do not react contemporaneously to changes in tax revenues.

[10] The emerging economies comprise approximately 20% of the global panel. When we remove the emerging economies from the panel and re-estimate the baseline SVAR, our results are strengthened.

[11] The correlation between external debt and foreign-currency-denominated debt is 56% in the emerging economies sub-sample, whereas only 8% in the entire sample

When controlling for tax revenues, the effects are unchanged and slightly strengthened. For the panel SVAR the difference in output multipliers stands at 0.35 when we include tax revenues with zero restrictions (difference of 0.4 without zero restrictions) and in both cases this difference is statistically significant.

4.3.2 Controlling for the risk premium

The identifying assumption made so far is that government spending and the ratio of external-to-domestic debt do not react to other macroeconomic shocks due to policy lag. Although quarterly data makes this assumption plausible, it may be argued that additional shocks could contemporaneously impact government spending and debt composition. Such an innovation could take the form of lower credit risk premia, thereby lower borrowing costs and endogenously leading an otherwise constrained government to borrow more in order to finance spending.[12]

We include the sovereign bond yield as an additional variable in the SVAR and experiment with three identifying restrictions. Case A is in line with Uribe and Yue (2006) who specify a VAR where interest rates are ordered after real variables. This presupposes that real variables do not react contemporaneously to financial variables and that financial variables respond with a lag. Case B assumes that reductions in the cost of borrowing lead to increases in spending, but is agnostic on where the debt is financed from. Case C1 (C2), assumes that reductions in the cost of borrowing lead to increases in spending, which are financed with external (domestic) debt. Moreover, including such forward-looking variables in the SVAR also captures fiscal foresight. In all cases, we continue to identify Foreign and Home shocks using the sign restrictions in Table 1.

Figure C.9 of the online appendix reports cumulative multipliers for the spending shocks from Case A. The bond yield moves in the same direction for both shocks, implying no asymmetric effects on the cost of borrowing. The Foreign shock produces output multipliers that are greater than those produced by the Home shock. Moreover, investment is crowded in for a Foreign shock, but crowded out for a Home shock. We can conclude therefore that the identified spending shocks do not arise as an endogenous reaction to declines in the costs of borrowing.[13]

[12]Reasons why in some countries credit spreads may be lower than in others include a higher level of (labor) productivity, higher institutional quality, higher capital account openness, lower debt-to-GDP ratios, etc. To check for potential omitted variables we regress the residuals of government spending shocks on the above variables and find they are uncorrelated at the 5% significance level. Results are available on request from the authors.

[13]In the remaining cases it is clear that the shock to the bond yield does not produce the same IRFs as those of a spending shock. Results are available on request from the authors.

4.3.3 Does currency denomination of debt matter?

It can be argued that it may not necessarily be the location of the creditor that matters for multipliers, but instead the currency denomination of debt. To check for this, we collect data on the currency denomination of debt and estimate the same SVAR as in Section 2.2, but replace the ratio of domestic-to-external public debt with the ratio of domestic currency-to-foreign currency debt. We assign the analogous restrictions that a foreign-currency-denominated government spending shock causes the ratio to decline, while a domestic-currency-denominated shock to increase it. Notably, the correlation between external debt and foreign-currency-denominated debt is 8% in the sample. As can be seen in Figure C.11 of the online appendix, the transmission channel for government spending shocks is not dependent on the currency denomination of debt. The output and investment responses are statistically indistinguishable between the two cases. Moreover, both shocks lead to investment crowding in, rather than producing heterogeneous responses.

4.3.4 Current account deficit

If the government finances a fiscal expansion by issuing debt, this may also cause the current account to deteriorate. This may happen regardless of the location of the creditor. However, if spending is financed by debt placed abroad the current account deterioration triggered by the fiscal expansion will be greater. This is because the externally-placed debt will imply an over-and-above deterioration from that generated by the fiscal expansion alone. In order to verify that our two shocks do not create the opposite effects on the current account, we order it last in our SVAR and test for this hypothesis. As can be seen in Figure C.12 of the online appendix, both Home- and Foreign-financed shocks cause the current account to deteriorate and the deterioration is greater when spending is financed abroad (2 percentage points vs. 0.5 percentage points). Moreover, the difference in output and investment multipliers remains positive and statistically significant (0.45 for output on impact; 0.59 for investment on impact). The data therefore supports the intuition.[14]

[14]When we include the sovereign bond yield as an additional variable in the SVAR, we find it declines on impact for both Home and Foreign shocks. Given the limited size of the current account deficit, the twin deficit that emerges does not trigger negative connotations associated with a potential crisis narrative (see Figures C.14 and C.15 in the online appendix).

4.3.5 Interaction-VAR

We experiment with an alternative VAR specification, which exploits cross-sectional information from the entire panel, but allows for an interaction term between government spending and the ratio of domestic-to-external public debt. This approach captures the effects of changes in government spending for different average compositions of debt in the economy (outstanding debt), rather than the marginal absorption that we have been identifying so far. This methodology is in line with Saborowski and Weber (2013). The interaction term on the ratio of domestic-to-external public debt takes on the values of 1% (low domestic-to-external debt) and 99% (high domestic-to-external debt). In doing so, we continue to identify a single government spending shock using a Cholesky decomposition. The results are in line with our baseline specification.

5 Can A Small Open Economy Model Explain The Findings in the Data?

In this section, we test whether the empirical results can be reconciled with the theoretical predictions from a canonical SOE model (as in Schmitt-Grohe and Uribe (2003)) with government spending. The standard model already has sufficient ingredients to illustrate how the location of financing affects the response of investment and the difference in (long-run) multipliers. We then illustrate a number of modifications and discuss how possible alternative mechanisms can account for the universe of the empirical results.

5.1 Households and firms

The representative household chooses consumption c_t, labor n_t, government debt b_t^h, and foreign debt $b_t^{f,k}$ to maximize its utility

$$\mathbf{E_0} \sum_{t=0}^{\infty} \beta^t \left[\log\left(c_t\right) - \theta \log\left(n_t\right)\right] \tag{5.1}$$

subject to the budget constraint:

$$c_t + i_t + b_t^h - b_t^{f,k} = w_t n_t + r_t k_{t-1} + R_{t-1}^h b_{t-1}^h - R_{t-1}^{f,k} b_{t-1}^{f,k} - T_t \tag{5.2}$$

i_t is investment in productive capital, $w_t n_t$ is labor income, $r_t k_{t-1}$ is the rent from capital, and $T_t > 0$ are lump-sum taxes (transfers when negative). b_t^h and $b_t^{f,k}$ denote the purchases of debt from the government and external financial markets, made at time t. If $b_t^h < 0$ and $b_t^{f,k} > 0$ the household is a borrower. The interest rate on government debt is determined endogenously through the Euler equation, whereas the interest rate on private foreign debt is assumed to follow a debt-elastic interest rate rule: $R_t^{f,k} = r^* + \nu \left[\exp\left(b_t^{f,k} - \overline{b^{f,k}}\right) - 1\right]$, where $R_t^{f,k}$ is a sum of the world interest rate, r^*, and a convex function of the deviation of debt from steady state, $\overline{b^{f,k}}$. $\nu \in [0, \infty)$ parametrizes the sensitivity of the interest rate to debt deviations and is interpreted as the degree of external financial market openness for households. As $\nu \to 0$, households have perfect access and can borrow from abroad at the world interest rate. When $\nu > 0$, the cost of external capital increases in an exponential fashion.

Output is produced using a Cobb-Douglas technology over capital and labor: $Y_t = k_{t-1}^{\alpha} n_t^{1-\alpha}$. Capital evolves according to the usual law of motion: $k_t = (1-\delta) k_{t-1} + i_t$.

5.2 Government

Public consumption follows the exogenous AR(1) process $g_t = \kappa^g + \rho_g g_{t-1} + \varepsilon_t^{g,h} + \varepsilon_t^{g,f}$ and is financed with lump-sum taxes, T_t, debt issued to domestic households, b_t^h, and debt issued to non-residents, b_t^f. For simplicity we assume that the interest rate on public external debt is equal to the public domestic interest rate $\left(R_t^f = R_t^h\right)$.[15] The government's budget constraint is given by:

$$g_t - T_t = b_t^h - R_{t-1}^h b_{t-1}^h + b_t^f - R_{t-1}^f b_{t-1}^f \tag{5.3}$$

The objective is to map the government spending shocks in the model to the ones identified in the empirical investigation. In Section 2 we disentangled the orthogonal cases of a home debt-financed and foreign debt-financed spending shock by extracting impulse response functions that satisfy restrictions on the ratio of domestic public debt to external public debt. Here, we omit specifying a tax rule and instead close the model by assuming that both domestic public debt and foreign public

[15] This can be seen as the solution to the government's financing cost minimization problem $\left(\min_{\{b_t^h, b_t^{f,g}\}} R_{t-1}^h b_{t-1}^h + R_{t-1}^f b_{t-1}^f \quad \text{s.t.} \quad \text{eq. 5.3}\right)$. We relax this assumption in Section 5.4.1.

debt follow exogenous processes:

$$b_t^h = \rho_B b_{t-1}^h + \varepsilon_t^{g,h}; \qquad b_t^f = \rho_B b_{t-1}^f + \varepsilon_t^{g,f} \tag{5.4}$$

where $\varepsilon_t^{g,h}$ and $\varepsilon_t^{g,f}$ are innovations that drive either the domestic or external debt process, but both affect government spending. When the government finances government spending using domestic (external) debt, only the shock $\varepsilon_t^{g,h}$ $\left(\varepsilon_t^{g,f}\right)$ is relevant. Following a shock to $\varepsilon_t^{g,h}$ $\left(\varepsilon_t^{g,f}\right)$, domestic (external) debt increases one-for-one with g_t, and (domestic) external debt is exogenous and set to steady state, $\left(\overline{b^h}\right)$ $\overline{b^f}$. By assumption, the shocks are uncorrelated, but occur together at every point in time.[16] The optimality conditions of the flexible price economy are shown in section D of the online appendix.

5.2.1 Calibration

We calibrate the model by setting β to 0.99 in order to achieve an interest rate of 1% at the baseline. We conventionally set α, to 0.33 and δ, to 0.025. We calibrate θ, to 1.75. κ^g, is set to 0.02 to obtain a steady-state level of government spending to GDP of 20%. Regarding ν, as we explain below, we perform impulse response functions (IRFs) in the range $[0, 0.5]$. We specify $\rho_G = \rho_B = 0.9$ such that all variables in the economy return to their steady states by period 20. Finally, the spending shock is of size 1% of its steady-state value.

5.3 The response of investment

Figure 5 plots the responses of investment following a home-debt-financed and a foreign-debt-financed spending shock for different values of ν. When ν is low, households can borrow externally at a favorable interest rate, while when ν is high external borrowing becomes prohibitively costly.[17] The key difference across the two spending shocks is the sensitivity of investment to ν. For a Foreign shock, investment is always crowded in. For a Home shock, investment is crowded in for low values of ν, but crowded out for high values of ν.

[Insert Figure 5 here]

[16] The intention here is to provide a mechanism for what we observe in the data, which is a limiting case of a purely home- and foreign- financed spending shock. Nevertheless, it is possible to endogenously determine the government's portfolio using insights from the sovereign default literature (e.g., D'Erasmo and Mendoza (2017)). We provide such a motivation for the model with interest rate spreads in Section 5.4.1.

[17] In theory, the latter is achieved when $\nu \to \infty$, but we experiment with several values for ν and conclude that a value of $\nu > 0.016$ is enough to crowd out investment for a Home-financed shock.

To understand this result, consider first that private access to external borrowing is prohibited, i.e., ν is high, so that $b_t^{f,k} = 0$. If spending is financed domestically, the economy is essentially closed, so we can write the resource constraint as: $c_t + i_t + g_t = Y_t$. On the other hand, if spending is financed externally, the resource constraint also includes external government debt: $c_t + i_t + g_t = Y_t + b_t^f - R_{t-1}^f b_{t-1}^f$. Assuming that labor supply is fixed, following a spending shock, output will be constant on impact. So, when spending is financed domestically, investment and/or consumption has to drop to satisfy the resource constraint. Due to consumption smoothing motives, consumption will generally decline less than investment. On the other hand, when financed externally, there is an equivalent increase in b_t^f, implying there is no crowding out. In the more general case with elastic labor, labor supply will increase in both cases due to a negative wealth effect. But, as long as the increase is similar across the two shocks, the effect from resource constraint feasibility will dominate.

Consider next that private agents have access to external borrowing. The resource constraint now takes the form: $c_t + i_t + g_t = Y_t + b_t^f - R_{t-1}^f b_{t-1}^f + b_t^{f,k} - R_{t-1}^{f,k} b_{t-1}^{f,k}$. Here, the economy is open regardless of where spending is financed and investment is crowded in for both spending shocks. Agents now have an additional instrument to offset the crowding out of investment by privately borrowing abroad. When $R_t^{f,k} = 1/\beta$, investment and private external borrowing offer the same return, so in equilibrium households borrow abroad to finance investment.

Finally, in the case where access is imperfect, $\left(R_t^{f,k} > 1/\beta\right)$, external funds demand a premium over the domestic interest rate in equilibrium. However, after the fiscal shock, the domestic interest rate rises above the equilibrium rate due to higher demand for assets. Agents will equate the domestic interest rate, the return from capital and the foreign interest rate. This implies that foreign borrowing will increase and investment will decline. The extent to which this happens depends on the difference between interest rates, which is in general higher for countries with lower access to external borrowing. Therefore, the degree of investment crowding out should depend on the level of financial integration of the private sector into international capital markets.

5.4 The response of labor and the impact output multiplier

Despite predicting responses of investment consistent with the data, the textbook SOE model cannot account for the differences in *impact* output multipliers. This obtains from the reason that capital is

predetermined and takes time to build. Therefore, the impact response of output primarily depends on the equilibrium response of labor.

[Insert Figure 6 here]

Figure 6 plots IRFs to a home debt-financed and a foreign debt-financed spending shock for the case where household external borrowing is restricted.[18] A spending shock induces a negative wealth effect on labor supply as households anticipate future increases in taxation. However, the strength of the wealth effect and the ensuing response of labor depends on how spending is financed. When spending is financed domestically, investment is crowded out and permanent income of households is lower than when spending is financed externally and investment is crowded in. In equilibrium, households will therefore supply more labor when spending is financed domestically. And since capital, as a state variable, is pre-determined and takes time to build, output responds only to changes in labor supply on impact. All this translates to an impact response of output that is lower than when spending is foreign-financed. However, from period 2 onward, the Foreign shock becomes more expansionary. This is a consequence of the crowding in of investment. As investment increases, the marginal product of labor rises and households further supply labor in period 2. Since capital takes one period to build, it also contributes to the increase in output in period 2. This translates to a period 2 response of output which is greater when spending is financed abroad.

5.4.1 Interest rate spread (and consumption crowding in)

One possible way to reconcile the model's prediction with regards to the impact output multiplier is to allow for an interest rate spread between external and domestic interest rates. For example, that the external public interest rate deviates from the domestic interest rate by a debt-elastic factor χ, such that: $R_t^f = R_t^h \left[1 + \chi \left(\frac{b_t^h}{\overline{b^h}}\right)\right]$, where χ is interpreted as a premium that external lenders demand in order to be compensated for sovereign default risk.[19] We place empirical discipline on the interest

[18] We obtain this by setting $\nu = 0.5$, which is a value sufficient to emphasize the difference across the two shocks, but also within the range of existing estimates. Although Aguiar and Gopinath (2007) and Guerron-Quintana (2013) assume a negligible value for parameter ν (around 0.001), the estimates in Garcia-Cicco et al. (2010) for Argentina, and in Miyamoto and Nguyen (2017) for many countries imply a sizeable response of the interest rate to debt deviations (2.8 for Argentina; 0.13 for Venezuela, 0.3 for Peru, 1.37 for Brazil, 0.5 for Finland and Norway, 0.7 for Canada; see Tables 4b and 4c therein for more cases).

[19] If the probability of default is greater for external debt than for domestic debt (for example, because it is in the interest of a benevolent government to maximize residents' utility), then the presence of external default risk will imply such a condition in equilibrium. Moreover, there is ample evidence of a positive spread between external and domestic interest rates on government debt (see, for example, Guidotti and Kumar (1991); Giovannini and de Melo (1993); Gordon and Li (2003); Du and Schreger (2013)).

rate spread by setting $\chi = 0.75$. This is line with evidence for emerging markets between 2005 to 2011 presented in Du and Schreger (2013), who find that foreign-currency credit spreads are greater than local-currency credit spreads by 0.67 to 0.87 basis points.

Moreover, a model with flexible prices cannot account for the crowding in of consumption, which is also a prediction of the data. To qualitatively reconcile the results, we also augment the model with sticky prices and rule-of-thumb consumers, as in Gali et al. (2007).[20]

[Insert Figure 7 here]

Figure 7 plots IRFs in the sticky-price model with an interest rate spread. First, because of the interest rate spread, a foreign-financed shock now produces a greater response on output on impact. This is because interest rate payments of the government are now greater when spending is financed externally. So the wealth effect on labor is larger for a foreign-financed shock, despite the crowding in of investment. Since output on impact largely depends on the impact response of labor, output increases by more than a home-financed shock. Second, the combination of price rigidities with rule-of-thumb households allows consumption to be crowded in for both spending shocks. This is because with sticky prices the markup declines following an expansionary government shock making it possible for the real wage to increase (see Gali et al. (2007)).

5.5 Discussion

The SOE model outlined above has illustrated that a small number of features are sufficient to approximate the empirical results, at least on qualitative grounds. However, it should be noted that it abstracts from several of the features and frictions, which are encountered in medium-scale DSGE models, and which are important for investigating questions of fiscal policy on quantitative grounds (see e.g., Ratto et al. (2009); Coenen et al. (2013)).[21]

Moreover, the modifications we have introduced are only intended to provide a single representation of the data, which may at the same time, also be consistent with other complementary frameworks. For example, our model abstracts from sovereign default. This can be a channel which

[20] The optimality conditions of the sticky price economy with interest rate spread (and its calibration, which is standard) are shown in section D of the online appendix. Other complementary ways to generate consumption crowding-in are: i) sticky prices and GHH preferences (Monacelli and Perotti (2008); Bilbiie (2011)), ii) government spending that enters the utility function combined with habit-forming consumption (Bouakez and Rebei (2007)), iii) "deep habit formation" (Ravn et al. (2006)), iv) housework and consumption-hours complementarity (Gnocchi et al. (2016)).

[21] Section D of the online appendix offers a quantitative comparison of the model with the data and discusses additional model variants (variable capital utilization, distortionary labor income taxes).

provides a complementary mechanism for external financing to benefit the private sector. If the government (selectively) defaults on external debt, the private sector would not be induced to crowd out investment, nor face negative wealth effects of higher taxation to pay for external debt. Second, the model abstracts from exchange rate movements associated with external borrowing. If an increase in external debt generates a real appreciation, this may partially offset the expansionary effects of external financing on output. This feature may be more relevant for less-developed economies (see e.g., Shen and Yang (2012)), which typically issue foreign debt in foreign currency and hence can also be subject to exchange rate risk. However, Cacciatore and Traum (2018) show that the effects of fiscal policy can be larger in economies more open to trade, irrespective of the trade balance dynamics. Moreover, there can be other complementary ways for the model to generate an impact multiplier that is higher for the foreign-financed shock. These can take the form of assuming that capital does not take time to build, or introducing labor adjustment costs.

Finally, a natural question that arises is "why would the government ever want to finance its purchases by issuing domestic debt?" On the one hand, there must be costs and/or constraints preventing the government from relying exclusively on foreign debt to finance its expenditures. As discussed, these can take the form of sovereign default risk, exchange rate risk, an inefficiency of the domestic financial market, as well as limited ability to target the nationality of the investor when auctioning off debt, due to, for example, secondary markets. On the other hand, an optimizing government, which endogenously chooses its debt portfolio, will also internalize the fact, that when time comes to initiate a fiscal consolidation by repaying foreign debt, the costs of a recession will be disproportionately larger.

Our framework does not model these trade-offs, but, in reduced form, they can be captured in a situation where the government faces a (high) elasticity with respect to foreign debt, similar to the one paid by private investors; this would be in a version of the debt-financing decision where instead of specifying exogenous debt, we close the model with a tax rule. In this case, government access to external borrowing would, analogously to private investors, also be costly. Hence any spending would be split between domestic and foreign funds, and the mixture dictated by the strength of the elasticity. In the case where the external frictions are substantial, the government would issue domestic debt, until the no-arbitrage condition between domestic and foreign interest rates is met in equilibrium.

6 Conclusion

How do fiscal multipliers differ if government spending is financed with domestic debt or foreign debt? To answer this question we estimated an SVAR identified using standard timing restrictions and a sign restriction on the movement of the ratio of domestic public debt to external public debt. We found that fiscal multipliers are larger when government spending is financed by debt placed abroad. In this case investment is also crowded in, as opposed to the event where spending is financed using domestic debt. In line with the theory, the difference is most emphasized when the private sector has limited access to external financing.

The results are robust to alternative identification schemes and when controlling for several characteristics. Namely, in an SVAR that controls for the government's cost of borrowing, and for the US, when estimated using a proxy-SVAR with defense news series.

We illustrate that the empirical findings can be partially accounted for by a canonical SOE model with government spending. The fundamental mechanism that brings about the different effect of government spending on investment relies on the specification of the economy's resource constraint.

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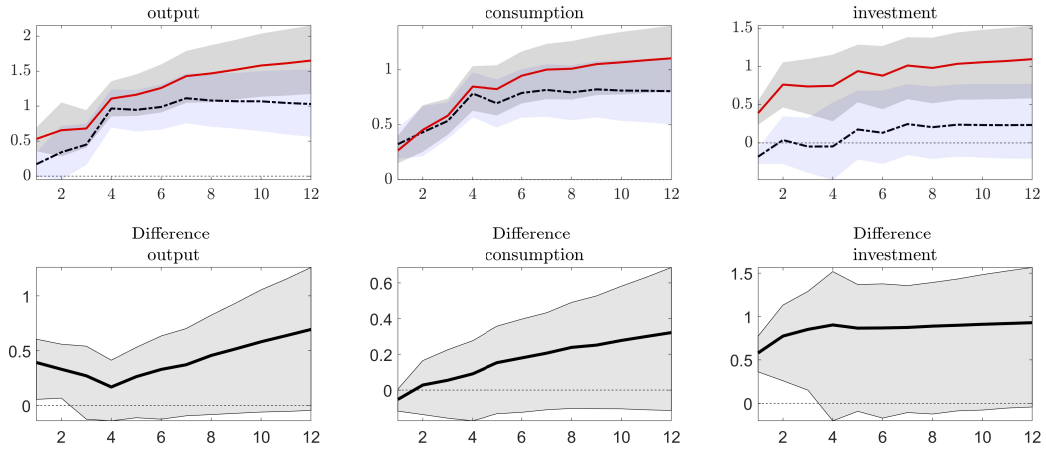
Table 1: Panel SVAR: Multipliers

	horizon	Foreign		Home		difference	
Output	1	**0.53**	[0.36 , 0.69]	**0.17**	[-0.01 , 0.34]	0.39	[0.06 , 0.61]
	4	**1.11**	[0.85 , 1.36]	**0.97**	[0.69 , 1.24]	0.17	[-0.14 , 0.41]
	12	**1.65**	[1.17 , 2.15]	**1.03**	[0.56 , 1.52]	0.69	[-0.05 , 1.26]
Consumption	1	**0.27**	[0.15 , 0.40]	**0.32**	[0.19 , 0.47]	-0.05	[-0.12 , 0.01]
	4	**0.85**	[0.63 , 1.03]	**0.78**	[0.57 , 0.97]	0.09	[-0.17 , 0.28]
	12	**1.1**	[0.80 , 1.40]	**0.8**	[0.50 , 1.10]	0.32	[-0.11 , 0.69]
Investment	1	**0.39**	[0.24 , 0.55]	**-0.18**	[-0.28 , -0.07]	0.58	[0.36 , 0.77]
	4	**0.75**	[0.28 , 1.16]	**-0.05**	[-0.48 , 0.53]	0.9	[-0.20 , 1.52]
	12	**1.1**	[0.58 , 1.54]	**0.24**	[-0.20 , 0.77]	0.93	[-0.04 , 1.57]

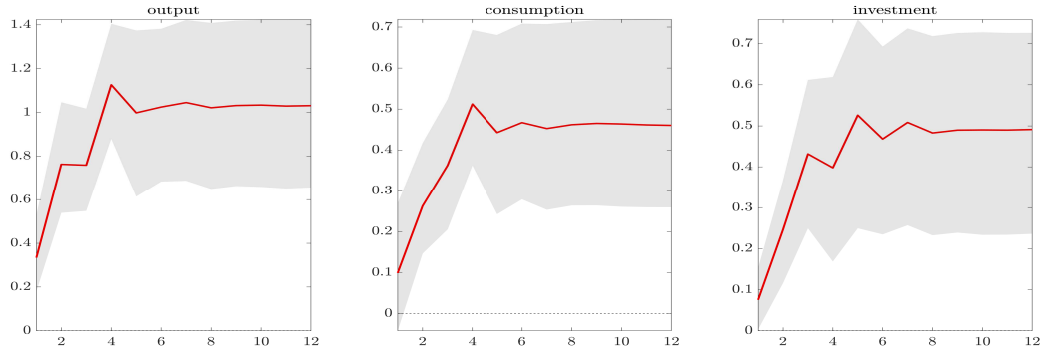
Notes: The table reports cumulative multipliers at different horizons for foreign-debt-financed and home-debt-financed government consumption shocks, as well as the difference in multipliers, defined as Foreign-Home. 68% confidence intervals are denoted inside the brackets.

Figure 1: Panel SVAR: Baseline. Cumulative multipliers



Notes: Top panel: Cumulative multipliers following a shock to foreign- (black) and home-debt-financed (red) government consumption calculated as in section 2.2.1. Lines correspond to median responses. Bottom panel: The difference in cumulative multipliers between foreign- and home-debt-financed government consumption. Shaded areas correspond to parameter uncertainty of one-standard deviation.

Figure 2: SVAR without debt. Cumulative multipliers



Notes: Cumulative multipliers following a shock to government consumption calculated as in section 2.2.1. Lines correspond to median responses. Shaded areas correspond to parameter uncertainty of one-standard deviation.

Table 2: Sensitivity to private sector's access to external financial markets

variable	Output			Consumption			Investment		
horizon	*1*	*4*	*12*	*1*	*4*	*12*	*1*	*4*	*12*
GDP variance									
Foreign	0.82	1.45	1.91	0.28	0.94	0.92	0.66	1.92	1.99
Home	0.23	1.07	0.53	0.41	0.64	0.41	-0.22	-0.2	0.06
Δ	0.61 (91.57%>0)	0.44 (73.30%>0)	1.53 (78.53%>0)	-0.12 (13.20%>0)	0.29 (78.33%>0)	0.61 (76.00%>0)	0.88 (98.40%>0)	2.21 (91.33%>0)	2.01 (84.40%>0)
Foreign	0.12	0.64	0.97	0.11	0.46	0.81	0.12	-0.12	0.14
Home	-0.01	0.33	0.66	0.17	0.62	0.9	-0.08	0.13	0.26
Δ	0.11 (68.53%>0)	0.29 (85.00%>0)	0.29 (71.57%>0)	-0.06 (35.73%>0)	-0.16 (30.73%>0)	-0.09 (41.17%>0)	0.22 (82.53%>0)	-0.25 (16.73%>0)	-0.03 (46.87%>0)
Loans from non-resident banks (% GDP)									
Foreign	0.6	1.6	2.17	0.31	1.04	1.38	0.38	1.1	1.44
Home	0.18	0.33	-0.47	0.33	0.26	-0.31	-0.03	0.34	0.24
Δ	0.44 (84.88%>0)	1.34 (87.54%>0)	2.72 (92.16%>0)	-0.01 (48.66%>0)	0.77 (85.92%>0)	1.77 (93.38%>0)	0.43 (81.88%>0)	0.82 (78.06%>0)	1.25 (78.04%>0)
Foreign	0.54	1.02	1.5	0.19	0.68	1.04	0.54	0.76	0.81
Home	0.08	0.99	1.15	0.27	0.66	0.95	-0.18	-0.16	0.15
Δ	0.51 (78.00%>0)	0.05 (58.16%>0)	0.41 (75.56%>0)	-0.07 (19.52%>0)	0.07 (60.16%>0)	0.15 (59.92%>0)	0.75 (98.56%>0)	1.11 (67.36%>0)	0.74 (80.74%>0)
Chinn-Ito index									
Foreign	0.47	0.14	0.99	0.29	0.86	1.07	0.33	1.21	1.44
Home	0.24	1.27	-0.33	0.31	0.49	-0.37	-0.09	-0.44	-0.43
Δ	0.21 (88.62%>0)	-1.30 (20.30%>0)	1.23 (93.66%>0)	-0.00 (48.66%>0)	0.40 (75.20%>0)	1.42 (98.00%>0)	0.45 (96.58%>0)	1.84 (68.04%>0)	2.07 (97.44%>0)
Foreign	0.28	0.87	1	0.22	0.51	0.56	0.19	0.12	0.13
Home	0.2	0.78	1.2	0.23	0.49	0.95	0.07	0.4	0.57
Δ	0.08 (62.96%>0)	0.11 (58.10%>0)	-0.26 (37.08%>0)	0.01 (51.72%>0)	0.01 (51.60%>0)	-0.43 (20.40%>0)	0.13 (73.76%>0)	-0.31 (20.54%>0)	-0.48 (20.88%>0)

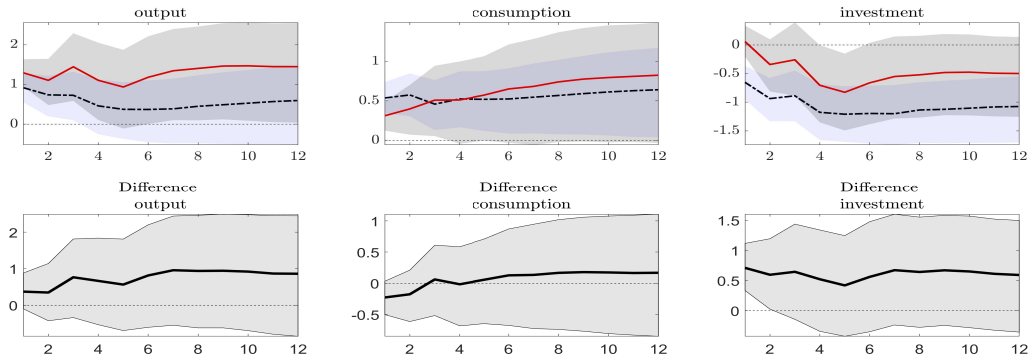
Notes: The table reports cumulative multipliers for different sub-samples that differ in the private sector's access to external financial markets. The latter are measured by: i) the variance of GDP, ii) loans to non-resident banks (% GDP), and iii) the Chinn-Ito index of financial openness. Grey shaded cells denote sub-samples where access is low. White cells denote sub-samples where access is high. Δ reports the difference in multipliers at different horizons, where the difference is defined as Foreign-Home. Inside the brackets is denoted the % of cases from draws of the simulated distribution of models, for which the difference is > 0. Data for non-resident bank loans are from Beck et al. (2009). Data for the Chinn-Ito index are from Chinn and Ito (2006).

Table 3: United States: Multipliers

	horizon	Foreign		Home		difference	
Output	1	**1.29**	[0.94 , 1.63]	**0.92**	[0.55 , 1.28]	0.37	[-0.10 , 0.88]
	4	**1.1**	[0.11 , 2.05]	**0.46**	[-0.25 , 1.12]	0.67	[-0.54 , 1.84]
	12	**1.45**	[0.04 , 2.55]	**0.6**	[-0.52 , 1.47]	0.86	[-0.85 , 2.45]
Consumption	1	**0.31**	[0.12 , 0.49]	**0.54**	[0.34 , 0.74]	-0.23	[-0.50 , 0.03]
	4	**0.51**	[-0.04 , 1.00]	**0.52**	[0.16 , 0.87]	-0.02	[-0.68 , 0.59]
	12	**0.83**	[-0.03 , 1.49]	**0.64**	[0.04 , 1.17]	0.17	[-0.85 , 1.11]
Investment	1	**0.06**	[-0.20 , 0.34]	**-0.65**	[-0.95 , -0.37]	0.71	[0.33 , 1.12]
	4	**-0.7**	[-1.35 , -0.00]	**-1.18**	[-1.66 , -0.68]	0.52	[-0.34 , 1.34]
	12	**-0.5**	[-1.26 , 0.14]	**-1.07**	[-1.70 , -0.55]	0.59	[-0.36 , 1.50]

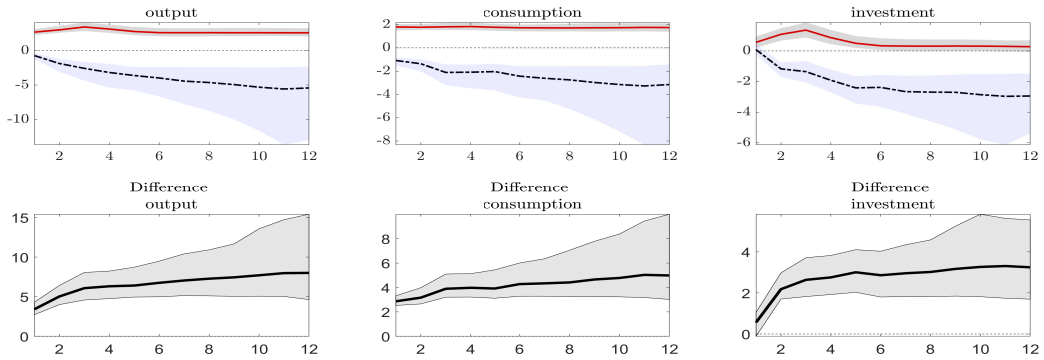
Notes: The table reports cumulative multipliers at different horizons for foreign-debt-financed and home-debt-financed government expenditure shocks, as well as the difference in multipliers, defined as Foreign-Home. 68% confidence intervals are denoted inside the brackets.

Figure 3: United States: SVAR with narrative defense series. Cumulative Multipliers



Notes: Top panel: Cumulative multipliers following a shock to foreign- (black) and home-debt-financed (red) government expenditures, calculated as in section 2.2.1. Lines correspond to median responses. Bottom panel: The difference in cumulative multipliers between foreign- and home-debt-financed government expenditures. Shaded areas correspond to parameter uncertainty of one-standard deviation.

Figure 4: United States: Proxy-SVAR with "poor man's sign restrictions." Cumulative multipliers



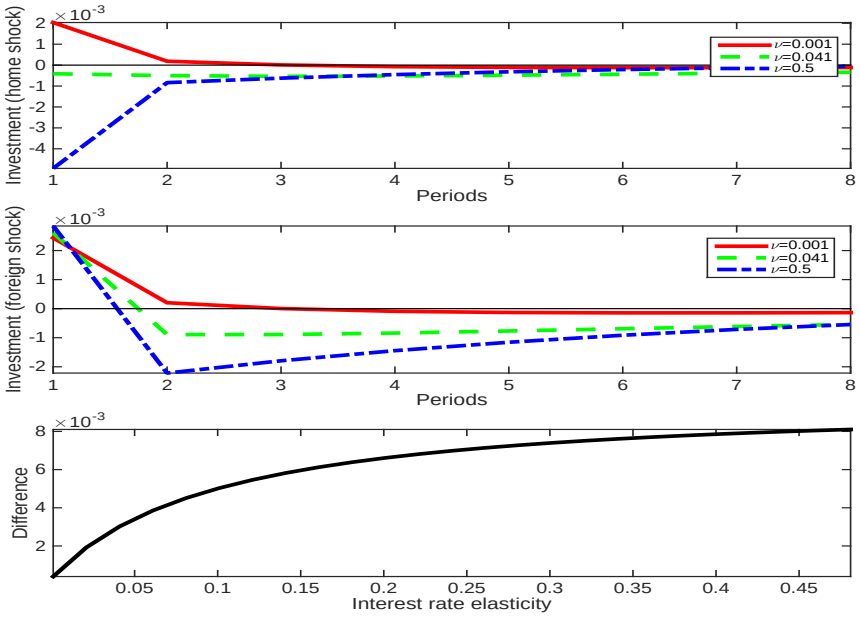
Notes: Top panel: Cumulative multipliers following a shock to foreign- (black) and home-debt-financed (red) government expenditures, calculated as in section 2.2.1. Lines correspond to median responses. Bottom panel: The difference in cumulative multipliers between foreign- and home-debt-financed government expenditures. Shaded areas correspond to parameter uncertainty of one-standard deviation.

Table 4: Robustness checks

variable	**Output**			**Consumption**			**Investment**		
horizon	***1***	***4***	***12***	***1***	***4***	***12***	***1***	***4***	***12***
Baseline, OECD	0.47*	0.24	0.76	-0.04	0.1	0.36	0.57*	1.03	0.98
Baseline, Emerging economies	0.41	0.22	0.57	0.01	-0.02	-0.25	0.36	-0.19	-0.32
Baseline, levels (logs)	0.34*	0.21	0.16	-0.07*	-0.06	-0.09	0.39*	0.56	0.37
Baseline, levels (HP-filtered logs)	0.37	0.35	0.59	-0.08*	-0.08	0.06	0.36*	0.57*	0.8
Baseline, no fixed effects	0.39*	0.18	0.71	-0.05	0.09	0.33	0.58*	0.9	0.92
Tax revenues, zero restrictions	0.35*	0.1	0.78	0.05	0.19	0.56	0.69*	0.24	0.92*
Tax revenues	0.4*	0.23	0.96	0.07	0.24	0.6	0.72*	0.31	1.03*
US: Tax revenues, zero restrictions	0.36	0.49	0.95	-0.1	0.11	0.43	0.51*	0.21	0.35
US: Tax revenues	0.29	0.61	0.96	-0.12	0.14	0.42	0.46*	0.27	0.37
Risk premium (A)	0.49*	0.28*	1.03*	-0.05	0.16	0.45	0.71*	1.14*	1.24*
Currency denomination	0.23	-0.02	0.38	-0.14	-0.8*	-0.35	-0.08	0.05	0.2
Twin deficits	0.45*	0.25	0.81*	-0.04	0.12	0.39*	0.59*	1.06	0.97*
Interaction VAR	0.41*	-0.03	0.03	0.21*	0.1	0.04	-0.06	3.21*	1.34*

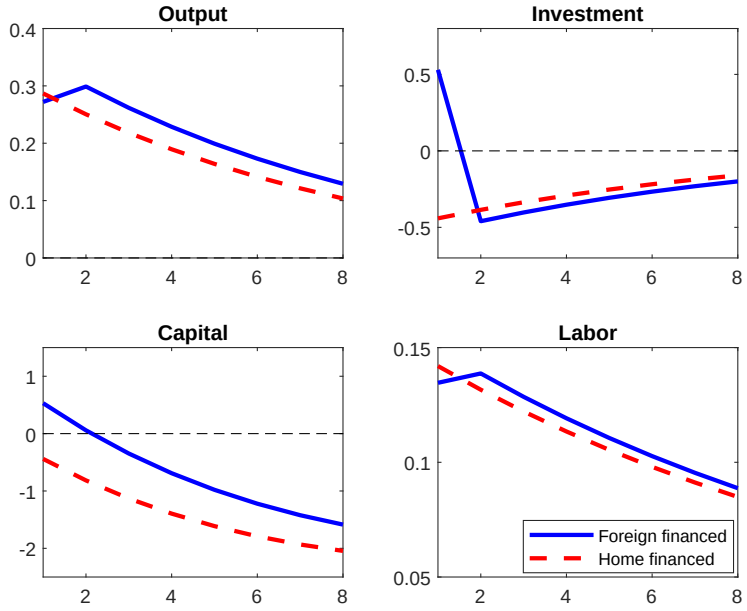
Notes: The table reports the difference in cumulative multipliers for different robustness checks. The difference is defined as Foreign-Home. * indicates that the difference is statistically significant at the 68% significance level (one-standard deviation).

Figure 5: Responses of investment for varying degrees of private access to financial markets



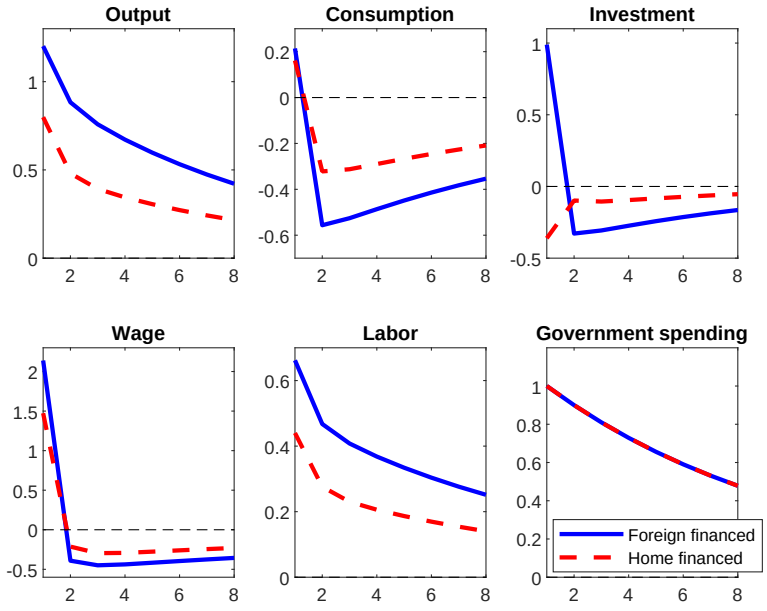
Notes: The top panel plots the responses of investment to a home-debt-financed spending shock. The middle panel plots the responses of investment to a foreign-debt-financed spending shock. The bottom panel plots the differences in investment (Foreign-Home) for a range of ν.

Figure 6: IRFs in baseline model



Notes: Impulse response functions to a 1% government spending shock financed with domestic debt (dashed red line) and external debt (solid blue line). Households do not have access to external financial markets ($\nu = 0.5$).

Figure 7: IRFs in the sticky price model with rule-of-thumb households and interest rate spread



Notes: Impulse response functions to a 1% government spending shock financed with domestic debt (dashed red line) and external debt (solid blue line). (Optimizing) households do not have access to external financial markets ($\nu = 0.5$).

Online Appendix

A Data and Variables

List of countries in panel: Argentina, Australia, Austria, Brazil, Bulgaria, Canada, Chile, Czech Republic, Finland, Hungary, Iceland, Indonesia, Ireland, Israel, Italy, Korea, Latvia, Lithuania, Luxembourg, Malta, Mexico, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States.

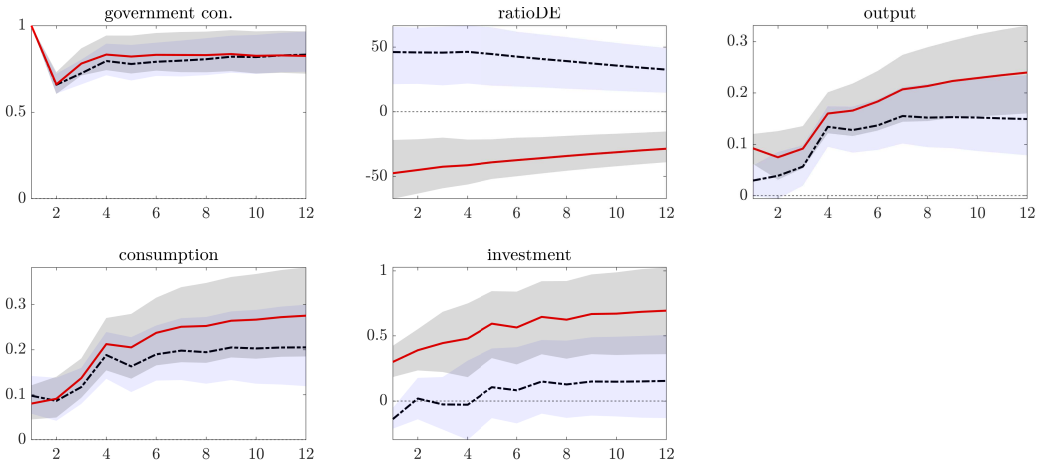
Unless stated otherwise, nominal values are converted to real values using the price deflator for GDP. Data are in constant 2000 US dollars.

Domestic public debt. Gross public sector debt, all maturities, all instruments, domestic creditors. Whenever gross public sector debt is not available we replace it with general government debt, and when the latter is not present we replace it with central government debt. *Source*: Quarterly Public Sector Debt statistics (IMF-World Bank). **External public debt**. Gross public sector debt, all maturities, all instruments, external creditors. Whenever gross public sector debt is not available we replace it with general government debt, and when the latter is not present we replace it with central government debt. *Source*: Quarterly Public Sector Debt statistics (IMF-World Bank). **Output**. Gross domestic product. *Source*: Eurostat for EU28, OECD for OECD economies. IMF-IFS for remaining countries. **Government consumption**. General government final consumption expenditure. *Source*: Eurostat for EU28, OECD for OECD economies. IMF-IFS for remaining countries. **Consumption**. Final household consumption expenditure. *Source*: Eurostat for EU28, OECD for OECD economies. IMF-IFS for remaining countries. **Investment**. Gross private fixed capital formation. *Source*: Eurostat for EU28, OECD for OECD economies. IMF-IFS for remaining countries. **Sovereign bond yield**. Government bond yield. Precise definition varies by country (e.g. 8-10 year government bond yield, 10-year government bond yield, weighted average, etc.), in percent. *Source*: IMF-IFS. **Net foreign assets**. Balance of payments, financial account. *Source*: IMF-IFS. **Tax revenues**. Net tax revenues, measured as the sum of revenues from direct and indirect taxes and social security contributions, minus interest rate payments, subsidies, and social benefits. *Source*: IMF-IFS.

United States The sample runs from 1952:Q1 to 2015:Q2 **Domestic public debt**. 1952:Q1 to 1969:Q4: Nominal federal debt in the hands of the public, cash basis. 1970:Q1 to 2015:Q2. The sum of federal debt held by Federal Reserve banks and federal debt held by private investors, minus federal debt held by foreign and international investors. *Source*: Ramey and Zubairy (2018) and Federal Reserve Economic Data. **External public debt**. Treasury securities held by Rest of the World. *Source*: Federal Reserve Economic Data. **Output**. Gross domestic product. *Source*: NIPA, Table 1.1.3, line 1. **Government expenditures**. Government consumption expenditures and gross investment. *Source*: NIPA, Table 1.1.3, line 22. **Consumption**. Personal consumption expenditures. *Source*: NIPA, Table 1.1.3, line 2. **Investment**. Gross private domestic investment. *Source*: NIPA, Table 1.1.3, line 7. **Tax revenues**. Net tax revenues, measured as the sum of revenues from personal current taxes, taxes on production and imports, taxes on corporate income, contributions for government social insurance, minus interest rate payments, subsidies, and government social benefits. *Source*: NIPA, Table 3.2.

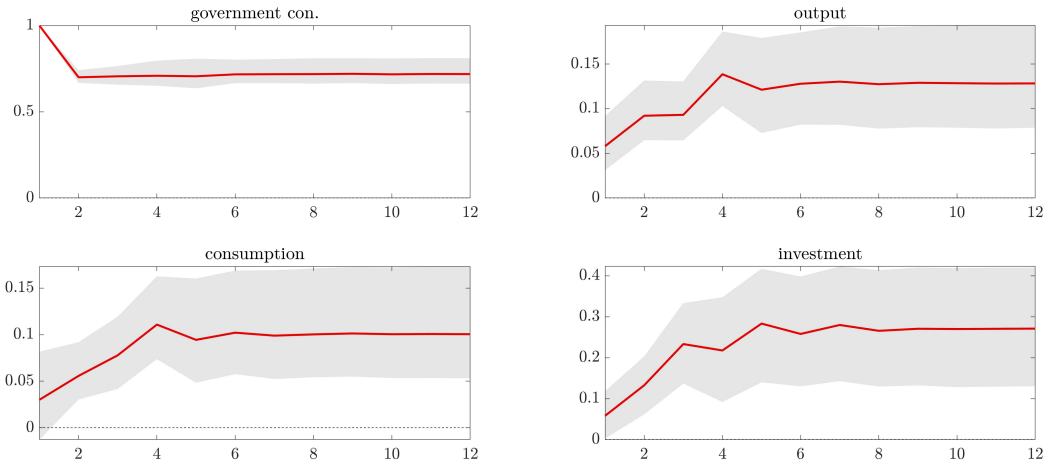
B Additional Figures

Figure B.1: Panel SVAR: Baseline. Cumulative IRFs



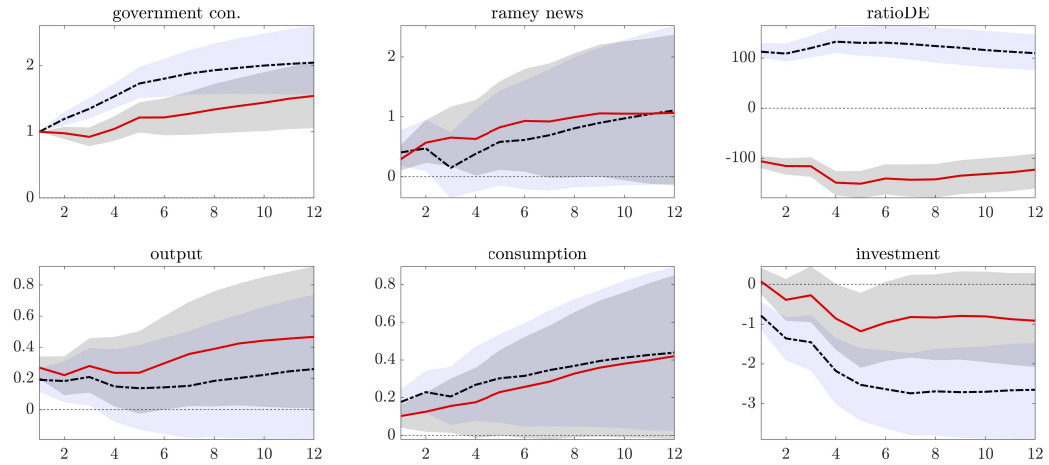
Notes: Cumulative impulse response functions following a shock to foreign- (black) and home-debt-financed (red) government consumption. Lines correspond to median responses. Shaded areas correspond to parameter uncertainty of one-standard deviation.

Figure B.2: SVAR without debt. Cumulative IRFs



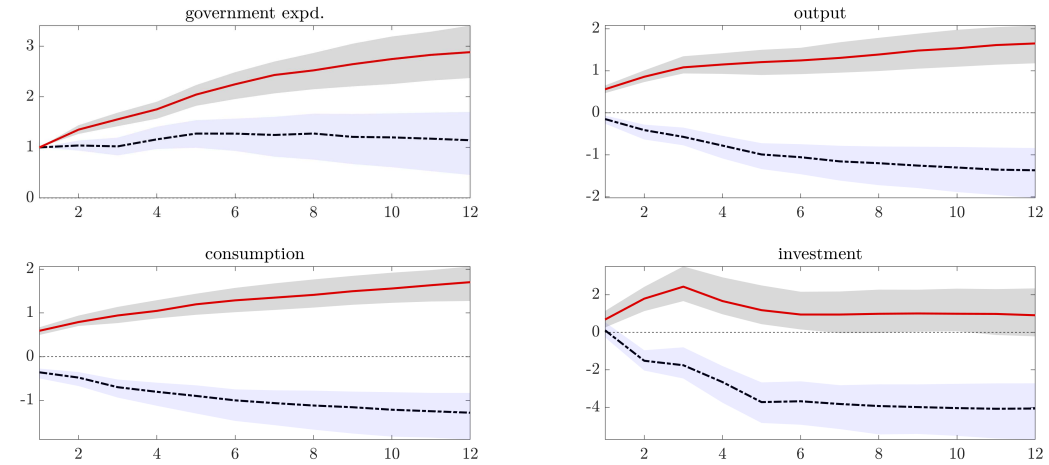
Notes: Cumulative impulse response functions following a shock to government consumption. Lines correspond to median responses. Shaded areas correspond to parameter uncertainty of one-standard deviation.

Figure B.3: US: SVAR with narrative defense news. Cumulative IRFs



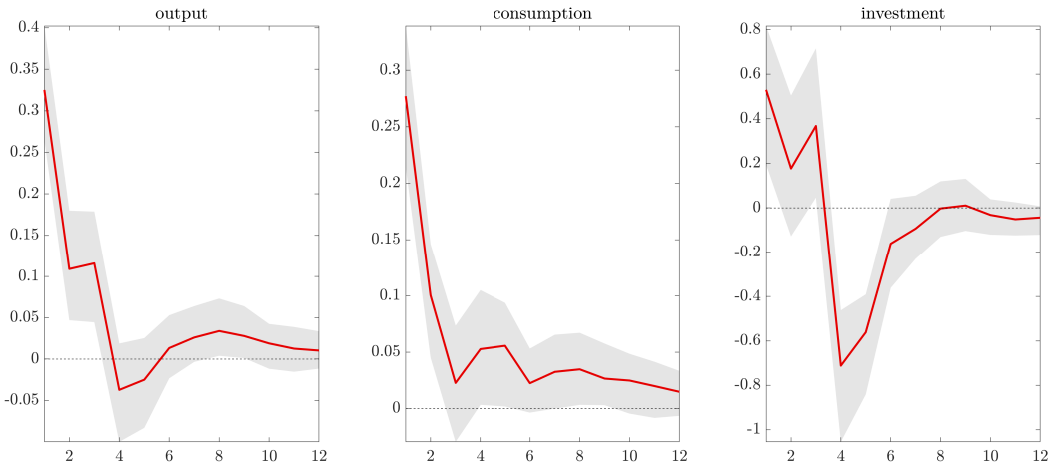
Notes: Cumulative impulse response functions following a shock to foreign- (black) and home-debt-financed (red) government expenditures. Lines correspond to median responses. Shaded areas correspond to parameter uncertainty of one-standard deviation.

Figure B.4: US: Proxy-SVAR with poor man's sign restrictions. Cumulative IRFs



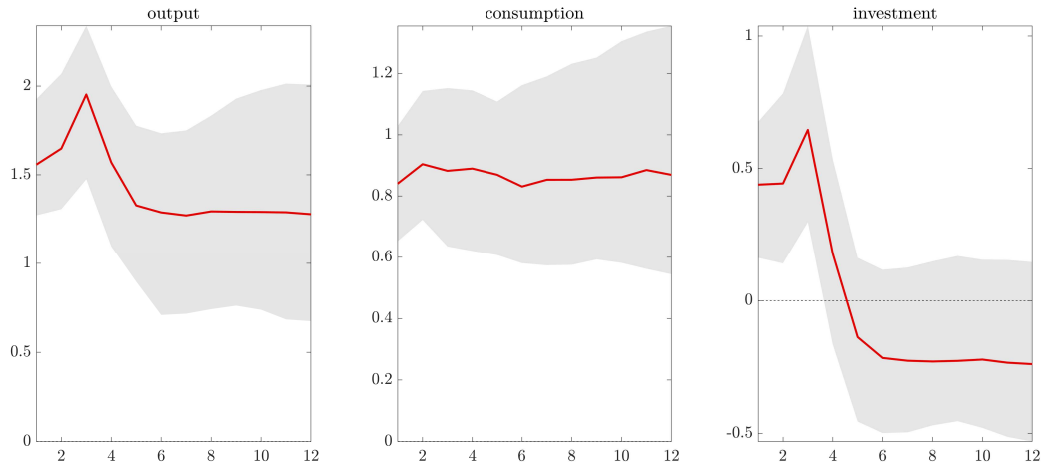
Notes: Cumulative impulse response functions following a shock to foreign- (black) and home-debt-financed (red) government expenditures in the Proxy-SVAR identified with "poor man's sign restrictions." Lines correspond to median responses. Shaded areas correspond to parameter uncertainty of one-standard deviation.

Figure B.5: US: Proxy-SVAR. IRFs



Notes: Cumulative impulse response functions following a shock to government expenditures in the Proxy-SVAR. Lines correspond to median responses. Shaded areas correspond to parameter uncertainty of one-standard deviation.

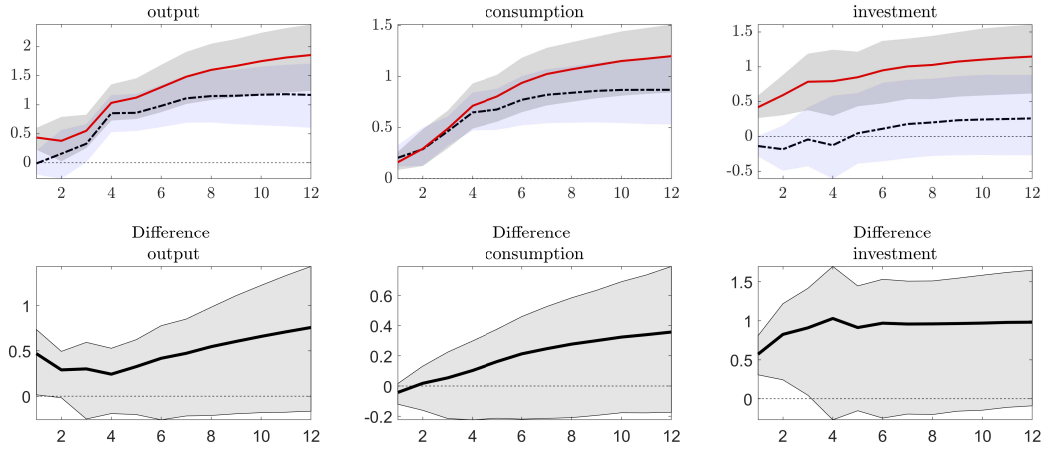
Figure B.6: US: Proxy-SVAR. Cumulative multipliers



Notes: Cumulative multipliers following a shock to government expenditures identified in the Proxy-SVAR. Lines correspond to median responses. Shaded areas correspond to parameter uncertainty of one-standard deviation.

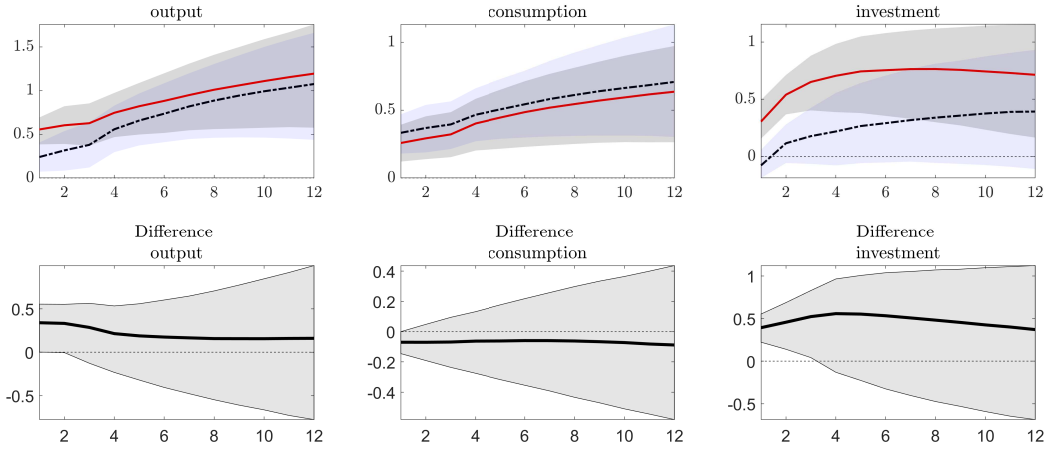
C Robustness Checks

Figure C.1: OECD economies: Cumulative multipliers



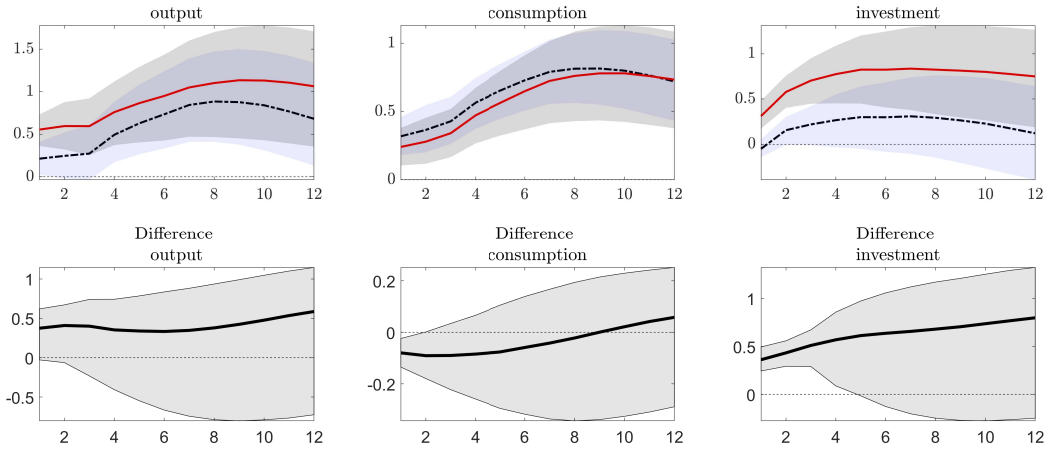
Notes: Top panel: Cumulative multipliers following a shock to foreign- (black) and home-debt-financed (red) government consumption. Cumulative multipliers are calculated as in section 2.2.1. Lines correspond to median responses. Shaded areas correspond to parameter uncertainty of one-standard deviation. Bottom panel: The difference in cumulative multipliers between foreign- and home-debt-financed government consumption. Shaded areas correspond to parameter uncertainty of one-standard deviation.

Figure C.2: Levels: Cumulative multipliers



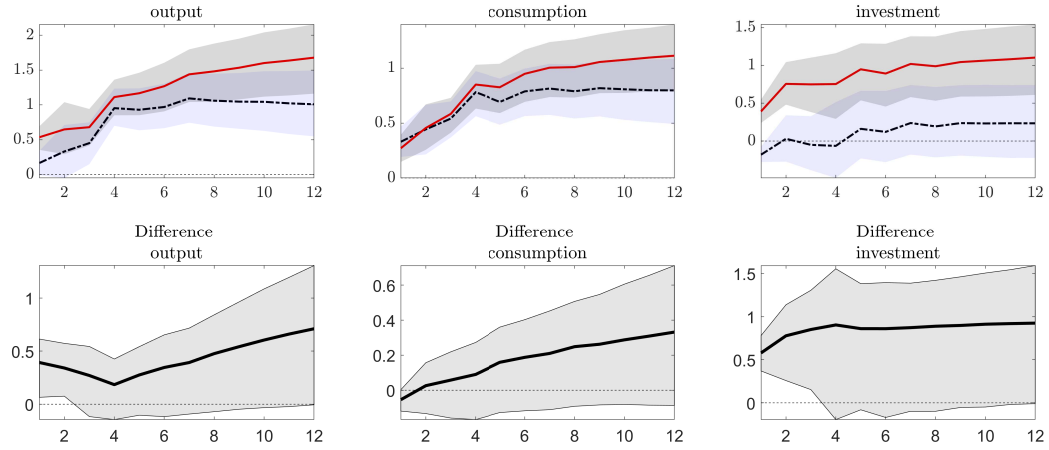
Notes: Top panel: Cumulative multipliers following a shock to foreign- (black) and home-debt-financed (red) government consumption. Cumulative multipliers are calculated as in section 2.2.1. Lines correspond to median responses. Shaded areas correspond to parameter uncertainty of one-standard deviation. Bottom panel: The difference in cumulative multipliers between foreign- and home-debt-financed government consumption. Shaded areas correspond to parameter uncertainty of one-standard deviation.

Figure C.3: Detrended levels: Cumulative multipliers



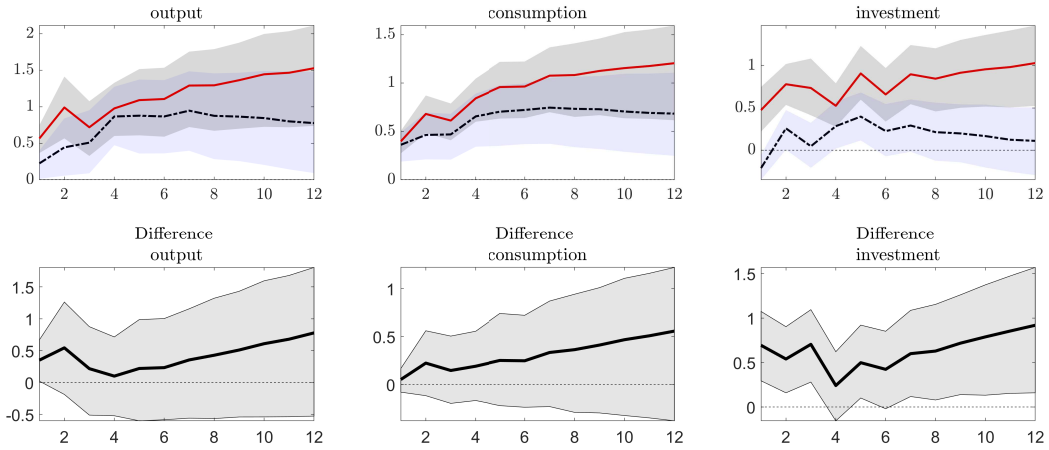
Notes: Top panel: Cumulative multipliers following a shock to foreign- (black) and home-debt-financed (red) government consumption. Cumulative multipliers are calculated as in section 2.2.1. Lines correspond to median responses. Shaded areas correspond to parameter uncertainty of one-standard deviation. Bottom panel: The difference in cumulative multipliers between foreign- and home-debt-financed government consumption. Shaded areas correspond to parameter uncertainty of one-standard deviation.

Figure C.4: No fixed effects: Cumulative multipliers



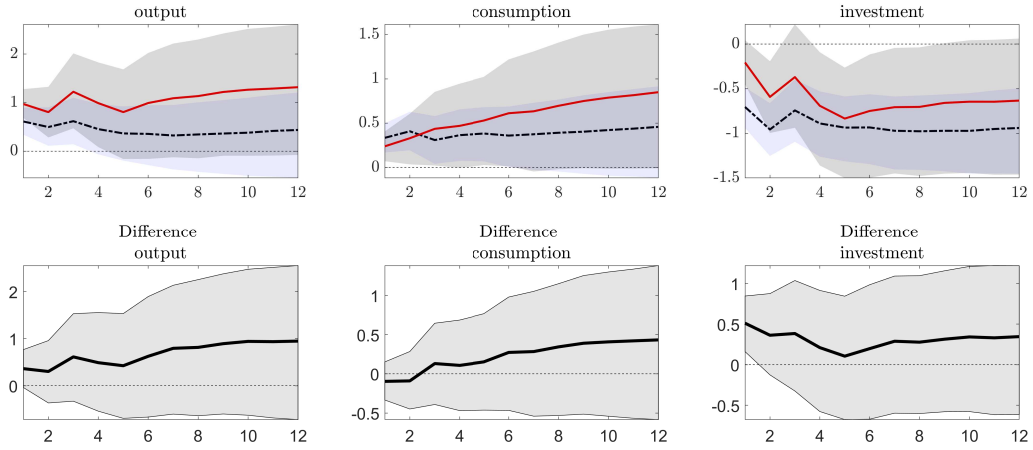
Notes: Top panel: Cumulative multipliers following a shock to foreign- (black) and home-debt-financed (red) government consumption. Cumulative multipliers are calculated as in section 2.2.1. Lines correspond to median responses. Shaded areas correspond to parameter uncertainty of one-standard deviation. Bottom panel: The difference in cumulative multipliers between foreign- and home-debt-financed government consumption. Shaded areas correspond to parameter uncertainty of one-standard deviation.

Figure C.5: Panel SVAR: Tax revenues (zero restrictions). Cumulative multipliers



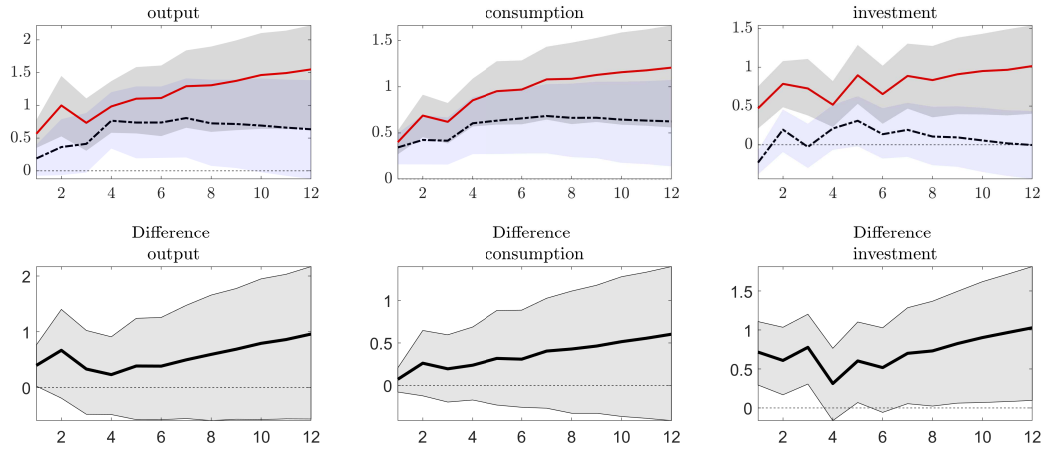
Notes: Top panel: Cumulative multipliers following a shock to foreign- (black) and home-debt-financed (red) government consumption. Cumulative multipliers are calculated as in section 2.2.1. Lines correspond to median responses. Shaded areas correspond to parameter uncertainty of one-standard deviation. Bottom panel: The difference in cumulative multipliers between foreign- and home-debt-financed government consumption. Shaded areas correspond to parameter uncertainty of one-standard deviation. Zero restriction on impact response of tax revenues following both Home and Foreign shocks.

Figure C.6: US: Tax revenues (zero restrictions). Cumulative multipliers



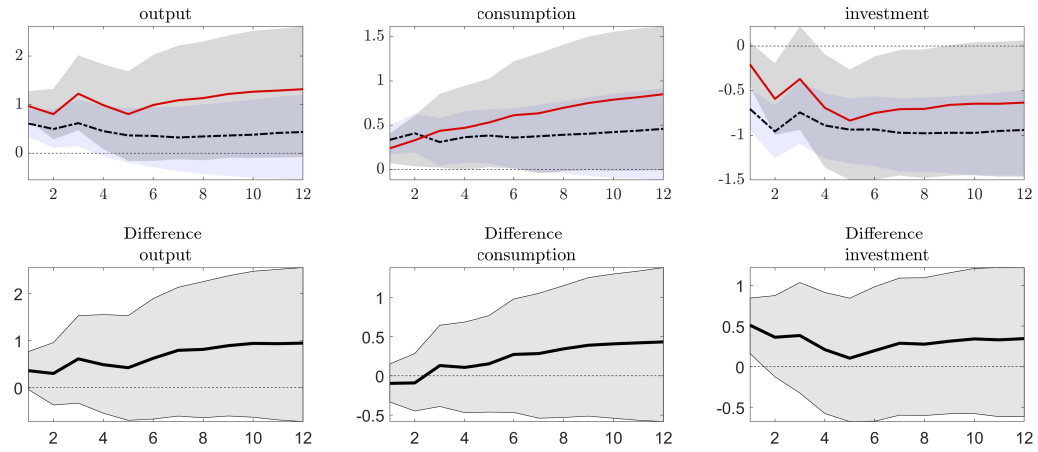
Notes: Top panel: Cumulative multipliers following a shock to foreign- (black) and home-debt-financed (red) government expenditures. Cumulative multipliers are calculated as in section 2.2.1. Lines correspond to median responses. Shaded areas correspond to parameter uncertainty of one-standard deviation. Bottom panel: The difference in cumulative multipliers between foreign- and home-debt-financed government expenditures. Shaded areas correspond to parameter uncertainty of one-standard deviation. Zero restriction on impact response of tax revenues following both Home and Foreign shocks.

Figure C.7: Panel SVAR: Tax revenues (no restrictions). Cumulative multipliers



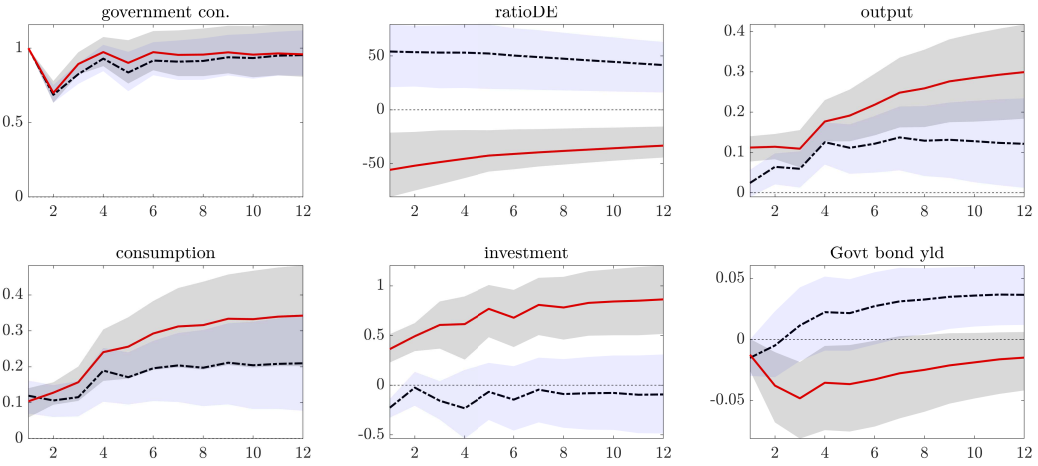
Notes: Top panel: Cumulative multipliers following a shock to foreign- (black) and home-debt-financed (red) government expenditures. Cumulative multipliers are calculated as in section 2.2.1. Lines correspond to median responses. Shaded areas correspond to parameter uncertainty of one-standard deviation. Bottom panel: The difference in cumulative multipliers between foreign- and home-debt-financed government expenditures. Shaded areas correspond to parameter uncertainty of one-standard deviation. Tax revenues ordered last.

Figure C.8: US: Tax revenues (no restrictions). Cumulative multipliers



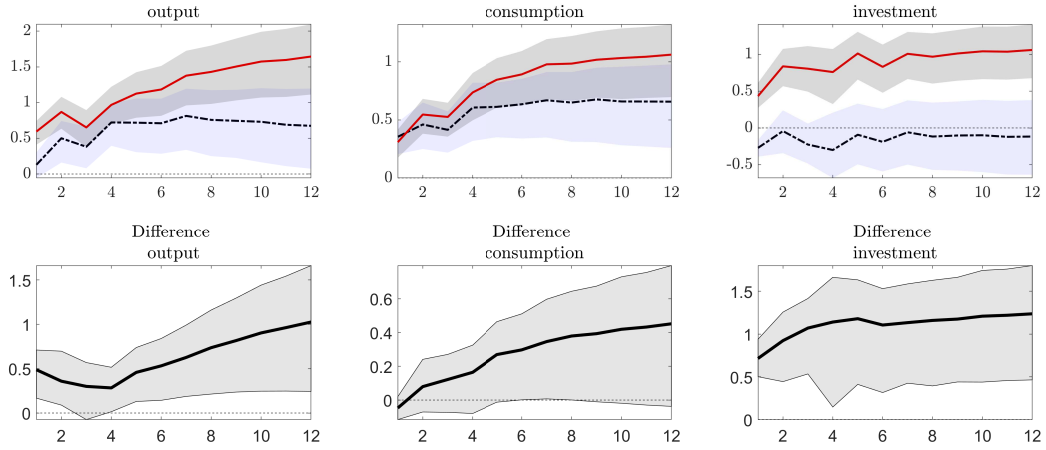
Notes: Top panel: Cumulative multipliers following a shock to foreign- (black) and home-debt-financed (red) government expenditures. Cumulative multipliers are calculated as in section 2.2.1. Lines correspond to median responses. Shaded areas correspond to parameter uncertainty of one-standard deviation. Tax revenues ordered last.

Figure C.9: Controlling for risk premium: Cumulative IRFs



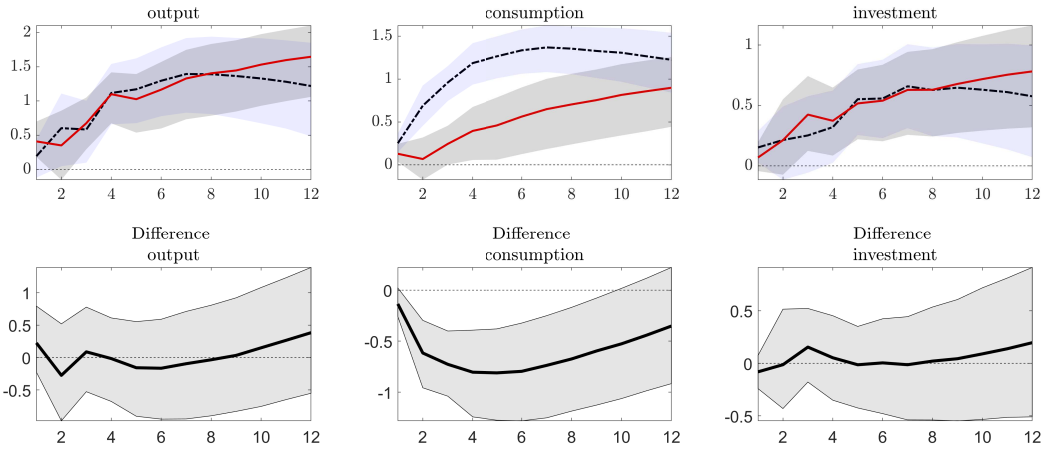
Notes: Cumulative impulse response functions following a shock to foreign- (black) and home-debt-financed (red) government consumption. Lines correspond to median responses. Shaded areas correspond to parameter uncertainty of one-standard deviation.

Figure C.10: Controlling for risk premium: Cumulative multipliers



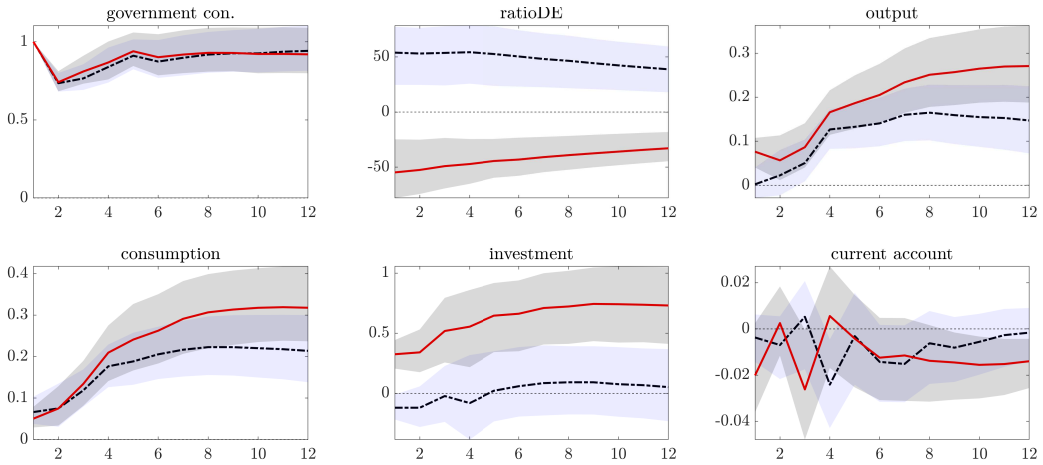
Notes: Top panel: Cumulative multipliers following a shock to foreign- (black) and home-debt-financed (red) government consumption. Cumulative multipliers are calculated as in section 2.2.1. Lines correspond to median responses. Shaded areas correspond to parameter uncertainty of one-standard deviation. Bottom panel: The difference in cumulative multipliers between foreign- and home-debt-financed government consumption. Shaded areas correspond to parameter uncertainty of one-standard deviation.

Figure C.11: Currency denomination: Cumulative multipliers



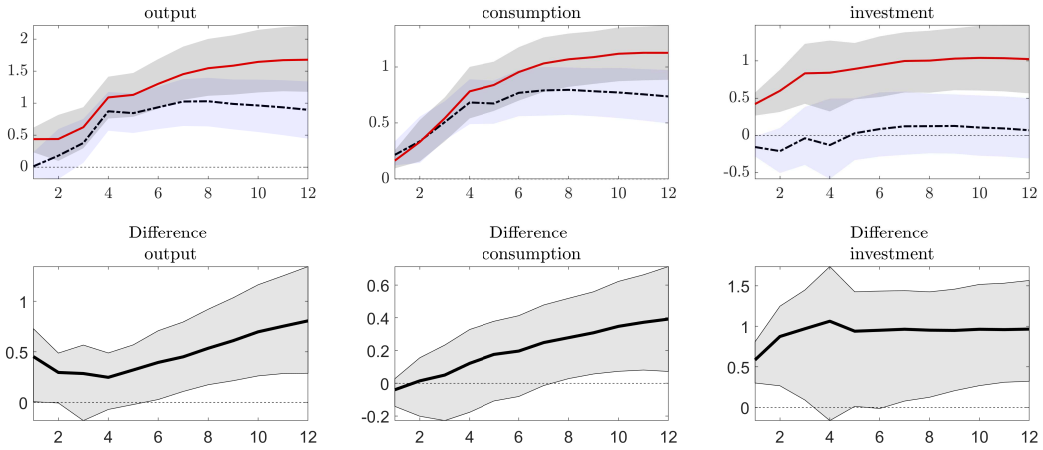
Notes: Top panel: Cumulative multipliers following a shock to government consumption financed with foreign-currency-denominated debt (black) and home-currency-denominated debt (red). Cumulative multipliers are calculated as in section 2.2.1. Lines correspond to median responses. Shaded areas correspond to parameter uncertainty of one-standard deviation. Bottom panel: The difference in cumulative multipliers between foreign-currency-denominated debt and home-currency-denominated debt.

Figure C.12: Twin deficits: Cumulative IRFs



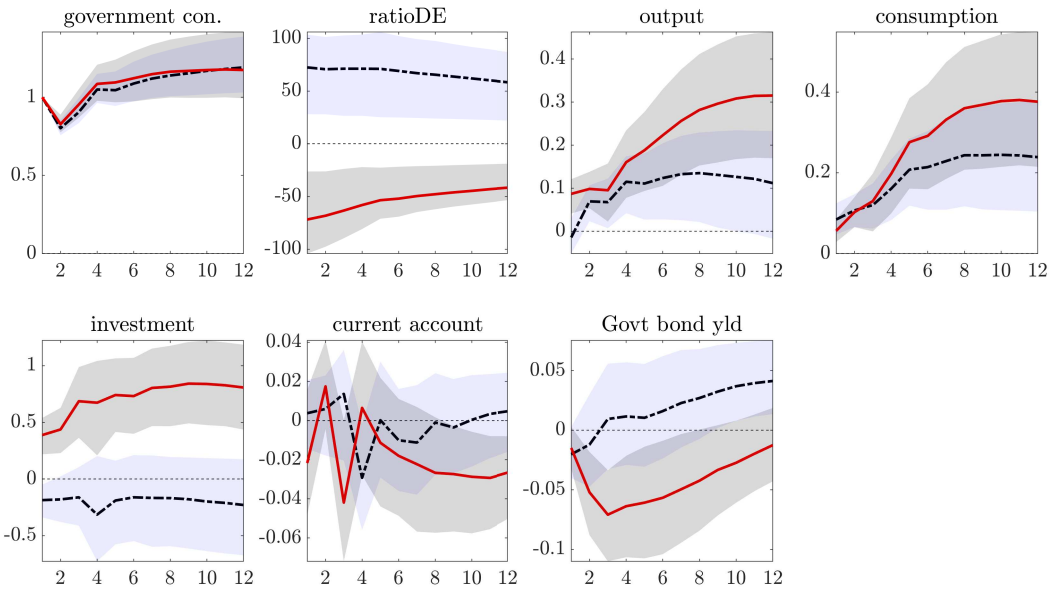
Cumulative impulse response functions following a shock to foreign- (black) and home-debt-financed (red) government consumption. Cumulative multipliers are calculated as in section 2.2.1. Lines correspond to median responses. Shaded areas correspond to parameter uncertainty of one-standard deviation.

Figure C.13: Twin deficits: Cumulative multipliers



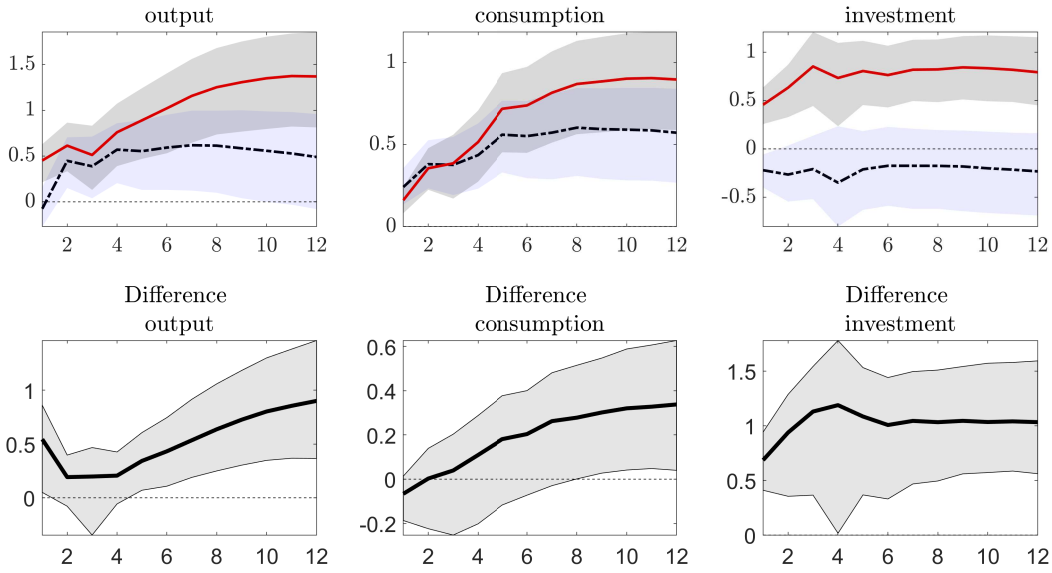
Notes: Top panel: Cumulative multipliers following a shock to foreign- (black) and home-debt-financed (red) government consumption. Cumulative multipliers are calculated as in section 2.2.1. Lines correspond to median responses. Shaded areas correspond to parameter uncertainty of one-standard deviation. Bottom panel: The difference in cumulative multipliers between foreign- and home-debt-financed government consumption. Shaded areas correspond to parameter uncertainty of one-standard deviation.

Figure C.14: Twin deficits and government bond yield: Cumulative IRFs



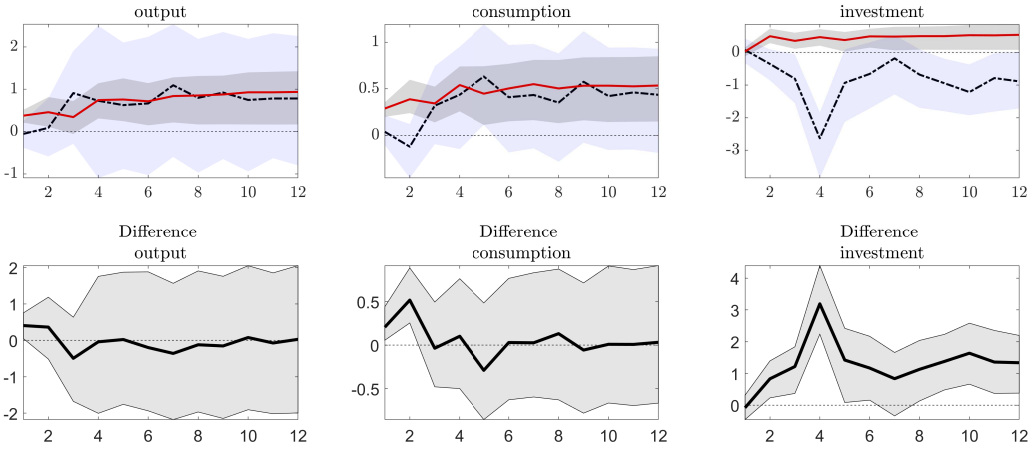
Cumulative impulse response functions following a shock to foreign- (black) and home-debt-financed (red) government consumption. Cumulative multipliers are calculated as in section 2.2.1. Lines correspond to median responses. Shaded areas correspond to parameter uncertainty of one-standard deviation.

Figure C.15: Twin deficits and government bond yield: Cumulative multipliers



Notes: Top panel: Cumulative multipliers following a shock to foreign- (black) and home-debt-financed (red) government consumption. Cumulative multipliers are calculated as in section 2.2.1. Lines correspond to median responses. Shaded areas correspond to parameter uncertainty of one-standard deviation. Bottom panel: The difference in cumulative multipliers between foreign- and home-debt-financed government consumption. Shaded areas correspond to parameter uncertainty of one-standard deviation.

Figure C.16: Interaction-VAR: Cumulative multipliers



Notes: Top panel: Cumulative multipliers following a shock to foreign- (black) and home-debt-financed (red) government consumption. Cumulative multipliers are calculated as in section 2.2.1. Lines correspond to median responses. Shaded areas correspond to parameter uncertainty of one-standard deviation. Bottom panel: The difference in cumulative multipliers between foreign- and home-debt-financed government consumption. Shaded areas correspond to parameter uncertainty of one-standard deviation.

D Small Open Economy Model

D.1 Flexible price model

D.1.1 Optimality conditions

The optimality conditions consisting of the competitive equilibrium of the economy are given by:

$$c_t^{-1} = \beta \mathbf{E_t} \left[c_{t+1}^{-1} \left(r_{t+1} + 1 - \delta \right) \right] \tag{D.1}$$

$$c_t^{-1} = \beta \mathbf{E_t} \left[c_{t+1}^{-1} R_t^h \right] \tag{D.2}$$

$$c_t^{-1} = \beta \mathbf{E_t} \left[c_{t+1}^{-1} R_t^{f,k} \right] \tag{D.3}$$

$$R_t^{f,k} = r^* + \nu \left[\exp\left(b_t^{f,k} - \overline{b^{f,k}} \right) - 1 \right] \tag{D.4}$$

$$w_t c_t^{-1} = \frac{\theta}{1 - n_t} \tag{D.5}$$

$$Y_t = k_{t-1}^{\alpha} n_t^{1-\alpha} \tag{D.6}$$

$$k_t = (1 - \delta) k_{t-1} + i_t \tag{D.7}$$

$$w_t = (1 - \alpha) k_{t-1}^{\alpha} n_t^{-\alpha} \tag{D.8}$$

$$r_t = \alpha k_{t-1}^{\alpha-1} n_t^{1-\alpha} \tag{D.9}$$

$$g_t - T_t = b_t^h - R_{t-1}^h b_{t-1}^h + b_t^f - R_{t-1}^f b_{t-1}^f \tag{D.10}$$

$$R_t^f = R_t^h \tag{D.11}$$

$$g_t = \kappa^g + \rho_g g_{t-1} + \varepsilon_t^{g,h} + \varepsilon_t^{g,f} \tag{D.12}$$

$$b_t^h = \rho_B b_{t-1}^h + \varepsilon_t^{g,h}; \qquad b_t^f = \rho_B b_{t-1}^f + \varepsilon_t^{g,f} \tag{D.13}$$

$$c_t + i_t + g_t = Y_t + b_t^f - R_{t-1}^f b_{t-1}^f + b_t^{f,k} - R_{t-1}^{f,k} b_{t-1}^{f,k} \tag{D.14}$$

D.1 is the Euler equation for capital. D.2 and D.3 are the Euler equations for domestic government debt and private external debt, respectively. D.4 is the debt-elastic interest rate rule for private external debt. D.5 is the intratemporal optimality condition. D.6 is the production function. D.7 is the law of motion for capital. D.8 is the optimality condition for wages. D.9 is the optimality condition for the rental rate of capital. D.10 is the government budget constraint. D.11 is the no-arbitrage condition between domestic and external interest rates. D.12 is the exogenous rule for government spending. D.13 are the exogenous processes for domestic and external government debt. Finally, D.14 is the aggregate resource constraint of the economy.

D.2 Sticky price model with rule-of-thumb consumers (and interest rate spread)

D.2.1 Optimality conditions

The economy is now populated by a continuum of households $h \in [0,1]$, of which a fraction s are rule-of-thumb (r) and the remaining fraction $1-s$ are optimizing (o). Preferences of both household h are again given by: $\mathbf{E_0} \sum_{t=0}^{\infty} \beta^t \left[\log\left(c_t^h\right) - \theta \log\left(n_t^h\right)\right]$. The optimality conditions determining the competitive equilibrium are given by:

$$w_t \left(c_t^h\right)^{-1} = \frac{\theta}{1 - \left(c_t^h\right)} \tag{D.15}$$

$$\left(c_t^o\right)^{-1} = \beta \mathbf{E_t} \left[\left(c_{t+1}^o\right)^{-1} \left(r_{t+1} + 1 - \delta\right)\right] \tag{D.16}$$

$$\left(c_t^o\right)^{-1} = \beta \mathbf{E_t} \left[\left(c_{t+1}^o\right)^{-1} R_t^h \left(1 + \pi_{t+1}\right)^{-1}\right] \tag{D.17}$$

$$(c_t^o)^{-1} = \beta \mathbf{E_t}\left[\left(c_{t+1}^o\right)^{-1} R_t^{f,k} \left(1+\pi_{t+1}\right)^{-1}\right] \tag{D.18}$$

$$R_t^{f,k} = r^* + \nu\left[\exp\left(b_t^{f,k} - \overline{b^{f,k}}\right) - 1\right] \tag{D.19}$$

$$\Pi_t = \left(\left(1-\phi\right)\Pi_t^{\#1-\varepsilon} + \phi\right)^{\frac{1}{1-\varepsilon}} \tag{D.20}$$

$$v_t = \left(1-\phi\right)\Pi_t^{\#-\varepsilon}\Pi_t^{\varepsilon} + \phi\Pi_t^{\varepsilon} v_{t-1} \tag{D.21}$$

$$\Pi_t^{\#} = \Pi_t\left(\frac{\varepsilon}{\varepsilon-1}\right) E_t \frac{\widehat{A}_t}{\widehat{D}_t} \tag{D.22}$$

$$\widehat{A}_t = \left(c_t^o\right)^{-1} Y_t mc_t + \phi\beta E_t \Pi_{t+1}^{\varepsilon-1}\widehat{A}_{t+1} \tag{D.23}$$

$$\widehat{D}_t = \left(c_t^o\right)^{-1} Y_t + \phi\beta E_t \Pi_{t+1}^{\varepsilon-1}\widehat{D}_{t+1} \tag{D.24}$$

$$k_{t+1}^o = \left(1-\delta\right)k_t^o + i_t^o \tag{D.25}$$

$$Y_t = K_{t-1}^{\alpha} N_t^{1-\alpha} \tag{D.26}$$

$$w_t = mc_t\left(1-\alpha\right)\left(\frac{K_{t-1}}{N_t}\right)^{\alpha} \tag{D.27}$$

$$r_t = mc_t\left(\frac{K_{t-1}}{N_t}\right)^{\alpha-1} \tag{D.28}$$

$$g_t - T_t = b_t^h - R_{t-1}^h\left(1+\pi_{t+1}\right)^{-1} b_{t-1}^h + b_t^f - R_{t-1}^f\left(1+\pi_{t+1}\right)^{-1} b_{t-1}^f \tag{D.29}$$

$$R_t^f = R_t^h\left[1+\chi\left(\frac{b_t^h}{\overline{b^h}}\right)\right] \tag{D.30}$$

$$g_t = \kappa^g + \rho_g g_{t-1} + \varepsilon_t^{g.h} + +\varepsilon_t^{g,f} \tag{D.31}$$

$$b_t^h = \rho_B b_{t-1}^h + \varepsilon_t^{g,h}; \qquad b_t^f = \rho_B b_{t-1}^f + \varepsilon_t^{g,f} \tag{D.32}$$

$$R_t^h = \left(1-\rho_i\right)\left(\frac{1}{\beta}\right)\left(1+\pi^*\right) + \rho_i R_{t-1}^h + \left(1-\rho_i\right)\phi_\pi\left(\pi_t - \pi^*\right) + \left(1-\rho_i\right)\phi_y\left(Y_t - Y_{t-1}\right) + \varepsilon_t^{mp} \tag{D.33}$$

$$C_t + I_t + g_t = Y_t + b_t^f - R_{t-1}^f\left(1+\pi_{t+1}\right)^{-1} b_{t-1}^f + b_t^f - R_{t-1}^f\left(1+\pi_{t+1}\right)^{-1} b_{t-1}^f \tag{D.34}$$

$$c_t^r = w_t n_t^r - T_t \tag{D.35}$$

$$C_t = sc_t^r + \left(1-s\right)c_t^o \tag{D.36}$$

$$N_t = sn_t^r + \left(1-s\right)n_t^o \tag{D.37}$$

$$K_t = \left(1-s\right)k_t^o \tag{D.38}$$

$$I_t = \left(1-s\right)i_t^o \tag{D.39}$$

D.15 is the intratemporal optimality condition for household h. D.16 is the Euler equation for capital. D.17 and D.18 are the Euler equations for domestic government debt and private external debt, respectively. D.19 is the debt-elastic interest rate rule for private external debt. D.20 describes the evolution of aggregate price inflation. D.21 is the definition of aggregate price dispersion. D.22 is the equation for reset price inflation. D.23 and D.24 are the auxiliary terms entering the reset price inflation equation. D.25 is the law of motion of capital. D.26 is the production function. D.27 is the optimality condition for wages. D.28 is the optimality condition for the rental rate of capital. D.29 is the government budget constraint. D.30 is the no-arbitrage condition between domestic and external interest rates. D.31 is the exogenous process for government spending. D.32 are the exogenous processes for domestic and external government debt. D.33 is the Taylor rule on nominal (domestic) interest rates. D.34 is the aggregate resource constraint of the economy. D.35 is the budget constraint of rule-of-thumb households, which equates consumption of rule-of-thumb households with after-tax labor income. Finally, equations D.36 to D.39 are the definitions of aggregate consumption, labor, capital, and investment.

D.2.2 Calibration

We set $\pi^* = 0.005$, implying that the average annualized inflation rate is about 2 percent. We set $\phi = 0.75$, implying that, on average, firms change their prices every 4 quarters, and $\epsilon = 6$, which gives steady state markups of around 20 percent. The parameters of the Taylor are set to $\phi_\pi = 1.35$, $\phi_y = 0.3$ and $\rho_i = 0.85$. We set the share of rule-of-thumb households, s, to 0.5, which is the value considered in Gali *et al.* (2007). Finally, we set $\chi = 0.75$ in line with evidence for emerging markets between 2005 to 2011 presented in Du and Schreger (2013), who find that foreign-currency credit spreads are greater than local-currency credit spreads by 0.67 to 0.87 basis points. This parameterization can bee seen in Table D.1. The remaining parameters are in line with what was discussed in the flexible price model (see section 5.2.1 in the article).

Table D.1: Parameter values for the sticky price model with rule-of-thumb households

Parameter	Value	Label
$1-s$	0.5	Share of rule-of-thumb households
ϕ	0.75	Calvo price stickiness
ε	6	Elasticity of substitution across varieties
π^*	0.005	Steady-state inflation
χ	0.75	Debt-elastic premium

D.3 Comparing IRFs in the model and the data

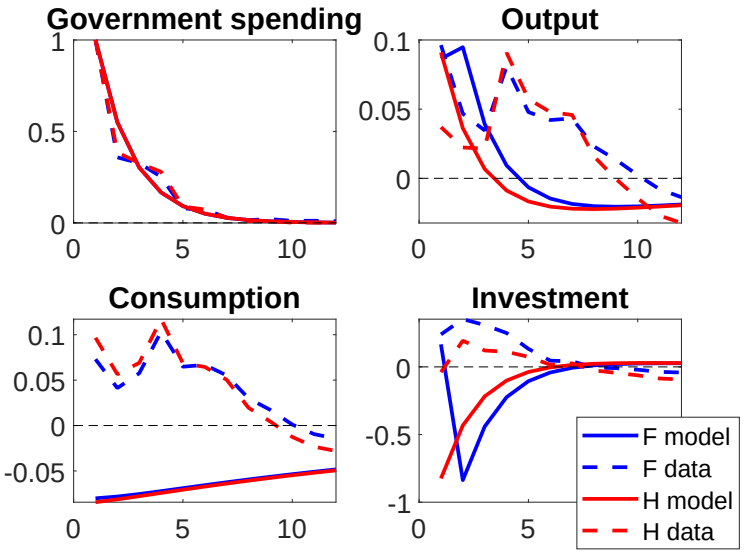
Here, we test whether the small open economy model developed above can qualitatively approximate the predictions from the data. Notably, given the stylized nature of the model and the fact that its parameters have not been estimated, this is a purely illustrative exercise. A more formal comparison would require developing a richer framework with all the standard frictions encountered in medium-scale DSGE models, but also in a setup where the government's portfolio decision is endogenously determined, subject to costs and constraints for borrowing in domestic and foreign markets. It would also require an estimation of parameters as well as estimating the SVAR on simulated data from the theoretical model.

Figures D.1 and D.2 compare the IRFs from the flexible price model and the sticky price model with an interest rate spread with the estimated IRFs from the baseline SVAR of Section 2. Since the SVAR in log-differences implies that the shock on the level of government spending is permanent, here we report IRFs from an SVAR estimated in logarithms using HP-filtered data. This now implies that the shocks in both specifications are transitory. In order to render the two objects comparable we set the persistence of the government shock in the model equal to 0.55.

First, the flexible model generates a positive response of investment that is quantitatively similar to the foreign-debt-financed shock estimated in the SVAR. However, the negative response of investment following a home-debt-financed shock is substantially more negative on impact. Without the introduction of sticky prices and rule-of-thumb households the responses of consumption are, as expected, not matched, but given that the SVAR does not include employment, the impact responses on output are quantitatively close, especially for the foreign-financed shock.

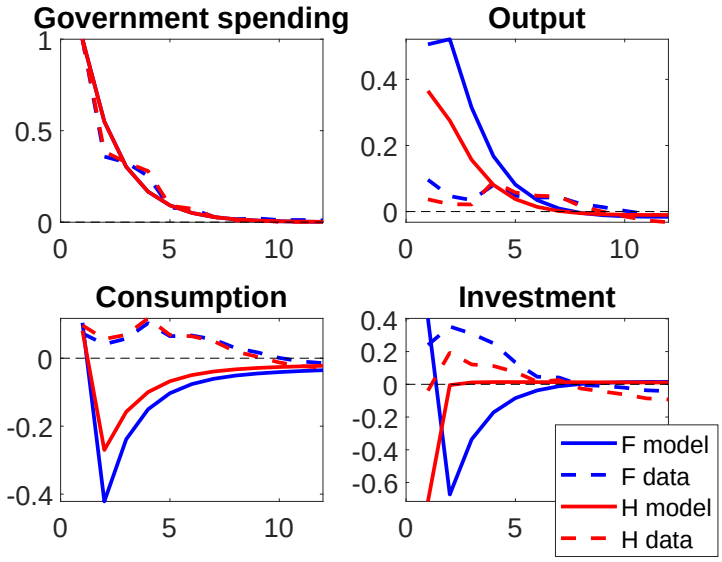
Second, the sticky price model performs better at capturing the positive impact response on consumption; the impact response on investment is still well-captured for the foreign-financed shock. But, given that employment is absent from the SVAR, this implies that the output response in the theoretical model over-predicts that of the data. However, the inclusion of the interest rate spread in this setup implies that the output response is greater for the foreign-debt-financed shock, as estimated in the data.

Figure D.1: IRFs in the SVAR with detrended levels and in the flexible price model



Notes: Impulse response functions to a 1% government spending shock financed with domestic debt (red) and external debt (blue). Solid blue line: Foreign-financed shock in the model. Solid red line: Home-financed shock in the model. Dashed blue line: Foreign-financed shock in the SVAR with detrended levels. Dashed red line: Home-financed shock in the SVAR with detrended levels. Persistence of government spending shock in the theoretical models, ρ^g, is equal to 0.55

Figure D.2: IRFs in the SVAR with detrended levels and in the sticky price model with interest rate spread



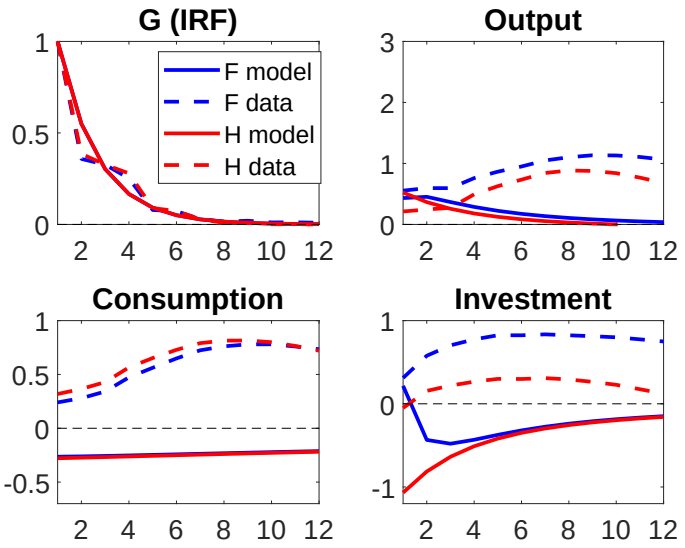
Notes: Impulse response functions to a 1% government spending shock financed with domestic debt (red) and external debt (blue). Solid blue line: Foreign-financed shock in the model. Solid red line: Home-financed shock in the model. Dashed blue line: Foreign-financed shock in the SVAR with detrended levels. Dashed red line: Home-financed shock in the SVAR with detrended levels. Persistence of government spending shock in the theoretical models, ρ^g, is equal to 0.55

In turn, Figures D.3 and D.4 compare the cumulative multipliers from the flexible price model and the sticky price model with an interest rate spread with the estimated cumulative multipliers

from the baseline (HP-filtered) SVAR of Section 2.

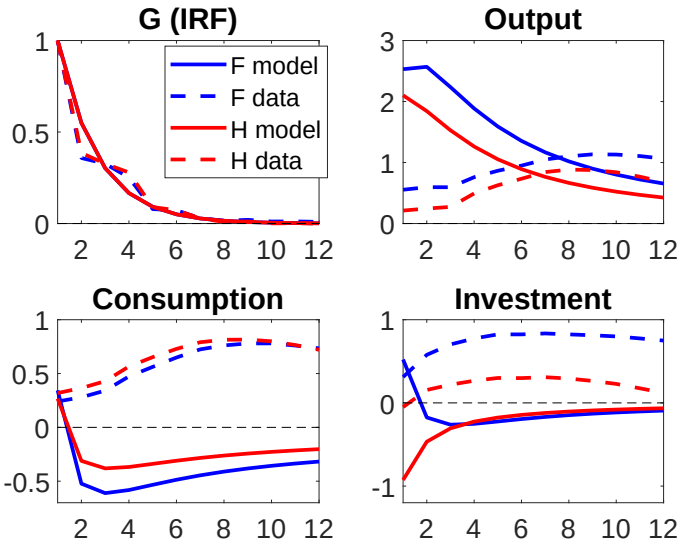
Importantly, the theoretical model only approximates the dynamics of cumulative multipliers from the data in the short run, even though the persistence of the government spending shock has been set to generate a comparable response of government spending. This is clearly a result of the stylized nature of the model, which abstracts from several of the features and frictions, which are encountered in medium-scale DSGE models, and which are important for investigating questions of fiscal policy (see e.g., Ratto *et al.* (2009); Coenen *et al.* (2013)). Importantly, in both the flexible price and the sticky price model, the model investment cumulative multipliers do not appear to be persistently positive for the foreign-financed shock. However, although both turn negative in quarter 2, the negative response is less pronounced in the sticky price model, reaching a trough of -0.1 in quarter 3 rather than -0.5 in quarter 3 compared to the flexible price model. This fast decay of the investment response has to do with the persistence of the government shock, whose autoregressive coefficient has been set to 0.5 in order to match the persistence of the government spending shock in the data.

Figure D.3: Cumulative multipliers in the SVAR with detrended levels and in the flexible model



Notes: Cumulative multipliers to a 1% government spending shock financed with domestic debt (red) and external debt (blue). Solid blue line: Foreign-financed shock in the theoretical model. Solid red line: Home-financed shock in the theoretical model. Dashed blue line: Foreign-financed shock in the SVAR with detrended levels. Dashed red line: Home-financed shock in the SVAR with detrended levels. Persistence of government spending shock in the theoretical models, ρ^g, is equal to 0.55. The plot of government spending is the IRF.

Figure D.4: Cumulative multipliers in the SVAR with detrended levels and in the sticky price model with interest rate spread



Notes: Cumulative multipliers to a 1% government spending shock financed with domestic debt (red) and external debt (blue). Solid blue line: Foreign-financed shock in the theoretical model. Solid red line: Home-financed shock in the theoretical model. Dashed blue line: Foreign-financed shock in the SVAR with detrended levels. Dashed red line: Home-financed shock in the SVAR with detrended levels. Persistence of government spending shock in the theoretical models, ρ^g, is equal to 0.55. The plot of government spending is the IRF.

D.3.1 Persistence of government spending shock

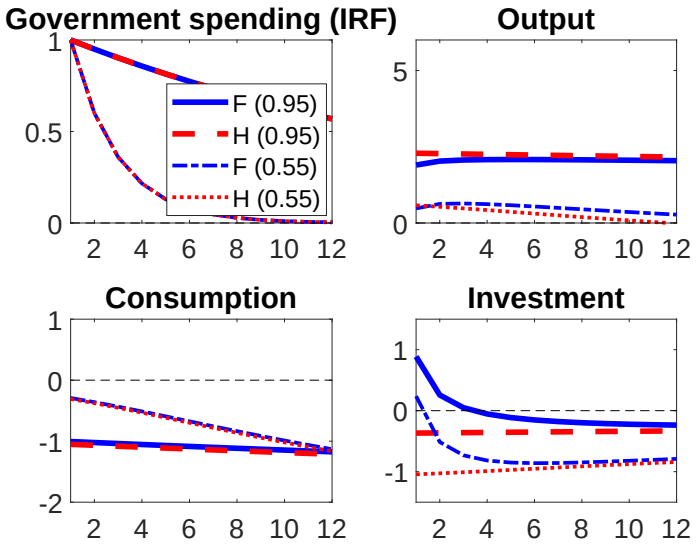
Given that model dynamics can differ with the persistence of the government spending shock, in Figures D.5 and D.6 we plot cumulative multipliers in the flexible and sticky price model for government spending shocks of different persistence ($\rho^g = 0.95$ and $\rho^g = 0.55$).

In line with Dupaigne and Feve (2016) we find that the more persistent the government shock the more positive is the response of investment (for both Foreign and Home shocks).[1] This follows from the fact that the strength of the negative wealth effect depends on the persistence of the shock. If the shock to government spending is short-lived, wealth is minimally affected, so consumption and labor supply do not respond meaningfully.

Second, for a given persistence, the sticky price model always implies a more persistent response of investment following a foreign-financed shock (as can also been seen when looking at Figures D.3 and D.4). The effects are more visible when $\rho^g = 0.95$; in this case investment turns negative in period 3 in the flexible price model, but only becomes negative in period 7 in the sticky price model.

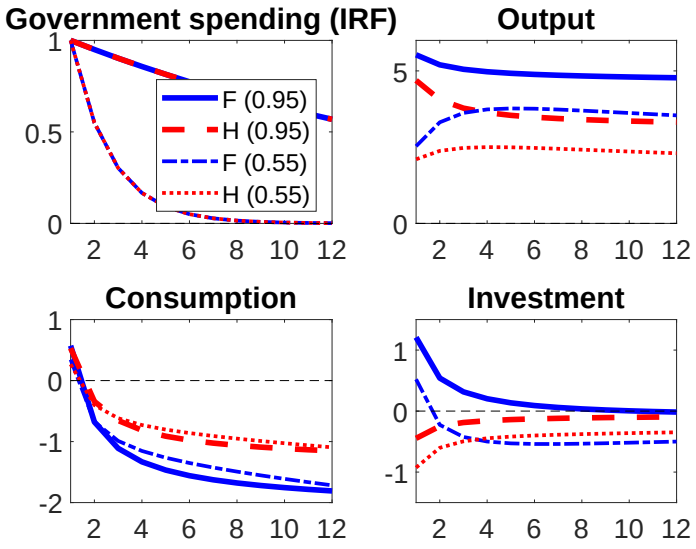
[1] In fact, when $\rho^g = 0.98$, both the Foreign and Home shock generate investment crowding in, as Dupaigne and Feve (2016) discuss, but the effect from the Foreign shock is greater.

Figure D.5: Persistence of government spending shock in the flexible price model



Notes: Cumulative multipliers to a 1% government spending shock financed with domestic debt (red) and external debt (blue). Solid blue line: Foreign-financed shock with persistence equal to 0.95. Dashed red line: Home-financed shock with persistence equal to 0.95. Dotted dashed blue line: Foreign-financed shock with persistence equal to 0.55. Dotted red line: Home-financed shock with persistence equal to 0.55.

Figure D.6: Persistence of government spending shock in the sticky price model with interest rate spread



Notes: Cumulative multipliers to a 1% government spending shock financed with domestic debt (red) and external debt (blue). Solid blue line: Foreign-financed shock with persistence equal to 0.95. Dashed red line: Home-financed shock with persistence equal to 0.95. Dotted dashed blue line: Foreign-financed shock with persistence equal to 0.55. Dotted red line: Home-financed shock with persistence equal to 0.55.

D.4 Other model variants

We return to the baseline model with flexible prices and test whether any alternative features can reconcile the predictions with the data, without resorting to sticky prices and the interest rate spread. More specifically, we experiment with i) variable capital utilization, and ii) distortionary labor income taxes.

D.4.1 Variable capital utilization

In this specification, the household owns the capital stock, chooses how intensively to utilize it, and then leases (effective) capital services, $\hat{k}_t$, to firms. With respect to the model in Section D.1, equations D.1, D.6, D.7, are replaced by D.40, D.45, and D.42, respectively, while equations D.43, D.44, D.41, are new and define the depreciation rate of capital, effective capital, and the rate of utilization, respectively.

$$\lambda_t = \beta \mathbf{E_t} \left[\lambda_{t+1} \left(r_{t+1} u_{t+1} + 1 - \delta \left(u_{t+1} \right) \right) \right] \tag{D.40}$$

$$\phi_1 + \phi_2 \left(u_t - 1 \right) = r_t \tag{D.41}$$

$$k_{t+1} = \left(1 - \delta \left(u_t \right) \right) k_t + i_t \tag{D.42}$$

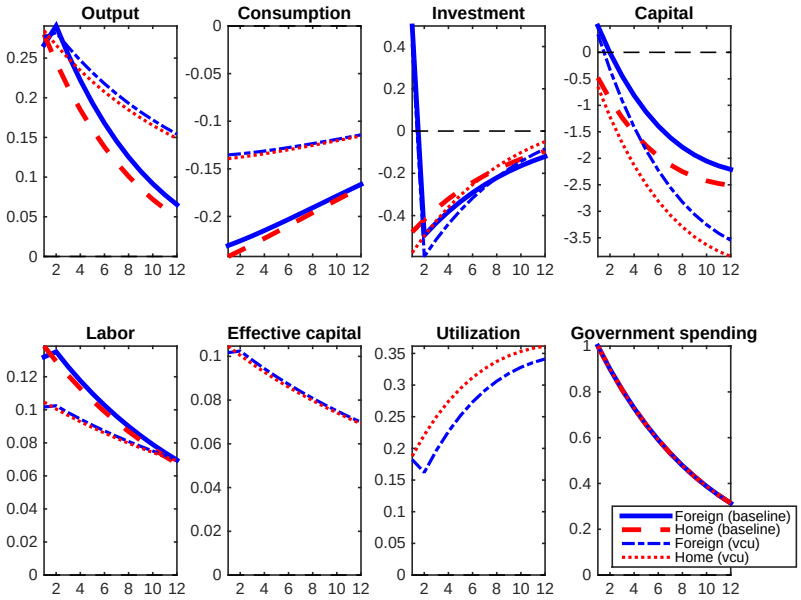
$$\delta \left(u_t \right) = \delta_0 + \phi_1 \left(u_t - 1 \right) + \frac{\phi_2}{2} \left(u_t - 1 \right)^2 \tag{D.43}$$

$$\widehat{k}_t = u_t k_{t-1} \tag{D.44}$$

$$Y_t = \widehat{k}_t^{\alpha} n_t^{1-\alpha} \tag{D.45}$$

The inclusion of variable capital utilization amplifies the effects of the government spending shock, although in a symmetric manner across the source of financing. Importantly, a home-debt-financed shock still produces an impact multiplier which is higher than a foreign-debt-financed shock (see Figure D.7). This is true even for low degrees of the parameter governing the convex costs associated with capital utilization (we illustratively set $\phi_2 = 0.01$, and $\phi_1 = {}^1\!/_\beta - (1 - \delta_0)$ in order to obtain $u = 1$ in steady state). This is again because of the wealth effect, which is still larger for a home-financed shock. Agents supply more labor, because they expect investment to be crowded out, which leads to more intensive utilization of capital.

Figure D.7: IRFs in the flexible price model with and without variable capital utilization

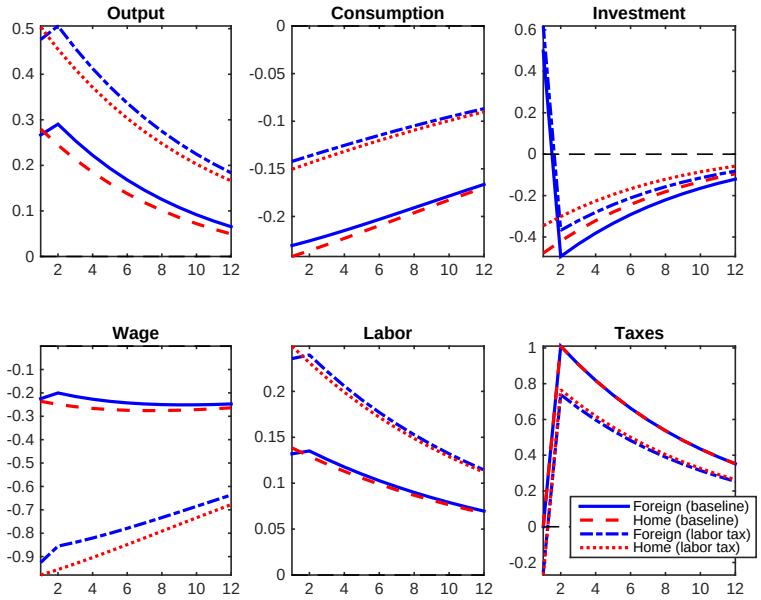


Notes: Impulse response functions to a 1% government spending shock financed with domestic debt (red) and external debt (blue). Solid blue line: Foreign-financed shock in the baseline model. Dashed red line: Home-financed shock in the baseline model. Dotted dashed blue line: Foreign-financed shock in the baseline model with variable capital utilization. Dotted red line: Home-financed shock in the baseline model with variable capital utilization.

D.4.2 Distortionary labor income tax

If labor income revenue is included in the government budget, lump-sum taxes need to adjust by less to satisfy the constraint. In this specification, households receive a net transfer in the first period equal to the amount of revenue raised by the distortionary labor income tax, since debt always matches the level of government spending. However, the fact that households also incur a distortionary tax on labor means that their after-tax wage is lower, strengthening the income effect and inducing labor supply to increase by more. So, overall the effect of a weaker wealth effect (due to lower lump-sum taxes) is dominated by the stronger income effect (due to a lower after-tax wage). This implies that the asymmetry with respect to the location of financing still holds. Hence our results are robust to the inclusion of a distortionary labor income tax. In Figure D.8, the value of τ^n is illustratively set to 80% in steady state so that the effects between the two models variants can be emphasized.

Figure D.8: IRFs in the flexible price model with and without labor income tax



Notes: Impulse response functions to a 1% government spending shock financed with domestic debt (red) and external debt (blue). Solid blue line: Foreign-financed shock in the baseline model. Dashed red line: Home-financed shock in the baseline model. Dotted dashed blue line: Foreign-financed shock in the baseline model with labor income tax. Dotted red line: Home-financed shock in the baseline model with labor income tax.

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