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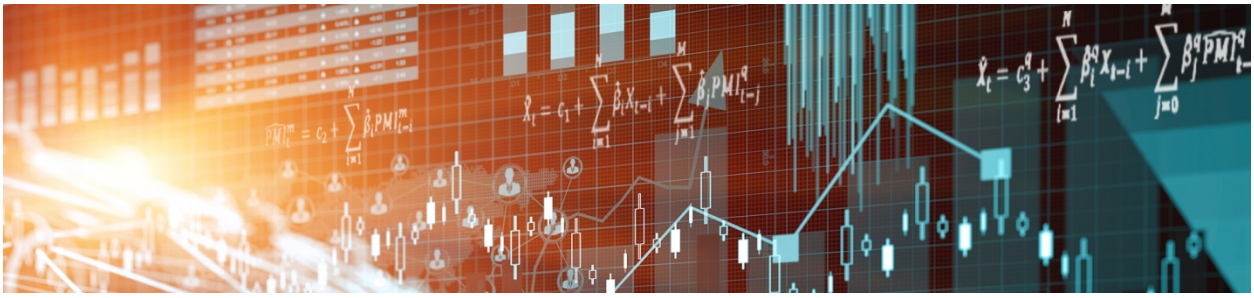
Sources of Borrowing and Fiscal Multipliers



by Romanos Priftis and Srecko Zimic

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Sources of Borrowing and Fiscal Multipliers

by

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Abstract

This paper finds that debt-financed government spending multipliers vary considerably depending on the location of the debt buyer. In a sample of 33 countries, we find that government spending multipliers are larger when government purchases are financed by issuing debt to foreign investors (non-residents), compared with when government purchases are financed by issuing debt to home investors (residents). A theoretical model (with flexible or sticky prices) shows that the location of the government creditor produces these differential responses to the extent that private investment is crowded out in each case. Increasing 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.

Bank topics: Debt management; Economic models; Fiscal policy; International financial markets
JEL codes: E2, E62, F41, H3

Résumé

Notre étude montre que les multiplicateurs pour les dépenses publiques financées par des emprunts varient considérablement selon le pays où se trouve l'acheteur du titre de créance. L'analyse, fondée sur un échantillon de 33 pays, permet de constater que les dépenses publiques ont des effets multiplicateurs plus importants quand elles sont financées par la vente de titres de créance à des investisseurs étrangers (non-résidents) plutôt qu'à des investisseurs nationaux (résidents). Un modèle théorique (en contexte de flexibilité ou de rigidité des prix) montre que le pays où se trouve le créancier public explique ces différences de réaction dans la mesure où l'investissement privé est évincé dans chaque cas. La mobilité internationale croissante des capitaux du secteur privé résident réduit la différence entre les effets des deux types de financement, dans le modèle comme les données.

Sujets : Gestion de la dette; Modèles économiques; Politique budgétaire; Marchés financiers internationaux
Codes JEL : E2, E62, F41, H3

Non-technical Summary

This is the first paper to investigate empirically and theoretically whether the transmission mechanism of a (debt-financed) fiscal shock depends on the location of the debt buyer.

Our empirical procedure consists of estimating a structural vector autoregression (SVAR) for a panel of 33 advanced and emerging economies, where data availability on public debt by creditor location is readily available at a quarterly frequency from 1995:Q1 to 2016:Q4. Identification is achieved by relying on standard timing restrictions and complementing them with a sign restriction on the movement of the ratio of domestic public debt to external public debt. We find that investment is crowded in for a foreign-debt-financed spending shock and crowded out for a home-debt-financed spending shock. This translates to an impact output multiplier that is 0.6 for a foreign shock and 0.25 for a home shock. Importantly, the impact responses on investment and output are significantly different across the two shocks in more than 98% of the drawn impulse response functions.

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 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 subsamples where private access to external finance is low (high), the difference of investment responses and output multipliers is greater (smaller).

We finally construct a small open economy model that explains the observed empirical regularity and clarifies the economic intuition of the mechanism. 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; on the contrary, because labor supply increases, investment will rise. The severity of the private sector's external borrowing friction is crucial in determining whether domestic government borrowing will displace investment.

On the policy front, our analysis can shed light on the effects of fiscal policies witnessed in recent years. For example, government expenditure cuts aimed to repay Greece's external creditors may have contributed to the deeper-than-expected recession. In contrast, the fact that expansionary fiscal policy in Japan primarily relied on domestic financing may explain the only modest effects on aggregate demand.

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; on the contrary, because labor supply increases, investment will rise. Ultimately, this implies that the impact (and cumulative) 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.

This is the first paper to test these hypotheses. Armed with this intuition, we approach the question in a twofold way. First, we inspect if the mechanism is present in the data. We study the effects of a government spending shock and outline a strategy for identifying whether it is financed with debt held by residents, or by non-residents.[1] 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 2016:Q4. 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 home- and foreign-debt-financed fiscal shocks contemporaneously affect government spending, output, consumption and investment. Additionally, a home- (foreign-) debt-financed fiscal shock increases (decreases) 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.

[1] It is important to clarify here that we abstract from issues such as the location of debt issuance, the currency denomination of debt, the jurisdiction of issuance, the maturity of the assets, and other features such as which is the issuing government agency. What we are solely interested in exploring is whether debt-financed government policy produces differential results on macroeconomic aggregates depending on whether the creditor resides within or outside the economy.

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 0.6 for a foreign shock and 0.25 for a home shock, in our baseline specification. In line with Blanchard and Perotti (2002), Fatas and Mihov (2001), and Pappa (2009), among others, we find that consumption is always crowded in. Importantly, the impact responses on investment and output are significantly different across the two shocks in more than 98% of the drawn impulse response functions.

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, Mendoza and Vegh (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 subsamples where private access to external finance is low (high), the difference of investment responses and output multipliers is greater (smaller).

To explore the mechanism more formally, we then construct a small open economy model with a government that finances its spending by borrowing domestically and abroad, and a domestic private sector, which faces frictions in borrowing abroad. Since the response of investment depends on the composition of the resource constraint, the mechanism outlined is present in all classes of economic models. But the statement related to the different size of *impact* output multipliers is not an immediately ensuing result in either the standard neo-classical real business cycle (RBC) model or a prototypical New-Keynesian (NK) model. This derives simply from the fact that capital is predetermined. 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. *Cumulative* multipliers are thus in line with the data. The difference in impact output multipliers can be accounted for once we introduce either of the two elements into the theory: i) a spread between external and domestic interest rates, or ii) investment-specific technology. The result then holds in the open-economy versions of both the RBC and NK models.

On the policy front, our analysis can shed light on the effects of fiscal policies witnessed in recent years. For example, government expenditure cuts aimed to repay Greece's external creditors may have contributed to the deeper-than-expected recession. In contrast, the fact that expansionary fiscal policy in Japan primarily relied on domestic financing may explain the only modest effects on aggregate demand. Interestingly, our analysis also implies that the composition of public debt alone can play

a role in determining the business cycle absent any additional debt issuance or changes in aggregate demand. Consider the example of a country that borrows $1 from domestic creditors to finance a $1 increase in exogenous spending. Assume also that it simultaneously reduces exogenous spending by $1 to repay $1 to external creditors. Given that the output multiplier is greater when spending is financed from abroad, portfolio rebalancing alone can trigger a downturn.

Related Literature

In previous iterations of this paper (Priftis and Zimic (2015) and Priftis and Zimic (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 debt and total public debt. The current version of the paper 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.

Our work ties in with several branches of the fiscal policy literature. On the empirical side, there are ample studies documenting the state-dependence of fiscal multipliers. However, there is no previous work looking at the subset of fiscal multipliers that are debt-financed. Christiano, Eichenbaum and Rebelo (2011) were among the first to show that fiscal multipliers are larger when nominal interest rates are at the zero lower bound. Auerbach and Gorodnichenko (2013) show that multipliers depend on the state of the economy, being larger during recessions. Although Ramey and Zubairy (2018) do not find evidence for this using historical military spending data. The work by Ilzetzki, Mendoza and Vegh (2013), in turn, finds that fiscal multipliers depend on several country and institutional characteristics, such as the level of economic development, the exchange rate regime, and trade openness. More recently, demographics have also been shown to be an important factor for the transmission mechanism of a government spending shock in Basso and Rachedi (2018). Broner *et al.* (2018) investigate how multipliers depend on the home bias of public debt. Like us, they rely on the crowding in or out of private investment, but they distinguish themselves in a a number of dimensions. Most notably, they do not assess marginal changes of debt and hence the way spending is financed.

There are other studies that investigate the capacity of debt expansions to crowd in investment. Traum and Yang (2015) show that whether investment is crowded in or out in the short run depends on what policies generate the debt increase. For example, if debt rises because of a fall in capital tax rates or an increase in government investment, then private investment is crowded in because both policies raise the return to capital. In contrast, if debt rises because consumption tax rates fall, then private

investment is crowded out, as the price of investment goods rises (relative to the price of consumption goods). More related to story of this paper, Cacciatore and Traum (2018) show that the domestic effectiveness of fiscal policy can be larger in economies more open to trade, irrespective of the trade balance dynamics. When trade linkages strengthen the expansionary effects of government spending, they reduce the effects of income tax cuts, and vice versa.

The remainder of the paper is structured as follows: section 2 describes the empirical strategy used to estimate the SVAR. Section 3 presents results of the estimation, along with robustness checks, for both the baseline specification and when conditioning on the degree of private external borrowing. Section 4 builds a theoretical model and uses it to illustrate the mechanism obtained in the data. Finally, section 5 concludes.

2 Econometric Methodology

We study the effects of a government spending shock and outline a strategy for identifying whether it is financed with debt issued to residents or to non-residents. Our empirical procedure consists of estimating an SVAR for a panel of advanced and emerging economies.

2.1 Data

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 expenditures, domestic public debt, external public debt, output, private consumption, and private investment. The size of the panel is dictated by both national accounts data and debt variables.

National accounts data is hard to reliably obtain at a quarterly frequency for many emerging economies. As Ilzetzki, Mendoza and Vegh (2013) explain, many countries may report data at a quarterly frequency, but collect them at annual frequency. Following this premise, our panel includes countries that report and collect government consumption data at quarterly frequency (for EU countries based on the ESA2010 common statistical standard; for other advanced and emerging economies based on the International Monetary Fund's (IMF's) Special Data Dissemination Standard (SDDS)).

The debt data is obtained from the Quarterly Public Sector Debt (QPSD) database of the IMF-World Bank, whose coverage begins in 1995:Q1. To the best of our knowledge, this is the only source of debt data at *quarterly* frequency where creditor location is accounted for. We also believe we are the first to exploit the QPSD data set for an analysis of debt variables by creditor location in large samples. Alternatives would have been to rely on the ECB's SDW, which reports *annual* debt data by residents

and non-residents for the EU28, starting in 1995. However, it would then be illegitimate to use annual government spending data with the Blanchard and Perotti (2002) framework. Another option would be to identify government spending shocks using international variation in (annual) military spending. Miyamoto, Nguyen and Sheremirov (2016) compile such information for a large panel of countries from the Stockholm International Peace Research Institute (SIPRI). However, this would oblige us to turn to the ECB SDW for debt data, which would significantly diminish the panel in both dimensions, as well as its heterogeneity. An additional contribution of our paper is to study fiscal multipliers in low-income countries that have not received particular attention in the literature.

For more information on data sources, see section A in the Appendix.

2.2 Reduced form VAR

Our approach follows Blanchard and Perotti (2002) and Ilzetzki, Mendoza and Vegh (2013). 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 (e.g., government expenditures, GDP, and other 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 expenditures 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 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.

In the reference specification, $Y_{n,t}$ contains the variables: *government expenditures, output, household consumption, private investment.* We follow Blanchard and Perotti (2002) and assume that government expenditures respond contemporaneously only to their own innovations. This translates to a Cholesky decomposition with government expenditures ordered first. We provide this specification as a reference for when we introduce debt variables, and for comparison with the literature.

[2]We also perform robustness checks where we estimate the system in levels and remove fixed effects. These are shown in section 3.4. We use country block bootstrap to take into account parameter uncertainty. Results are robust to using standard residual bootstrap.

2.3 Identifying debt-financed fiscal shocks

The main question of interest is whether the location of debt financing of government spending can affect the endogenous variables in the system differently. We use the debt data to construct the *ratio* of domestic public debt to external public debt and introduce this into the SVAR. $Y_{n,t}$ is now modified to be: *government expenditures, ratio, output, household consumption, private investment.*

Instead of a general government spending shock, we now identify separately two government spending shocks: a home debt-financed spending shock (Home) and a foreign debt-financed spending shock (Foreign). Using a Cholesky decomposition in this setup is no longer meaningful because both shocks, whatever the source of financing, impact government expenditures and the ratio contemporaneously. The strategy we employ is to use standard timing restrictions as in Blanchard and Perotti (2002) to separate the two spending shocks from other potential structural shocks. Since all other shocks in the system do not affect government spending, identification is guaranteed. Second, we employ sign restrictions on the response of the ratio to distinguish between a Home- and Foreign-government spending shock. In particular, a Home shock increases the ratio, while the Foreign shock decreases it.[3] Since the restrictions are placed on the contemporaneous increases of debt, this approach identifies the change of *marginal* domestic to external debt to finance government spending, rather than just outstanding debt in the economy. The exact assumptions are summarized in Table 1.[4]

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 VAR. 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. "?" denotes unrestricted contemporaneous effect. 0 denotes no contemporaneous effect (timing restriction). Sign restrictions are imposed for 1 quarter.

[3] In the set of models that are consistent with the data and sign restrictions, we select the model that maximizes the difference in the 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 counterparts of a purely home- or purely foreign-financed spending shock. Retaining all the 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.

[4] We have opted for this approach because it is the closest to the standard method of identifying fiscal shocks, used for example in Ilzetzki, Mendoza and Vegh (2013). We only deviate with regards to assigning an additional sign restriction on the ratio. In the previous version of this paper (Priftis and Zimic (2015)), we use a slightly more involved identification. 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 debt and total public debt. In the robustness section (3.4) we also use an interaction VAR to identify debt-financed government spending shocks. Throughout all approaches the qualitative results are unaffected.

2.4 Fiscal multipliers

Following the literature on fiscal multipliers (e.g., Ilzetzki, Mendoza and Vegh (2013)) we calculate the cumulative multiplier m_{t+s} as

$$m_{t+s} = \frac{\sum_{q=t}^{t+s} \Delta X_q}{\sum_{q=t}^{t+s} \Delta G_s} \left(\frac{\overline{X}}{\overline{G}} \right) \tag{2.2}$$

which measures the cumulative change of the endogenous variable X (where X can be output Y, consumption C, investment I) per unit of additional government expenditures G, from the impulse at time t, to the horizon s. $\left(\frac{\overline{X}}{\overline{G}} \right)$ is the sample average of the endogenous variable over government expenditures.

3 Results

3.1 Government spending shock in an SVAR without debt

Figure B.1 plots the impulse response functions to a 1% innovation in government spending in the reference SVAR without debt, where government spending is ordered first. A government spending shock produces the well-known effects of an increase in output, a crowding in of consumption and an insignificant response on private investment on impact. In the medium-run, the response of investment becomes positive. The results are in line with a number of studies in the empirical fiscal policy literature. For example, Blanchard and Perotti (2002), Fatas and Mihov (2001), and Pappa (2009) all document the crowding in of consumption. Fatas and Mihov (2001) find insignificant responses on private investment, whereas Pappa (2009) 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.

Figure B.2 plots cumulative multipliers based on these impulse response functions. The impact multiplier on output is 0.3 and 0.15 on consumption. The cumulative multiplier on output increases along the horizon and converges to a level of 1.2 after 3 years. In a bivariate VAR with government consumption and output, Ilzetzki, Mendoza and Vegh (2013) find an impact output multiplier of 0.37 in high-income countries, which in the long run reaches a level of 0.8.

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

Figures B.3 and B.4 plot the cumulative multipliers following a 1% government spending shock in the SVAR with debt, identified using timing and sign restrictions. The main difference across the two ways of financing government spending relate to the response of investment. In line with the theory, a foreign debt-financed spending shock produces a crowding in of investment (investment multiplier is 0.35 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 0.6 and converges to a level of 2 after 3 years. On the other hand, if it is financed domestically, the impact output multiplier is 0.25 and only reaches a level of 1.2 after 3 years. In both cases, consumption is crowded in, reflecting the results of the reference SVAR and the literature. Finally, all impact responses are statistically significant.

To test whether the *difference* in multipliers is statistically significant, in Figure B.5 we plot the empirical probability density function (PDF) of the difference in impact multipliers across the two shocks. The difference is defined as Foreign-Home and the empirical PDF is obtained by drawing from the posterior distribution of the models. With regards to output, foreign financing produces a median impact multiplier, which is greater by 0.39 than the impact output multiplier for home financing. This difference is positive in 98% of the cases. With regards to investment, foreign financing produces a median impact multiplier, which is greater by 0.54 than the impact investment multiplier for home financing. In this case, the difference is positive in 99% of cases.

3.3 Does private external borrowing matter?

The key mechanism for obtaining different fiscal multipliers in the two financing cases depends on the degree of crowding out of private investment. In the theoretical model, we show that whether investment will be crowded out depends on the extent to which the private sector has access to external financial markets. We show this argument more formally in section 4.3, but the intuition is simple: if the private sector has access to external borrowing, then it can undo the effects that a government spending shock has on its private investment. Hence, we should observe a smaller difference in the impact responses of output for Home and Foreign shocks if external finance by the private sector is available.

In the spirit of Ilzetzki, Mendoza and Vegh (2013), we re-estimate the SVAR by conditioning 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 subsample where private access to external finance is high, and another where private access to external finance is low. We consider the following three measures 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 risk premia for both government bonds and private sector lending rates (see, e.g., Pancrazi, Seoane and Vukotic (2015)). When volatility is high, access to external financing should be limited. In contrast, countries with more non-resident bank loans will have better access to foreign financial markets. Recent studies that make use of this measure, especially for

emerging economies are Bandyopadhyay, Lahiri and Younas (2012). However, given that this variable is reported as a share of GDP, very advanced economies (e.g., US) are classified into the "low access" subsample. Clearly, none of these statistics are perfect measures of the private sector's access to external markets, but given a lack of data for the element we are after, these proxies approximate well on average. Moreover, the analysis provides an informative slicing of the panel across different dimensions, which provides further robustness to the baseline results.

The results from slicing the panel along these dimensions are summarized in Table 2. The table reports the cumulative multipliers of output, consumption, and investment at different horizons, for a foreign debt-financed and a home-debt financed spending shock. It also reports the median of the empirical PDF of the difference in multipliers (Foreign-Home), as well as the percentage of cases, where this difference is greater than zero. Grey cells correspond to the "low access" subsamples, whereas white cells correspond to the "high access" subsamples.

Overall, the results are consistent with the intuition developed. First, the results are in line with the predictions of the unconditional SVAR specification. A Foreign shock produces investment crowding in, and a Home shock produces investment crowding out for all measures. The impact output multiplier following a Foreign shock is also greater than the impact output multiplier following a Home shock. Moreover, across all measures, 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. With regards to the output impact multiplier, the results are strongest using the Chinn-Ito index of financial openness. In particular, in the "low access" subsample the difference is 0.52 (with 98.7% of cases with a positive difference), while in the "high access" subsample the difference is only 0.03 (with 55.4% of cases with a positive difference). With regards to the impact response of investment, the effect is most pronounced using the GDP volatility measure. In the "low access" subsample the difference is 0.85 (with 99.8% of cases with a positive difference), while in the "high access" subsample the difference is 0.12 (with 78.4% of cases with a positive difference).

3.4 Robustness checks

We perform a battery of robustness checks. All are summarized in Table 3. For each robustness case, the table reports the cumulative multipliers of output, consumption, and investment at different horizons, for a foreign debt-financed and a home-debt financed spending shock. It also reports the median of the empirical PDF of the difference in multipliers (Foreign-Home), as well as the percentage of cases, where this difference is greater than zero.

3.4.1 OECD, emerging economies, and the US

First, we test the baseline specification using different country groupings (OECD, emerging economies, US). For the US in particular, we use longer data that starts in 1970:Q1.[5]

The results carry over to the OECD subgroup with a median difference in the impact response of output standing at 0.36, and is positive in 95.2% of cases. Moreover, investment is crowded in following a Foreign shock and crowded out following a Home shock. The difference stands at 0.56 and is positive for 99.5% of cases.

Focusing on the emerging economies subsample, the results are weakened. The median impact output multiplier is greater for a Home shock (1.18) than for a Foreign shock (0.95) with a difference of -0.23. The difference is nevertheless positive in 40% of cases, implying that the data does not reveal a difference in multipliers. Investment is crowded in on impact following both shocks, but the impact response is greater for a Foreign shock. The difference is 0.45 and is positive in 78% of cases. The emerging economies comprise approximately 20% of the global panel: this suggests that data quality for these countries may be lacking.[6]

In the case of the US (using data which starts in 1970:Q1), the results are in line with the predictions. The difference in impact output multipliers is 0.28, and the difference is positive in 100% of cases. On the side of investment, both shocks lead to investment crowding out, although the Foreign shock causes investment to decline by half of the Home shock (-0.1 vs -0.21). This difference is also positive in 100% of cases. The fact that investment is crowded out in both cases in the US is in line with Leeper, Traum and Walker (2017). They find that investment is decisively crowded out in a regime of active monetary policy coupled with passive fiscal policy.

3.4.2 Reduced-form robustness

Second, we perform robustness checks with regards to the reduced form model: we re-estimate the baseline specification without fixed effects, and in levels. In both instances the results carry through. For the specification without fixed effects, the difference in output multipliers is 0.31 and is positive for 93.3% of cases. Investment is crowded in by a Foreign shock and crowded out by a Home shock. The median difference is 0.55 and is positive for 99.6% of cases. When we estimate the SVAR in levels, the difference in impact output multipliers is again 0.31 and the difference is positive for 90.2% of the cases. Here, again, investment is crowded in by a Foreign shock and crowded out by a Home shock. The median difference is now 0.46 and is positive for 99.5% of cases.

[5] Obtained from: Federal Reserve Economic Data | St. Louis Fed

[6] When we remove the emerging economies from the panel and re-estimate the baseline SVAR, our results are qualitatively unaffected, but quantitatively strengthened.

3.4.3 Alternative identification schemes

Third, we look at two alternative identification schemes, which condition the panel into low and high domestic-to-external debt shares. The "1 shock" robustness case splits the panel into two subsamples: one where the ratio of domestic-to-external debt is below the median (low ratio), and another where the ratio of domestic-to-external debt is above the median (high ratio). The "Interaction VAR" estimates the entire panel, but allows for an interaction term between government spending and the ratio of domestic-to-external public debt. This is in line with the methodology in Saborowski and Weber (2013).[7] The thresholds for the ratio are then set to the two limiting cases of 1% (low domestic-to-external debt ratio) and 99% (high domestic-to-external debt ratio). In both the "1 shock" and "Interaction VAR" cases, we identify a single government spending shock using a Cholesky decomposition, as in the reference SVAR of section 3.1. Clearly, the "low ratio" and "high ratio" thresholds reflect average domestic-to-external shares in the data (outstanding debt) and cannot capture the increases in government spending, which are contemporaneously accompanied with increases in domestic, or external debt holdings (marginal debt) that we have been identifying so far.

The identification based on the "1 shock" specification is not particularly insightful. In fact, for countries with low domestic debt-to-external debt ("foreign") the multiplier is 0.09, while for countries with high domestic debt-to-external debt ("home") the impact output multiplier is 0.38. The responses of investment are in line with our baseline specification, though. Investment increases in countries with a lower share of domestic-to-external debt (0.14) and decreases in countries with a higher share (-0.22). The increase in output for the high ratio group is, rather, driven by higher consumption (0.32).

When interacting government spending with the ratio on domestic-to-external debt ("Interaction VAR"), the results are more in line with our baseline specification. The difference in impact output multipliers between a low ratio ("foreign") and high ratio ("home") case is 0.48 (and positive for 90% of cases). On impact the asymmetric responses of investment are muted, but in the longer run investment increases in the low ratio ("foreign") case and decreases in the high ratio ("home") case.

4 Theoretical Model

We present a standard small open-economy model (Schmitt-Grohe and Uribe (2003)) that has the necessary and sufficient ingredients to illustrate how the location of debt-financing of government spending affects the crowding in or crowding out of private investment. As hinted at earlier, this is a direct consequence of whether the private sector has access to external financial markets. We show that the result naturally obtains from the specification of the economy's resource constraint. Consequently,

[7] We thank Sebastian Weber for sharing his codes.

the predictions are not model-dependent and hold in both the neo-classical and the New-Keynesian versions of the small open economy model. To keep the framework intentionally simple, we present only the version with flexible prices.[8]

4.1 Outline

The economy is populated by a representative household, which supplies labor and rents capital to perfectly competitive firms for the production of a final good, which is consumed domestically.[9] The household can purchase government debt and borrow from international capital markets at a debt-elastic interest rate. Fiscal policy is determined by an (automaton) government, which finances public spending via lump-sum taxes, debt issued to resident households, and debt issued to non-residents.

4.1.1 Households

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[10]

$$\mathbf{E_0} \sum_{t=0}^{\infty} \beta^t \left[\log\left(c_t\right) - \psi \log\left(n_t\right)\right] \tag{4.1}$$

subject to the budget constraint:

$$c_t + i_t + b_t^h - b_t^{f,k} = w_t n_t + r_t k_{t-1} + R_{t-1}^h b_{t-1}^h - R_{t-1}^{f,k} b_{t-1}^{f,k} - T_t \tag{4.2}$$

$E_0\left[.\right]$ denotes the expectation operator and $0 < \beta < 1$ is the subjective discount factor. $\psi > 0$ denotes the weight on labor dis-utility. 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. $R_{t-1}^h b_{t-1}^h$ and $R_{t-1}^{f,k} b_{t-1}^{f,k}$ denote the gross returns from debt decisions made at time $t-1$.

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 of the

[8] The New-Keynesian model with sticky prices (and GHH preferences) is available on request.

[9] The framework abstracts from the role of the real exchange rate. Shen and Yang (2012) analyze the effects of investment crowding out in a setting of limited capital mobility that is specific to developing countries. In such an environment, an increase in foreign aid reduces the crowding out of investment, but generates a real appreciation of the exchange rate. The latter can partially offset the expansionary effects on output. However, Cacciatore and Traum (2018) show that the domestic effectiveness of fiscal policy can be larger in economies more open to trade, irrespective of the trade balance dynamics. When trade linkages strengthen the expansionary effects of government spending, they reduce the effects of income tax cuts.

[10] We chose logarithmic utility as the simplest case of the class of separable utility functions in consumption and labor. Allowing for a more general specification with constant relative risk aversion for consumption, or a Frisch labor supply elasticity that is different to $\frac{n^*}{1-n*}$ does not affect the results. We explain the implications of introducing GHH preferences in section 4.4.

form:

$$R_t^{f,k} = r^* + \nu \left[\exp\left(b_t^{f,k} - \overline{b_t^{f,k}} \right) - 1 \right] \tag{4.3}$$

$R_t^{f,k}$ is a sum of the world interest rate r^* and a convex function of the deviation of debt from its steady state value $\overline{b_t^{f,k}}$. $\nu \in [0, \infty)$ 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 $\nu \to \infty$, the cost of external capital increases in an exponential fashion.

4.1.2 Firms

Output is produced using a Cobb-Douglas technology over capital and labor:

$$Y_t = k_{t-1}^{\alpha} n_t^{1-\alpha} \tag{4.4}$$

where α determines the income share of capital in production. Capital evolves according to the law of motion

$$k_t = (1 - \delta) k_{t-1} + i_t \tag{4.5}$$

where δ is the depreciation rate. Firms choose k_{t-1} and n_t to maximize profits taking prices $\{w_t, r_t\}$ as given.

4.1.3 Government

Exogenous public expenditures g_t are financed with lump-sum taxes T_t, debt issued to domestic households b_t^h, and debt issued to non-residents $b_t^{f,g}$. For simplicity we assume that the interest rate for public external debt is equal to the public domestic interest rate $\left(R_t^{f,g} = R_t^h \right)$.[11] The government's budget constraint is given by:

$$g_t - T_t = b_t^h - R_{t-1}^h b_{t-1}^h + b_t^{f,g} - R_{t-1}^{f,g} b_{t-1}^{f,g} \tag{4.6}$$

Public expenditures follow an exogenous AR(1) process with constant κ^g and persistence ρ^g

$$g_t = \kappa^g + \rho_g g_{t-1} + \varepsilon_t^{g,h} + \varepsilon_t^{g,f} \tag{4.7}$$

[11] This can be seen as the solution to the government's financing cost minimization problem $\left(\min R_{t-1}^h b_{t-1}^h + R_{t-1}^{f,g} b_{t-1}^{f,g} \quad \text{s.t.} \quad \text{eq. 4.6} \right)$, which yields the no-arbitrage solution $R_t^h = R_t^{f,g}$ and a positive share of both domestic and foreign debt in equilibrium. We relax this assumption in section 4.4, where we assume that the public external interest rate is assigned a premium for sovereign risk, which may result in it being higher than the private external interest rate.

The objective is to map the theoretical exercise to the shocks 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 debt follow exogenous processes:

$$b_t^h = \rho_B b_{t-1}^h + \varepsilon_t^{g,h}; \qquad b_t^{f,g} = \rho_B b_{t-1}^{f,g} + \varepsilon_t^{g,f} \tag{4.8}$$

where $\varepsilon_t^{g,h}$ and $\varepsilon_t^{g,f}$ are innovations that drive the domestic debt and external debt processes, respectively, as well as government spending (eq. 4.7). When the government finances government spending using domestic debt, only the shock $\varepsilon_t^{g,h}$ is relevant. In contrast, when the government finances government spending using external debt, only the shock $\varepsilon_t^{g,f}$ is relevant. In the first instance, following a shock to $\varepsilon_t^{g,h}$, domestic debt b_t^h increases one-for-one with g_t, and external debt $b_t^{f,g}$ is exogenous and set to its steady-state value $\overline{b^{f,g}}$. In the second instance, following a shock to $\varepsilon_t^{g,f}$, external debt $b_t^{f,g}$ increases one-for-one with g_t, and domestic debt b_t^h is exogenous and set to its steady-state value $\overline{b^h}$. By assumption, the shocks are uncorrelated, but occur together at every point in time.[12] This makes the analysis here equivalent to the approach of section 2.[13]

4.1.4 Identities

The resource constraint of the economy is given by aggregating the budget constraints of the household and government

$$c_t + i_t + g_t = Y_t + b_t^{f,g} - R_{t-1}^{f,g} b_{t-1}^{f,g} + b_t^{f,k} - R_{t-1}^{f,k} b_{t-1}^{f,k}. \tag{4.9}$$

The optimality conditions consisting of the competitive equilbrium of the economy can be found in section C of the Appendix.

[12] We can similarly specify a tax rule (as in Leeper (1991); $T_t = \rho_T T_{t-1} + \xi \left(\frac{B_{t-1}}{\overline{B}}\right)$, where $B_t = b_t^h + b_t^{f,g}$ and $\overline{B}$ is the steady-state value of total debt) and then analyze debt-financing of spending in the following manner: when the government finances government spending using domestic debt, we let b_t^h be endogenous and set external public debt to its steady-state value, $b_t^{f,g} = \overline{b^{f,g}}$. Conversely, when the government finances government spending using external debt, we let $b_t^{f,g}$ be endogenous and set domestic public debt to its steady-state value, $b_t^h = \overline{b^h}$. The drawback of this approach is that we cannot have both shocks occur simultaneously, as is the case in section 2.

[13] In practice, if a government auctions off debt, it does not actively seek to influence the composition of the investor base in terms of its nationality, at least in developed countries. However, 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 4.4.

4.2 Calibration

We calibrate the model by setting the discount factor to 0.99 in order to achieve an interest rate of 1% at the baseline. The world interest rate is given by $r^* = \frac{1}{\beta}$. Following conventional parameterization in the macroeconomic literature we set the share of capital in production α to 0.33, and given that our model is quarterly, the depreciation rate δ is set to 0.025. We calibrate the weight of labor supply in the utility function ψ to 1.75, as it can be analytically derived from the steady-state relationship between capital and labor, given α and δ. We calibrate the constant in the government spending rule κ^g to 0.02 to obtain a steady-state level of government spending to GDP of 20%. Regarding the private financial openness parameter ν, as we explain below, we perform impulse response functions (IRFs) in the range [0, 50]. We specify the persistence of government spending ($\rho_G = 0.9$) and debt rule ($\rho_B = 0.9$) processes such that all variables in the economy return to their steady states by period 20. Finally, the government spending shock is of size 1% of its steady-state value. Parameter values can be seen in Table 4.

4.3 Analysis

4.3.1 The response of investment and consumption

Figure C.1 plots the responses of investment following a home debt-financed and a foreign debt-financed spending shock for different values of $0 \leq \nu < 50$. When ν is low, households can borrow externally at a favorable interest rate, while when ν is high external borrowing becomes prohibitively costly.[14] The key difference across a home debt-financed and a foreign debt-financed government spending shock is the sensitivity of investment to ν. For a foreign debt-financed shock, investment is always crowded in. For a home debt-financed shock, investment is crowded in for low values of ν, but crowded out for high values of ν. This difference can be understood by contrasting the fundamental transmission channels of a government spending shock in closed and open economies.

Consider first that v is large. Infinitesimal changes in $b_t^{f,h}$ will lead to infinite marginal increases in $R_t^{f,h}$, which disincentivize private external borrowing. In this case private external borrowing is perfectly restricted, so $b_t^{f,h}$ is constant. If government spending is financed domestically, the economy is essentially closed, so we can write the aggregate 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: $c_t + i_t + g_t = Y_t + b_t^{f,g} - R_{t-1}^{f,g} b_{t-1}^{f,g}$. It is clear, that an increase in government spending will lead to a greater crowding out of consumption and/or investment when financed domestically, *ceteris paribus*.

[14] In theory, the latter is achieved when $\nu \to \infty$, but we experiment with several values for ν and conclude that a value of $\nu = 50$ is enough to restrict all private foreign borrowing.

If financed externally, then there is an equivalent increase in $b_t^{f,g}$, allowing for investment to increase even in the case of an output multiplier less than one. The reason is that labor increases following a government spending shock (due to a negative wealth effect).

Consider next that ν is low. The aggregate resource constraint now takes the original form in equation 4.9. In this case the economy is open regardless of where spending is financed and investment is crowded in for both types of spending shocks. In the case of a foreign-debt-financed shock, the argument coincides with the above. In the case of a domestically financed shock, households now borrow privately from abroad to finance their purchases of domestic government debt.

4.3.2 Labor supply in equilibrium and the impact output multiplier

Despite predicting responses of investment along the lines mentioned earlier, the neo-classical small open economy model cannot account for the differences in *impact* output multipliers obtained in the empirical section. In fact, the home-debt-financed spending shock produces an impact multiplier that is greater than that produced by the foreign-debt-financed spending shock.[15] This obtains from the equilibrium response of labor. In subsequent periods, though, the foreign shock becomes more expansionary and yields *cumulative* multipliers in line with the data.

To see this, Figure C.2 plots IRFs to a home debt-financed and a foreign debt-financed spending shock for the case where household external borrowing is restricted ($\nu = 50$). A spending shock will induce a negative wealth effect as households anticipate future increases in taxation to finance debt servicing interest rate payments. This will incentivize them to increase their labor supply. However, the degree 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 in response to a domestically financed spending shock. And since capital, as a state variable, is pre-determined, output responds only to changes in labor supply on impact. All this translates to an impact response of output that is 0.55 when spending is foreign-financed, but 0.59 when spending is home-financed.[16]

From period 2 onward, the foreign-debt-financed spending shock becomes more expansionary. This is a direct consequence of the crowding in of investment. As investment increases, in period 2, the marginal product of labor rises. Households are incentivized to supply further labor when spending is financed abroad. In addition, since capital takes one period to build, it also contributes to the

[15] Again, these predictions carry through to a New-Keynesian small open economy framework with sticky prices and GHH preferences. Results are available on request.

[16] Of course, the values depend on parameterization, but the qualitative difference is independent of the calibration of the model and shock processes.

increase in output in period 2. This translates to a period 2 response of output of 0.6 when spending is foreign-financed, but 0.54 when spending is home-financed.

4.4 Extensions

To qualitatively replicate the predictions from the data regarding impact ouput multipliers, we augment the model to allow for i) an interest rate spread between external and domestic interest rates, and ii) investment-specific technology. For consistency, we again show the implications in the flexible price model, but note that results would carry through in the NK framework. There, we would additionally obtain a crowding in of consumption, which is also a prediction obtained from the data. The latter, though, would not materially affect the difference in impact output responses between two shocks.[17]

4.4.1 Interest rate spread between external and domestic interest rates

The model is equivalent to the one outlined previously, with the exception of the no-arbitrage condition, which yielded $R_t^{f,g} = R_t^h$. Here, we assume that the external public interest rate deviates from the domestic interest rate by a debt-elastic factor χ, such that: $R_t^{f,g} = R_t^h \left[1 + \chi \left(\frac{b^{f,g}}{\bar{b}^{f,g}}\right)\right]$. We interpret χ as a premium that external lenders demand in order to be compensated for sovereign default risk. If the probability of default is greater on external debt than domestic debt (for example, because it is in the interest of a benevolent government to maximize residents' utility), then the presence of external sovereign default risk will imply such a condition in equilibrium.[18] 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)).

Illustratively, we set $\chi = 0.5$. Figure C.3 plots IRFs for a home- and foreign-debt-financed spending shock in the model with an interest rate spread. A foreign-financed shock now produces a greater response to output on impact. The intuition is simple: interest rate payments of the government are now greater when spending is financed externally. This means that the wealth effect on labor is larger

[17] One may be curious if other features that have been designed to generate a crowding in of consumption, may also reconcile the predictions regarding impact output responses between the model and the data. We have experimented with the following and find that they fail: i) GHH preferences circumvent the wealth effect. But in the flexible price model, GHH preferences imply that labor does not increase following a government spending shock. As a result, ouput too will not increase on impact. ii) By adding GHH preferences to the sticky price model (as in Monacelli and Perotti (2008)), we obtain an increase in labor supply because the real wage increases (since the markup declines, consumption increases, too). But the increase in labor is again greater following a home-financed shock, because in equilibrium households compensate for the crowding out of investment. iii) The same holds in both the RBC and NK models for preference specifications with varying degrees of the wealth effect (Jaimovich and Rebelo (2009)). iii) The equilibrium response of labor is again the same if, instead of GHH preferences, we augment the sticky price model with rule-of-thumb consumers (Gali, Lopez-Salido and Valles (2007)). iv) Finally, the same is true if we allow for government spending to enter the utility function (Bouakez and Rebei (2007)). All results are available on request.

[18] For selective default frameworks see, for example, Vasishtha (2010) or Paczos and Shakhnov (2016).

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. The impact multipliers on output are 0.85 (Foreign) and 0.55 (Home).

4.4.2 Investment-specific technology

As in Basu, Fernald and Zheng (2012), we assume there are two goods-producing sectors: a consumption sector and an investment sector. Production in the consumption sector requires labor and capital inputs. The production function is given by $Y_t^C = k_{t-1}^{\alpha} n_t^{\alpha_1}$. In contrast, the investment sector uses only labor as input. The production function is given by $Y_t^I = \left(n_t^I\right)^{\alpha_2}$. Inputs are immobile across sectors, so total labor in the economy is given by $N_t = \sigma n_t + (1-\sigma)\, n_t^I$, where σ measures the share of labor allocated to the production of the consumption good. Aggregate output in the economy is given by $Y_t = Y_t^C + Y_t^I$.

With respect to the new parameters in the model, we assume that $\alpha = \alpha^1 = \alpha^2 = 0.33$ and illustratively set $\sigma = 0.4$. Figure C.4 plots IRFs for a home- and foreign-debt-financed spending shock in the model with investment-specific technology. Here, too, a foreign-financed shock produces a greater response to output on impact. This happens because of the co-movement between output Y_t^I and labor n_t^I in the investment good sector. As explained earlier, the crowding in of investment following a foreign-debt-financed shock is given from the increase in labor. Since investment is now produced using investment-specific labor, for investment to increase it must be the case that n_t^I increases by more than if spending were financed domestically. Given σ, the impact multipliers on output are 0.15 (Foreign) and 0.05 (Home).

5 Conclusion

In this paper we have asked the following question: How do fiscal multipliers differ if a government spending shock is financed with home debt or foreign debt? To answer this question, we have estimated an SVAR identified using standard timing restrictions and complementing them with a single sign restriction on the movement of the ratio of domestic public debt to external public debt. We have 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. We also find that, in line with the theory, the difference in output multipliers is most emphasized when the private sector has limited access to external financing. The latter is proxied using measures on i) GDP volatility, ii) the share of non-resident bank loans to GDP, and iii) the Chinn-Ito index of financial openness.

We validate our econometric methodology by building a model that can account for these asymmetries. The fundamental mechanism that brings about the differential effect of government spending financing is the extent to which private investment is crowded out or in. When the private sector obtains access to foreign borrowing, then investment is crowded in for both types of government spending shock, and output multipliers are quantitatively similar. When private access to foreign borrowing is restricted, then the difference between the two shocks is quantitatively different. A standard small open economy model (with flexible or sticky prices) cannot account for the differences in impact multipliers, but can predict the differences in cumulative multipliers. If supplemented with i) an interest rate spread between external and domestic interest rates, or ii) investment-specific technology, then impact multipliers between the model and the data are also reconciled.

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A Data and variables

List of countries in sample: 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-International Finance Statistics for remaining countries.

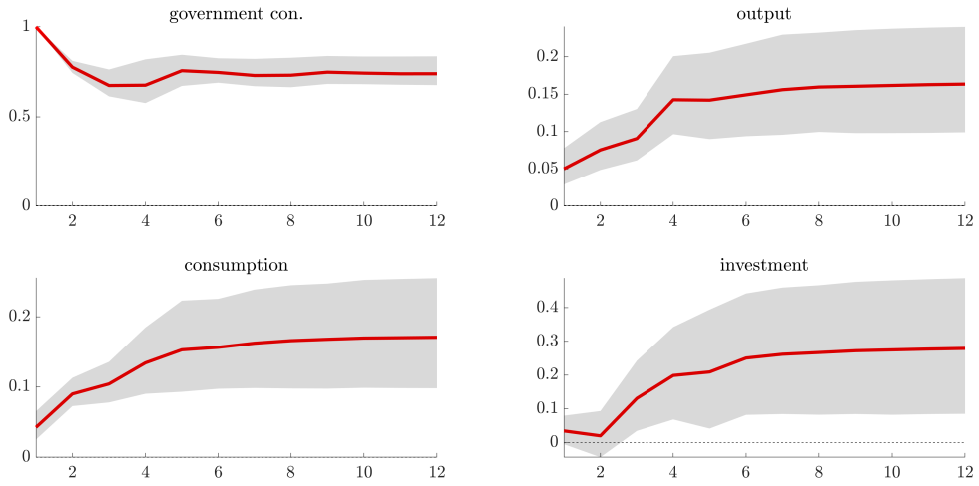
Government Expenditures. General government final consumption expenditure. *Source*: Eurostat for EU28, OECD for OECD economies. IMF-International Finance Statistics for remaining countries.

Consumption. Final household consumption expenditure. *Source*: Eurostat for EU28, OECD for OECD economies. IMF-International Finance Statistics for remaining countries.

Investment. Gross private fixed capital formation. *Source*: Eurostat for EU28, OECD for OECD economies. IMF-International Finance Statistics for remaining countries.

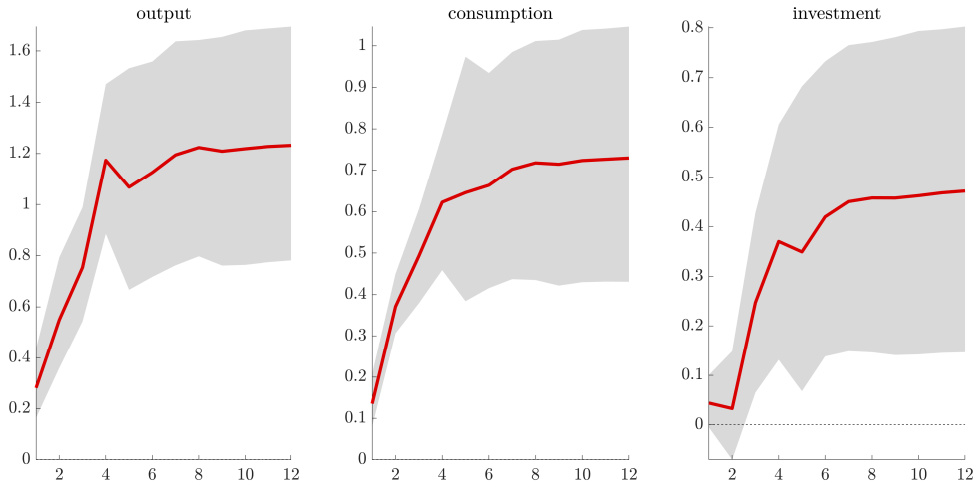
B Empirical Results

Figure B.1: **Reference SVAR without debt – Impulse response functions to government spending shock**



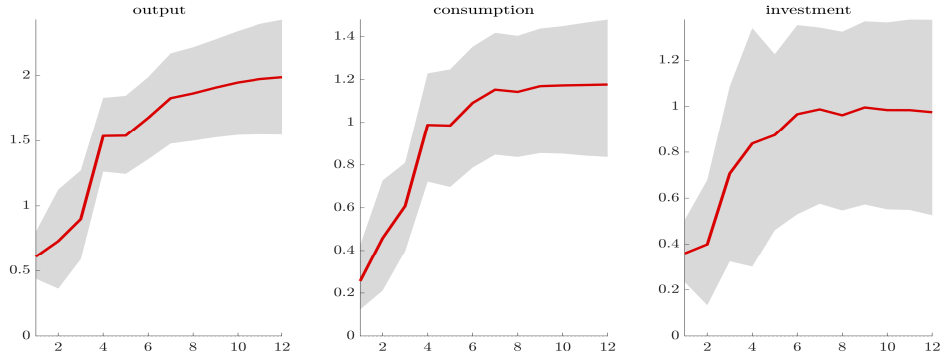
Notes: IRFs of a shock to government expenditures. Red lines correspond to median responses. Grey shaded areas correspond to parameter uncertainty of one-standard deviation.

Figure B.2: **Reference SVAR without debt – Cumulative multipliers to government spending shock**



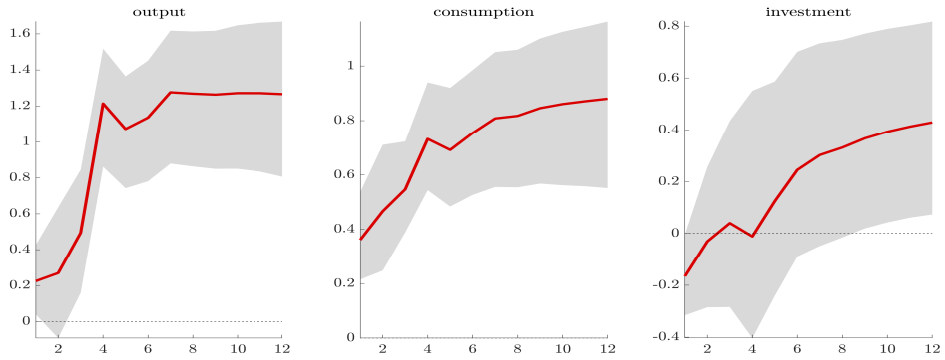
Notes: Cumulative multipliers following a shock to government expenditures. Cumulative multipliers are calculated as in eq. 2.2. Red lines correspond to median responses. Grey shaded areas correspond to parameter uncertainty of one-standard deviation.

Figure B.3: **Cumulative multipliers to foreign-debt-financed government spending shock**



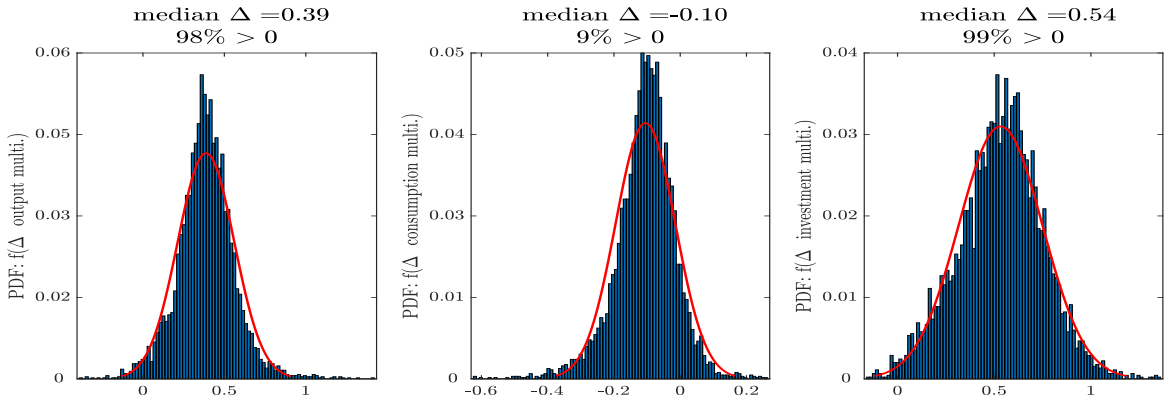
Notes: Cumulative multipliers following a shock to foreign-debt-financed government expenditures. Cumulative multipliers are calculated as in eq. 2.2. Red lines correspond to median responses. Grey shaded areas correspond to parameter uncertainty of one-standard deviation.

Figure B.4: **Cumulative multipliers to home-debt-financed government spending shock**



Notes: Cumulative multipliers following a shock to home-debt-financed government expenditures. Cumulative multipliers are calculated as in eq. 2.2. Red lines correspond to median responses. Grey shaded areas correspond to parameter uncertainty of one-standard deviation.

Figure B.5: **Empirical probability density function for difference of impact multipliers**



Notes: Empirical probability density function (PDF) of the difference in impact multipliers across the two shocks, where the difference is defined as Foreign-Home. The empirical PDF is obtained by drawing from the posterior distribution of the models. The median change in impact multipliers (Foreign-Home) is calculated for each draw in the posterior set of models. The red curve shows a Normal distribution that approximates the empirical PDF.

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*
Baseline									
Foreign	0.55	1.42	1.88	0.25	0.97	1.19	0.37	0.84	1.01
Home	0.25	1.27	1.26	0.34	0.72	0.82	-0.17	-0.01	0.38
Δ	0.32 (93.20%>0)	0.11 (68.94%>0)	0.65 (90.88%>0)	-0.09 (8.32%>0)	0.26 (79.18%>0)	0.39 (82.92%>0)	0.55 (99.40%>0)	0.93 (72.32%>0)	0.65 (83.60%>0)
GDP variance									
Foreign	0.9	1.83	2.31	0.36	1.46	1.74	0.59	1.83	1.78
Home	0.31	1.99	1.12	0.48	0.77	0.41	-0.24	-0.08	0.17
Δ	0.57 (97.34%>0)	-0.47 (34.54%>0)	1.02 (89.30%>0)	-0.07 (18.90%>0)	0.62 (96.88%>0)	1.29 (96.08%>0)	0.85 (99.82%>0)	1.98 (85.50%>0)	1.63 (96.10%>0)
Foreign	0.31	1.08	1.34	0.22	0.7	0.83	0.09	0.2	0.35
Home	0.18	0.53	0.9	0.15	0.57	0.89	-0.02	0.3	0.47
Δ	0.11 (71.22%>0)	0.52 (96.24%>0)	0.45 (79.62%>0)	0.06 (70.40%>0)	0.13 (68.94%>0)	-0.03 (47.08%>0)	0.12 (78.42%>0)	-0.11 (32.58%>0)	-0.10 (40.14%>0)
Loans from non-resident banks (% GDP)									
Foreign	0.76	1.89	1.79	0.23	1.15	1.36	0.3	0.93	1.03
Home	0.17	0.47	0.14	0.48	0.35	0.1	-0.17	0.26	0.04
Δ	0.59 (86.00%>0)	1.48 (89.72%>0)	1.67 (83.50%>0)	-0.23 (20.42%>0)	0.82 (83.08%>0)	1.32 (84.40%>0)	0.47 (96.86%>0)	0.65 (78.86%>0)	0.96 (80.56%>0)
Foreign	0.6	1.28	1.73	0.25	0.86	1.03	0.48	0.78	0.76
Home	0.38	1.25	1.38	0.26	0.57	0.86	-0.1	-0.19	0.38
Δ	0.24 (84.42%>0)	-0.01 (47.54%>0)	0.38 (82.58%>0)	-0.01 (42.66%>0)	0.33 (82.92%>0)	0.20 (69.54%>0)	0.61 (97.84%>0)	1.06 (66.74%>0)	0.40 (76.44%>0)
Chinn-Ito index									
Foreign	0.6	1.56	1.79	0.16	1.38	1.45	0.42	1.37	1.19
Home	0.08	1.52	1.21	0.2	0.79	0.75	-0.13	0.12	0.61
Δ	0.52 (98.70%>0)	-0.13 (40.30%>0)	0.60 (85.70%>0)	-0.05 (24.14%>0)	0.59 (96.54%>0)	0.73 (88.78%>0)	0.57 (88.68%>0)	1.38 (73.00%>0)	0.71 (74.86%>0)
Foreign	0.59	0.92	1.44	0.4	0.5	0.77	0.35	-0.08	0.27
Home	0.53	0.91	0.83	0.52	0.6	0.73	-0.15	0.19	0.02
Δ	0.03 (55.40%>0)	0.06 (54.74%>0)	0.67 (77.00%>0)	-0.13 (21.78%>0)	-0.15 (33.64%>0)	0.10 (56.10%>0)	0.47 (99.56%>0)	-0.24 (24.88%>0)	0.29 (70.20%>0)

Notes: The table reports cumulative multipliers for the baseline SVAR, and for different subsamples 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 openess. Grey shaded cells denote subsamples where access is low. White cells denote subsamples 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 posterior set 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: Robustness checks

variable	**Output**			**Consumption**			**Investment**		
horizon	*1*	*4*	*12*	*1*	*4*	*12*	*1*	*4*	*12*
Baseline									
Foreign	0.55	1.42	1.88	0.25	0.97	1.19	0.37	0.84	1.01
Home	0.25	1.27	1.26	0.34	0.72	0.82	-0.17	-0.01	0.38
Δ	0.32 (93.20%>0)	0.11 (68.94%>0)	0.65 (90.88%>0)	-0.09 (8.32%>0)	0.26 (79.18%>0)	0.39 (82.92%>0)	0.55 (99.40%>0)	0.93 (72.32%>0)	0.65 (83.60%>0)
Baseline - OECD									
Foreign	0.38	1.13	1.82	0.11	0.94	1.27	0.36	0.68	0.93
Home	0.03	1.03	1.3	0.12	0.66	0.89	-0.18	-0.24	0.36
Δ	0.36 (95.22%>0)	0.04 (56.22%>0)	0.55 (92.32%>0)	-0.02 (36.80%>0)	0.31 (82.28%>0)	0.39 (85.98%>0)	0.56 (99.54%>0)	0.99 (76.06%>0)	0.59 (85.72%>0)
Baseline - Emerging economies									
Foreign	0.95	3.32	-0.17	0.2	1.13	-0.34	0.54	4.42	0.88
Home	1.18	1.88	2.69	1.13	0.29	1.02	0.1	0.38	1.19
Δ	-0.23 (39.54%>0)	1.53 (67.72%>0)	-2.92 (36.86%>0)	-0.93 (0.94%>0)	0.73 (60.32%>0)	-1.56 (39.76%>0)	0.45 (78.02%>0)	4.46 (82.66%>0)	-0.23 (48.54%>0)
Baseline - US (1970)									
Foreign	0.95	-0.28	-1.04	0.1	-0.06	-0.49	-0.1	-1.28	-1.66
Home	0.67	-0.27	0.16	0.07	-0.27	0.23	-0.21	-0.84	-0.78
Δ	0.28 (100.00%>0)	-0.01 (0.00%>0)	-1.20 (0.00%>0)	0.02 (100.00%>0)	0.21 (100.00%>0)	-0.72 (0.00%>0)	0.10 (100.00%>0)	-0.44 (0.00%>0)	-0.88 (0.00%>0)
No fixed effects									
Foreign	0.55	1.42	1.88	0.26	0.96	1.19	0.37	0.81	0.28 (100.00%>0)
Home	0.25	1.25	1.27	0.34	0.71	0.81	-0.17	0	0.39
Δ	0.31 (93.32%>0)	0.12 (69.22%>0)	0.64 (91.36%>0)	-0.09 (8.84%>0)	0.27 (79.36%>0)	0.39 (83.42%>0)	0.55 (99.58%>0)	0.89 (70.88%>0)	0.63 (83.32%>0)
Levels									
Foreign	0.63	1.02	1.94	0.25	0.5	0.96	0.42	0.89	1.16
Home	0.34	0.78	1.6	0.33	0.48	0.79	-0.02	0.32	0.75
Δ	0.31 (90.20%>0)	0.24 (79.24%>0)	0.26 (64.32%>0)	-0.08 (14.74%>0)	0.03 (55.42%>0)	0.13 (60.38%>0)	0.46 (99.50%>0)	0.63 (73.82%>0)	0.42 (70.16%>0)
1 shock									
Low Ratio	0.09	0.54	0.69	0.1	0.47	0.63	0	0.14	0.24
High Ratio	0.38	1.42	1.38	0.32	0.81	0.83	-0.03	-0.22	-0.2
Interaction VAR									
Low Ratio	0.41	0.88	0.99	0.29	0.44	0.58	0.09	0.44	0.55
High Ratio	-0.07	0.53	0.08	-0.14	0.36	0.32	-0.03	-0.71	-0.45
Δ	0.48 (90.30%>0)	0.36 (61.64%>0)	0.87 (71.18%>0)	0.43 (98.92%>0)	0.08 (54.82%>0)	0.25 (63.42%>0)	0.12 (65.32%>0)	1.16 (92.70%>0)	0.99 (87.58%>0)

Notes: The table reports cumulative multipliers for the baseline SVAR, and for different robustness checks. 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 posterior set of models, for which the difference is > 0. *Baseline*: variables in log-differences, estimation with fixed effects. *No fixed effects*: variables in log-differences, estimation without fixed effects. *Levels*: variables in levels, estimation with fixed effects. *1 shock*: variables in log-differences, estimation with fixed effects, Cholesky identification of spending shock, split subsamples by "low ratio" < median of average ratio, and "high ratio" > median of average ratio). *Interaction VAR*: variables in log-differences, estimation with fixed effects, Cholesky identification of spending shock, interaction term on ratio thresholds with "low ratio"=1% and "high ratio"=99%.

C Theoretical model

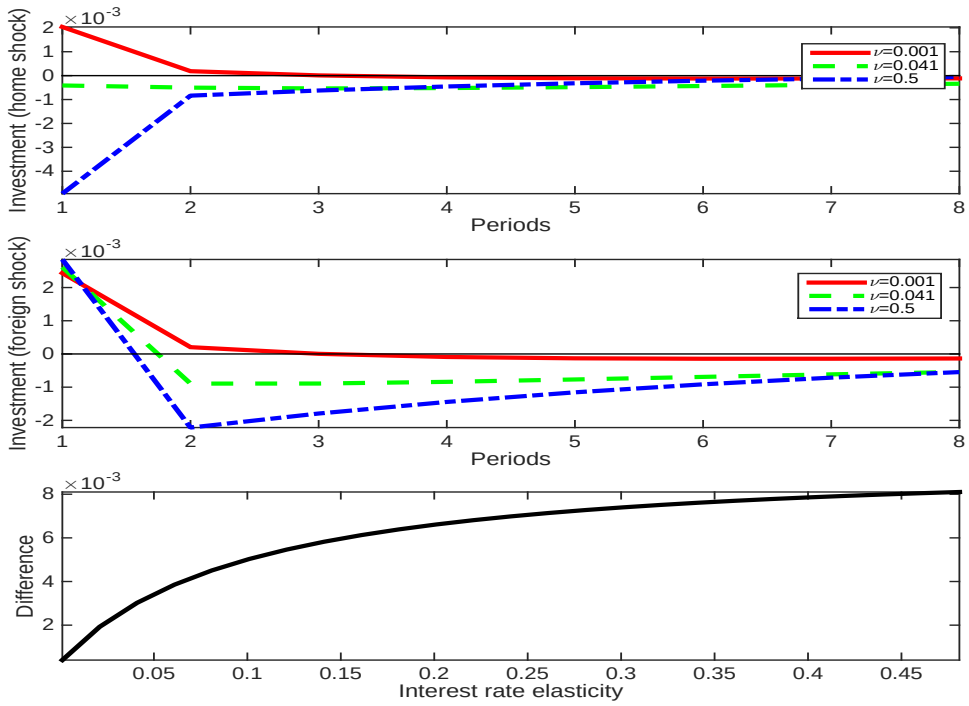
Optimality conditions

- Euler equation - capital: $c_t^{-\gamma} = \beta \mathbf{E_t}\left[c_{t+1}^{-\gamma}\left(r_{t+1}+1-\delta\right)\right]$
- Euler equation - domestic government debt: $c_t^{-\gamma} = \beta \mathbf{E_t}\left[c_{t+1}^{-\gamma} R_t^h\right]$
- Euler equation - external private debt: $c_t^{-\gamma} = \beta \mathbf{E_t}\left[c_{t+1}^{-\gamma} R_t^{f,k}\right]$
- Debt-elastic interest rate: $R_t^{f,k} = r^* + \nu\left[\exp\left(b_t^{f,k} - \overline{b_t^{f,k}}\right) - 1\right]$
- Intratemporal optimality: $w_t c_t^{-\gamma} = \psi n_t^{\phi}$
- Production function: $Y_t = k_{t-1}^{\alpha} n_t^{1-\alpha}$
- Capital law of motion: $k_t = (1-\delta)\, k_{t-1} + i_t$
- Wage: $w_t = (1-\alpha)\, k_{t-1}^{\alpha} n_t^{-\alpha}$
- Rental rate of capital: $r_t = \alpha k_{t-1}^{\alpha-1} n_t^{1-\alpha}$
- Government budget constraint: $g_t - T_t = b_t^h - R_{t-1}^h b_{t-1}^h + b_t^{f,g} - R_{t-1}^{f,g} b_{t-1}^{f,g}$
- No-arbitrage: $R_t^{f,g} = R_t^h$
- Government spending process: $g_t = \kappa^g + \rho_g g_{t-1} + \varepsilon_t^g$
- Debt processes: $b_t^h = \rho_B b_{t-1}^h + \varepsilon_t^{g,h}$; $b_t^{f,g} = \rho_B b_{t-1}^{f,g} + \varepsilon_t^{g,f}$
- Aggregate resource constraint: $c_t + i_t + g_t = Y_t + b_t^{f,g} - R_{t-1}^{f,g} b_{t-1}^{f,g} + b_t^{f,k} - R_{t-1}^{f,k} b_{t-1}^{f,k}$

Table 4: Parameter values

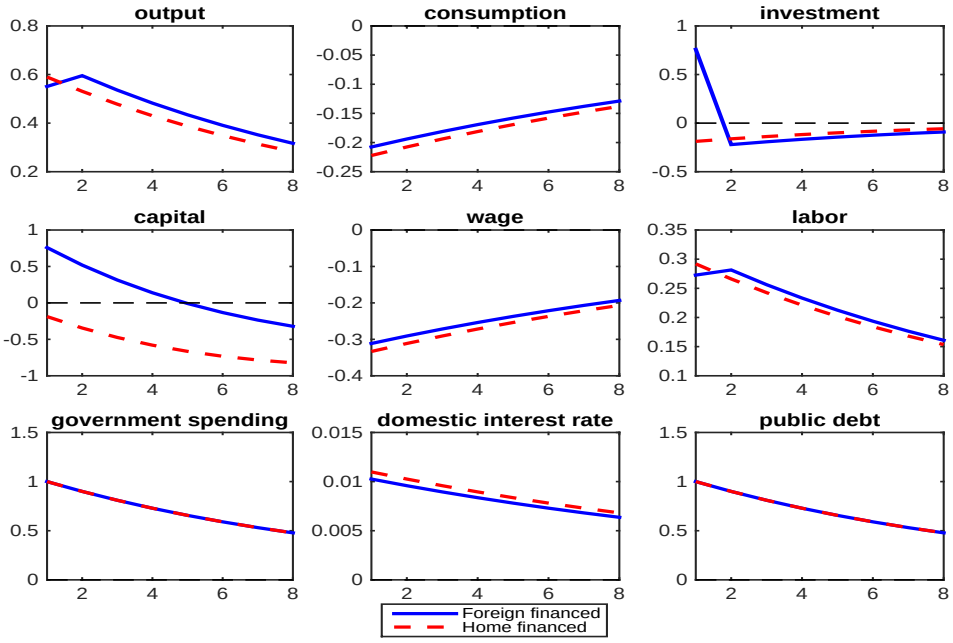
Parameter	Value	Label
β	0.99	Discount factor
r^*	$\frac{1}{\beta}$	World interest rate
α	0.33	Capital share
δ	0.025	Depreciation rate
ψ	1.75	Weight on labor supply disutility
ν	[0, 50]	Private financial openness
κ^g	0.02	Government spending constant
ρ_g	0.9	Government spending autocorrelation coefficient
ρ_B	0.9	Debt rule autocorrelation coefficient

Figure C.1: **Responses of investment for a home- and foreign-debt-financed government spending shock**



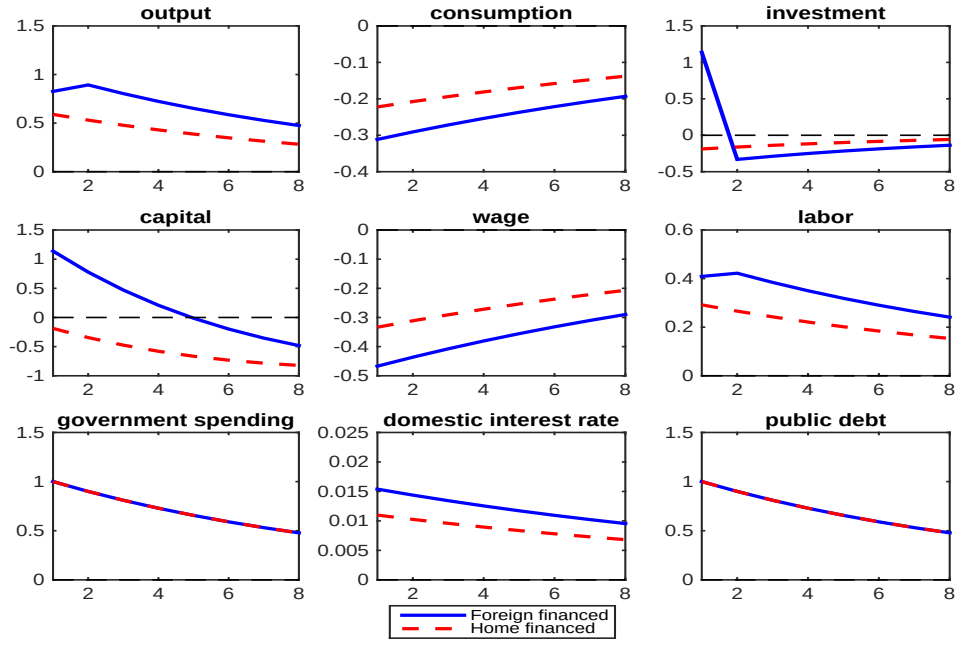
Notes: The top panel plots the responses of investment to a home-debt-financed spending shock. The middle panel plots the responses of investment to a foreign-debt-financed spending shock. For both cases, the private interest rate debt-elasticity varies between $\nu = 0.001$ (solid red line), $\nu = 0.041$ (dashed green line), $\nu = 0.5$ (dotted-dashed blue line). The bottom panel plots the differences in investment (Foreign-Home) for a range of ν.

Figure C.2: **IRFs for a home- and foreign-debt-financed government spending shock without private external borrowing**



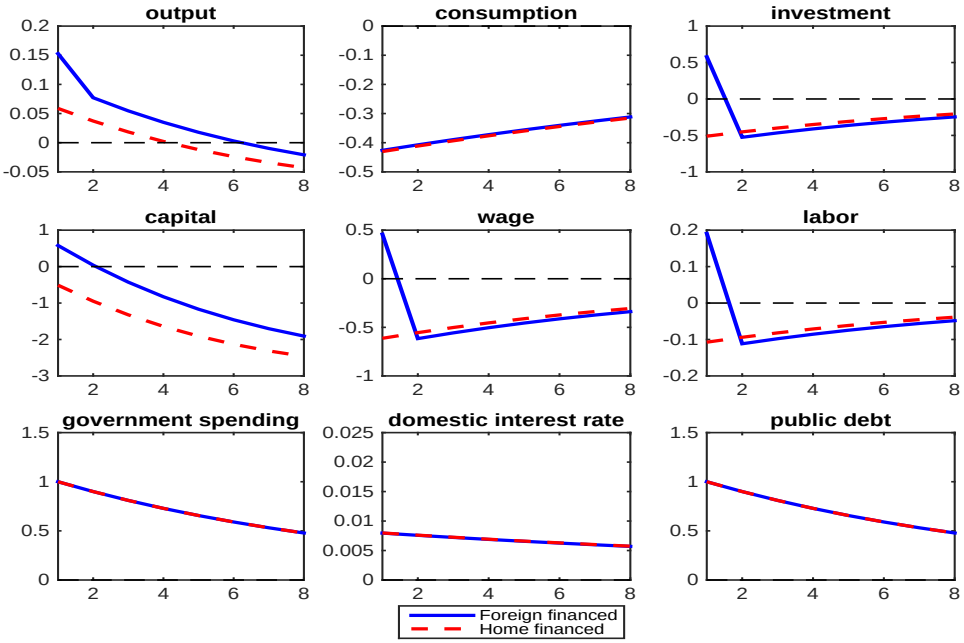
Notes: Impulse response functions to a 1% government spending shock financed with domestic debt (dashed red line) and external debt (solid blue line). Households do not have access to external financial markets ($\nu = 50$). Public debt is external debt (domestic debt) for a Foreign (Home)-debt-financed shock.

Figure C.3: **IRFs for a home- and foreign-debt-financed government spending shock without private external borrowing - Positive 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). Households do not have access to external financial markets ($\nu = 50$). Public debt is external debt (domestic debt) for a Foreign (Home)-debt-financed shock. Model with interest rate spread between external and domestic interest rates.

Figure C.4: **IRFs for a Home and Foreign government spending shock without private external borrowing - Investment specific technology**



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 ($\nu = 50$). Public debt is external debt (domestic debt) for a Foreign (Home)-debt-financed shock. Model with investment specific technology.