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Fiscal Multipliers and Foreign Holdings of Public Debt

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This article explores a natural connection between fiscal multipliers and foreign holdings of public debt. Although fiscal expansions can raise domestic economic activity through various channels, they can also have crowding-out effects if the resources used to acquire public debt reduce domestic consumption and investment. These crowding-out effects are likely to be weaker when governments have access to foreign savings when selling their debt, leading to larger fiscal multipliers. We test this hypothesis for the U.S. in the post-war period and for a panel of 17 advanced economies from the 1980s to the present. To do so, we assemble a novel database of public debt holdings by domestic and foreign creditors for these countries. We combine these data with standard measures of fiscal policy shocks and show that, indeed, the size of fiscal multipliers is increasing in the share of public debt held by foreigners. In particular, the fiscal multiplier is smaller than one when the foreign share is low, such as in the U.S. in the 1950s and 1960s and Japan today, and larger than one when the foreign share is high, such as in the U.S. and several European countries today.

Key words: Sovereign debt, Fiscal multiplier, Foreign holdings of public debt.

JEL Codes: E62, F32, F34, F36, F41, F62, F65, G15, H63.

1. INTRODUCTION

Since the onset of the global financial crisis, fiscal policy has taken centre stage in the policy debate. Given the magnitude of the crisis and the constraints faced by monetary policy as nominal interest rates approached zero, most countries initially responded with strong fiscal stimuli. However, many of them faced market pressures that forced them to backtrack and implement strict austerity

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measures shortly thereafter. These developments motivated a new wave of empirical research on the effects of fiscal policy, particularly on the size of fiscal multipliers.[1]

There is another aspect of fiscal policy that gathered attention in the aftermath of the crisis, especially in the euro-area periphery. Namely, the increase in the stock of public debt was largely absorbed by domestic banks, and the share of public debt held by foreigners declined. This prompted a growing literature seeking to understand the determinants and macroeconomic consequences of the distribution of public debt between domestic residents and foreigners.[2]

In this article, we argue that there is a natural connection between fiscal multipliers and the foreign holdings of public debt. The intuition is simple. There are various channels through which fiscal expansions, either increases in public spending or reductions in taxes can raise domestic economic activity.[3] But fiscal expansions can also have crowding-out effects on the domestic private sector. One direct source of crowding out is that the resources used by the domestic private sector to acquire public debt can detract from consumption and investment. This suggests that the crowding out effect of fiscal expansions are weaker and, thus, fiscal multipliers are larger when governments have access to foreign savings when selling their debt.

The goal of this article is to test this hypothesis. To do so, we assemble a novel database of public debt holdings by domestic residents and foreigners, and proxy governments' access to foreign savings with the share of public debt held by foreigners. Our main result is that, indeed, the fiscal multiplier is increasing in the foreign share of public debt. This result holds both for the U.S. during the post-war period, and for a panel of advanced (OECD) economies over the last few decades. According to our estimates the public spending multiplier in the U.S. was significantly smaller than one in the 1950s, when the foreign share was less than 5%, and significantly greater than one today, when the foreign share is close to 50%. Consistently, the estimated deficit multiplier in our sample of OECD economies also depends on the foreign share. In particular, it is smaller than one for low levels of the foreign share, such as Japan's 8%, and greater than one for high levels of the foreign share, such as Ireland's 64%.

To derive our results, we follow existing methodologies regarding both the identification of fiscal shocks and the empirical specifications used to estimate their effects. To identify fiscal shocks we use two alternative approaches: (i) the narrative approach, based on government spending shocks for the U.S. from Ramey and Zubairy (2018a) and fiscal consolidations for a group of OECD economies from Guajardo *et al.* (2014a); and (ii) the structural VAR approach of Blanchard and Perotti (2002) to estimate government spending shocks for the U.S. To estimate fiscal multipliers, we follow Ramey and Zubairy's (2018a) two-step procedure. First, we use the fiscal shocks described above to instrument the fiscal variable of interest, *i.e.*, government spending or public deficit shocks. Second, we use this instrumented fiscal variable to estimate the corresponding multiplier. In both steps we use Jordà's (2005) local projection method.

We first estimate baseline, *unconditional* multipliers. We then incorporate our measures of foreign debt holdings to estimate *conditional* multipliers. For the United States, data on public debt holdings by domestic residents and foreigners is available, at a quarterly frequency starting in 1951, from the Federal Reserve Economic Databank (FRED). For the panel of OECD economies, we constructed a novel annual dataset of the allocation of public debt between domestic residents and foreigners. The underlying data was collected from public sources, such as Balance of Payments (Financial Accounts, International Investment Positions) and Monetary Surveys, and provided to us directly by Central Banks, Ministries of Finance and Statistical Offices.

1. See Ramey (2016a) for a recent survey.

2. Arsanalp and Tsuda (2012), Broner *et al.* (2013) and Brutti and Saure (2016) provide accounts of public debt developments during the European crisis.

3. For a review of these channels, see Ramey (2011a).

The data on foreign holdings of public debt reveal interesting patterns. First of all, there is significant variation across countries: in some, such as Canada and Japan, the share of public debt held by foreigners is consistently low, whereas in others, such as Finland and Austria, foreigners hold more than 75% of public debt towards the end of the sample. Over time, in line with the rise of financial globalization, the general pattern is one of increasing public debt in the hands of foreigners. In the U.S., for instance, the share of public debt held by foreigners has increased from less than 5% in the 1950s to close to 50% today. Although this trend has been present across most OECD economies in our sample, it has not been uniform over time. During the recent European debt crisis, for instance, there was a decline in the share of debt held by foreigners in the euro periphery.

Conceptually, the size of fiscal multipliers should depend on the *marginal* foreign share of public debt, *i.e.*, on the share of the change in public debt brought about by a fiscal shock that is absorbed by foreigners. Testing this empirically, however, is difficult because the marginal foreign share is not directly observable. One possibility would be to estimate it from the observed correlation between changes in foreign holdings of public debt and changes in total public debt over a window of time following fiscal shocks. But it is hard to establish causality from this correlation, because observed changes in foreign holdings are likely endogenous to ex-post economic conditions. Thus, we need an ex-ante measure of the foreign share that is determined prior to the realization of the fiscal shock.[4] We find that the *average* foreign share, *i.e.*, the share of public debt held by foreigners, provides such a measure. In particular, we show that the average foreign share at the time of a fiscal shock is a good predictor of the marginal foreign share in its aftermath.

Our findings suggest that the effects of fiscal policy depend crucially on governments' access to foreign savings when selling their debt. This insight is key for understanding the effects of the surge in public spending in response to the COVID-19 crisis, given the heterogeneity in governments' access to foreign savings. Moreover, our findings challenge the conventional Mundell-Fleming view on fiscal multipliers in open economies. According to this view, such multipliers are smaller in open economies because part of the effect of fiscal expansions on aggregate demand falls on foreign goods.[5] Our findings instead point to an alternative interpretation of this inflow of foreign goods: namely, they reflect capital inflows, which help finance fiscal expansions thereby minimizing their crowding-out effects on domestic investment. In a similar vein, the common perception is that there are positive trade-induced spillovers of fiscal policy, because a fiscal expansion in any one country raises its demand for foreign goods. Our findings instead point to a potentially negative spillover, induced by financial linkages: to the extent that fiscal expansions are financed via foreign borrowing, their crowding-out effects are exported and consumption and investment are reduced elsewhere.[6]

Literature review

Our article is closely related to two strands of literature. The first one is the literature on the effects of fiscal policy. On the empirical side, and in the wake of the financial crisis,

4. For example, consider a fiscal expansion that leads to higher economic growth for reasons unrelated to the foreign share of public debt holdings. If this higher growth then results in an increase in foreign purchases of public debt, we would be classifying the event as having a high marginal foreign share. But it would be the expansionary effect of the fiscal shock that causes the high foreign share, and not the other way around.

5. Strictly speaking, in the Mundell–Fleming model the effects of fiscal expansions are partly undone through currency appreciations. But the empirical literature tends to find that the exchange rate depreciates following a fiscal expansion and, in many estimates, there is actually no or little crowding out of net exports (*e.g.* Monacelli and Perotti, 2010; Corsetti *et al.*, 2012; Ravn *et al.*, 2012; Kim, 2015). For additional evidence on the relationship between multipliers and trade, see Ilzetzki *et al.* (2013), and Cacciatore and Traum (2018).

6. Broner *et al.* (2021) show how these negative spillovers can lead to excessive public spending in financially integrated economies.

much of the recent work has argued that fiscal multipliers appear to be larger than previously thought (*e.g.* Acconcia *et al.*, 2014; Blanchard and Leigh, 2013; Mertens and Ravn, 2013). It has also argued that multipliers are state contingent, being relatively large during recessions (*e.g.* Auerbach and Gorodnichenko, 2012), at the zero lower bound (*e.g.* Christiano *et al.*, 2011; Miyamoto *et al.*, 2018), and for fiscal contractions (Barnichon *et al.*, forthcoming). These findings have been partially challenged, though. Alesina and Ardagna (2013) for instance, argue that fiscal contractions can actually be expansionary.[7] Ramey and Zubairy (2018a), in turn, question the state-contingency of fiscal multipliers.

More recently, the literature has emphasized that the effects of fiscal policy depend on whether governments have access to foreign markets to place their debt. This point has been made theoretically by Broner *et al.* (2014), Farhi and Werning (2016), and Priftis and Zimic (2021).[8] Of these, Priftis and Zimic (2021) are closest to us and were the first to explore this issue empirically. Our work differs from theirs in terms of both methodology and scope, however. First, they use an SVAR as their empirical model, while we use local projections. Second, they use sign restrictions on ex-post changes in public debt holdings to identify spending shocks financed by domestic and foreign sources. Instead, we condition fiscal shocks on the ex-ante foreign share of public debt. As explained above, the use of ex ante data significantly reduces endogeneity concerns. It also makes the analysis more relevant for policy, since the foreign share of debt holdings can be used to predict the effects of fiscal policy. Finally, we substantially extend existing datasets on foreign and domestic holdings of public debt.

Our article is also related to the literature on the effects of public debt. The idea that public debt can crowd out private investment and that the extent of this crowding out depends on whether the private sector is financially constrained is of course very old (*e.g.* Diamond, 1965; Barro, 1974). Consistent with this view, empirical studies have recently documented a negative cross-country correlation between high levels of public debt and growth (Reinhart and Rogoff, 2010; Cecchetti *et al.*, 2011), and a negative correlation between public debt and private investment both at the national and subnational levels (Huang *et al.*, 2018, 2021).

The literature on public debt has also recently studied the connection between debt sustainability and the distribution of public debt holdings between domestic and foreign residents. One set of papers has emphasized the stabilizing role of domestic debt holdings ex ante, which raise incentives for debt repayment (*e.g.* Guembel and Sussman, 2009; Broner and Ventura, 2011; Gennaioli *et al.*, 2014; Chari *et al.*, 2020). Another set of papers has instead emphasized the de-stabilizing role of domestic debt holdings ex post, which might generate feedback loops between the public and private sectors in times of crisis (*e.g.* Acharya *et al.*, 2014; Fahri and Tirole, 2018). Acharya *et al.* (2018), in particular, provide evidence that is consistent with the crowding-out effect of domestic debt holdings that is at the heart of our story: they document that, during the euro area sovereign debt crisis, purchases of sovereign debt by undercapitalized euro-area banks contributed to the decline in corporate lending.[9]

7. The crowding-out effects emphasized in this article are one potential reason why fiscal contractions may be expansionary, especially when governments rely heavily on domestic financial markets.

8. In a related vein, Caballero *et al.* (2016) and Sin (2016) argue that if the increase in safe/liquid assets associated with fiscal expansions is absorbed by foreigners their associated benefits on the domestic economy might be smaller, leading to smaller multipliers. Also related is the finding of large multipliers from externally financed transfers (Nakamura and Steinsson, 2014; Corbi *et al.*, 2019). We find similarly sized multipliers when the foreign share of public debt is high.

9. A related literature has focused on the role of foreign investors in determining sovereign yields. Bernanke *et al.* (2004), Wu (2005), and Warnock and Warnock (2009), for instance, provide evidence that treasury purchases by foreign creditors reduce long-term yields.

FIGURE 1

Foreign share of U.S. public debt holdings (in percentage)

Notes: Foreign share is defined as the fraction of the U.S. federal government's treasury securities liabilities held by the rest of the world.

The article is structured as follows. Section 2 describes the dataset that we use for the United States. Section 3 develops a simple model to explain the basic connection between the fiscal multiplier and foreign holdings of public debt. Sections 4 and 5 respectively describe our empirical methodology and our main results for the U.S. Section 6 does the same for our panel of OECD economies. Section 7 concludes.

2. U.S. DATA

We want to analyse the relationship between the foreign share of public debt holdings and the fiscal multiplier in the U.S. during the post-war period. To do so, we need to measure the distribution of public debt holdings between domestic residents and foreigners, and to identify fiscal shocks.

2.1. *Public debt holdings*

We obtain quarterly data on U.S. public debt holdings by foreign residents from 1950 from the Federal Reserve Economic Databank (FRED). We highlight some of the key features of the data here, with the full details contained in Appendix A.

Figure 1 shows the time evolution of the foreign share for the U.S. The figure shows that during the Bretton Woods period the share of public debt in foreign hands was low, about 5%. The foreign share increased sharply after the collapse of Bretton Woods in the early 1970s, and then hovered around 20% until the mid-1990s. Since then, the foreign share has increased steadily until reaching 50% today.

2.2. *Fiscal shocks*

Changes in fiscal policy are in general endogenous to current and expected economic conditions, making it difficult to identify exogenous fiscal shocks. The literature proposes two main

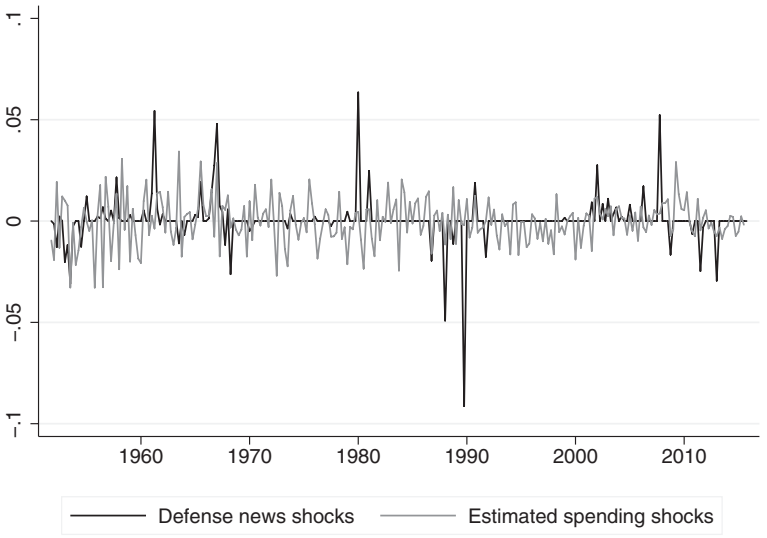

FIGURE 2
Identified U.S. fiscal shocks

Notes: The defense news shocks are from Ramey and Zubairy (2018b). The estimated shocks are from Ramey (2016b). Both shocks are normalized by potential GDP.

approaches to overcome this difficulty. The first is the *narrative approach*, which identifies exogenous shocks to fiscal variables from official documents by selecting policy announcements driven by factors other than current economic conditions. The second approach identifies exogenous shocks to fiscal variables as the difference between observed levels and those predicted by estimated *fiscal rules*.

We use the narrative shocks to U.S. government spending provided by Ramey and Zubairy (2018b), who build on Ramey's (2011b) defense news series. This series consists of news from magazines and newspapers on changes in U.S. government defense spending. Crucially, the series includes changes in spending linked to political and military events and not to the state of the economy. The size of fiscal shocks reflect changes to the expected present discounted value of government spending. We depict the resulting defense news shocks in Figure 2.

One can also identify innovations to fiscal variables as the difference between their realized values and those predicted using either structural VARs or fiscal rules. These methodologies rely on the identifying assumption that fiscal variables do not respond contemporaneously to shocks to their macroeconomic determinants.[10] This seems reasonable for government spending, since it does not respond automatically to the state of the economy and its discretionary component is subject to decision and implementation lags.[11] The use of quarterly, rather than annual, data makes satisfying this assumption even more likely. Figure 2 displays spending shocks estimated according to this methodology as in Blanchard and Perotti (2002). We also use these shocks, albeit through the methodology of Ramey and Zubairy (2018a), which we explain in detail in Section 4.

10. Auerbach and Gorodnichenko (2012) use lagged expert forecasts to eliminate the predictable component of fiscal spending innovations. We chose not to do this because experts' forecasts do not cover all of our sample.

11. This is not the case for other components of the fiscal balance. Government investment is highly cyclical and taxes and transfers have large automatic components.

We combine the identified fiscal shocks with our data on public debt holdings to assess the empirical relation between the foreign share of public debt and the size of fiscal multipliers. Before doing so, we present a simple model to illustrate the mechanisms at play.

3. A STYLIZED MODEL OF MULTIPLIERS AND DEBT HOLDINGS

We develop a simple model to illustrate how the foreign share of public debt holdings affects the size of the fiscal multiplier. The goal of the model is to highlight the main economic forces at work and to provide a conceptual context for our empirical strategy.

3.1. *Preferences and technology*

Consider a small open economy populated by a representative agent of mass one and a government. There are two periods, $t \in \{0, 1\}$. There is a single good that can be used for consumption and investment. Agents only consume at $t = 1$ and there is no uncertainty, so utility is given by

$$U_0 = C_1. \tag{1}$$

There are private and government production technologies. The agent receives an endowment of E_0 units of the good at $t = 0$. If she invests K at $t = 0$ she produces

$$Y_1^P = F(K) \tag{2}$$

at $t = 1$, where $F'(\cdot) > 0$ and $F''(\cdot) < 0$. The government receives no endowment at $t = 0$. If the government invests G at $t = 0$, it produces

$$Y_1^G = \gamma \cdot G \tag{3}$$

at $t = 1$.[12]

3.2. *Financial markets*

The representative agent and the government trade bonds among themselves and with an international financial market that is large and is willing to borrow and lend at a (gross) return of one. As a result, the equilibrium interest rate is

$$R = 1. \tag{4}$$

The representative agent can borrow and lend from the international financial market, but she can only pledge a fraction $\lambda \in [0, 1]$ of her capital and of her public bond holdings. As a result, she faces the credit constraint

$$B^* \geq -\lambda \cdot \left(K + B^H\right), \tag{5}$$

where B^* and B^H are holdings of international and government bonds, respectively, and $B^* < 0$ implies borrowing from the international financial market. Equation (5) says that borrowing from foreigners cannot exceed a fraction of the value of pledgeable assets. Since there is no uncertainty

12. We assume that there are diminishing returns in the private technology to ensure an interior solution. We assume that there are constant returns in the public technology only to simplify the analysis.

in the model, the credit obtained by the private sector is riskless. The private budget constraints at $t=0$ and $t=1$ are

$$K+B^H+B^*=E_0 \text{ and } C_1=Y_1^P+B^H+B^*+Y_1^G-T_1, \tag{6}$$

where T_1 are taxes at $t=1$. We assume taxes are zero at $t=0$.[13]

The government also borrows in order to invest at $t=0$. Since taxes are zero at $t=0$, the government's budget constraints at $t=0$ and $t=1$ are

$$G=B \text{ and } B=T_1. \tag{7}$$

We assume that a fraction θ of bonds issued by the government are purchased by the international financial market, so

$$B^F=\theta\cdot B \text{ and } B^H=(1-\theta)\cdot B. \tag{8}$$

We take the "foreign share" θ as exogenous in this simple model, but there is a growing literature on the determinants of public debt holdings.[14] Broadly speaking, there are two opposing forces at work. Risk diversification pushes agents away from holding too many domestic government bonds. But there are forces that push in the opposite direction, such as a favourable treatment of domestic agents in case of default, financial repression, macroprudential regulation, asymmetric information, costs of buying foreign assets, and capital controls.[15] In any case, we are not concerned with the source of the foreign share here, but rather on its effect on the size of the fiscal multiplier.

3.3. *Equilibrium and the fiscal multiplier*

Under these assumptions, it is straightforward to show that the representative agent solves

$$\max_K F(K)-K+E_0+Y_1^G-T_1 \tag{10}$$

$$\text{s.t. } K\leq\frac{E_0}{1-\lambda}-B^H,$$

taking Y_1^G, T_1, and B^H as given. The first term in the constraint is the maximum amount of resources that the agent can invest in capital and government bonds. It equals the endowment

13. This is without loss of generality in our setting. Even if the government could raise taxes at $t=0$, it would not do so because the crowding-out effects of taxation are greater than those of debt.

14. Broner *et al.* (2014), for instance, highlight the role of discrimination to account for the reduction in the foreign share of public debt holdings during the recent European crisis. Reinhart and Sbrancia (2015) document the use of financial repression to deal with public debt in the post-war period. See Dell'Ariccia *et al.* (2018) for a general discussion on the drivers of debt holdings.

15. As an example, consider the effect of financial repression on debt sustainability. We can do so through a simple extension of our model in which the government is benevolent and can choose to default on its debt in period 1. Suppose, moreover, that there are no costs to defaulting on foreigners but each unit that is defaulted on a domestic agent generates a cost of κ. In this case, assuming that default is non-discriminatory, the government repays its debt if and only if

$$\kappa\cdot(1-\theta)\cdot B\geq\theta\cdot B\Leftrightarrow\theta\leq\frac{1}{1+\kappa}. \tag{9}$$

This condition is intuitive: the larger the cost of defaulting on domestic agents, the lower the amount of debt that they must hold to make repayment credible.

Of course, the representative agent does not internalize the effects of its debt holdings on enforcement, and will not willingly hold public debt if she is constrained. In this case, we can interpret $1-\theta$ as a "financial repression" threshold, which determines the minimum amount of domestic public debt that the representative agent is forced to hold. See Chari *et al.* (2020) for a related model.

times a financial multiplier, which is increasing in the pledgeability of investments λ.[16] If the constraint is not binding, private investment is such that the return to capital is equal to the international interest rate. Thus,

$$K = \min\left\{\frac{E_0}{1-\lambda} - B^H, K^*\right\} \tag{11}$$

where $F'\left(K^*\right) \equiv 1$.

Total output at $t = 1$ is therefore

$$Y = Y^P + Y^G = F\left(\min\left\{\frac{E_0}{1-\lambda} - (1-\theta)\cdot B, K^*\right\}\right) + \gamma \cdot B. \tag{12}$$

To calculate the fiscal multiplier, we take the derivative of output Y with respect to either government spending G or the deficit B.[17] Assuming that the credit constraint is binding, *i.e.*, $K < K^*$, the multiplier equals

$$M \equiv \frac{dY}{dG} = \frac{dY}{dB} = \gamma - (1-\theta)\cdot F'(K). \tag{13}$$

When the credit constraint is binding the multiplier has two terms. The first term, which is positive, is the direct effect of an increase in public spending on public output. The second term, which is negative, is the financial crowding-out effect. As long as $\theta < 1$, part of the increase in public debt is absorbed by the private sector, which crowds out private investment. This effect is decreasing in the foreign share θ and is the crucial element of our story. To sum up, a higher foreign share θ is associated with a higher fiscal multiplier. This is what we want to test in the empirical section.

3.4. *Foreign demand for public debt: a discussion*

Before turning to the empirical analysis, there is one question we need to address: what is the empirical counterpart to the foreign share θ? In the model, θ is equal to both the average foreign share, B_t^F/B_t, and the marginal foreign share, dB_t^F/dB_t. In practice, these need not be equal. If they are different, it should be the marginal share that determines the size of the fiscal multiplier.[18] That is, we would like to compare fiscal expansions that cause a large increase in foreign holdings of public debt (*i.e.* high dB_t^F/dB_t) to those that do not (*i.e.* low dB_t^F/dB_t).

In practice, however, we cannot directly observe the marginal foreign share. One possibility would be to estimate it based on the correlation between changes in foreign holdings of public debt and changes in total debt over a window of time following fiscal shocks. But in this case it would be hard to establish causality, because observed changes in foreign holdings are likely endogenous to ex-post economic conditions. For example, consider a fiscal expansion that leads to higher economic growth for reasons unrelated to the foreign share in public debt holdings. If this higher growth then results in an increase in foreign purchases of public debt, we would be classifying the event as having a high marginal foreign share. But, it would be the expansionary

16. This expression is particularly simple because we assume that capital and government bonds are equally pledgeable. Our results are robust as long as neither capital nor government bonds are fully pledgeable.

17. The two multipliers are the same in this model because there is no taxation at $t = 0$. Our results always hold for dY/dB. They also hold for dY/dG as long as $dT/dG < 1$, *i.e.*, as long as increases in G lead to increases in B.

18. For example, even if $B_t^F = 0$ so that the average foreign share equals zero, a fiscal expansion will have no crowding-out effects if $dB_t^F/dB_t = 1$.

TABLE 1
Predictive ability of average foreign share

	U.S.	International panel
	Δ Foreign holdings	Δ Foreign holdings
Δ Total debt$_t$	−0.013	0.134***
	(0.038)	(0.059)
Foreign share$_{t-1}$	−0.000	−0.631***
	(0.000)	(0.135)
Δ Total debt$_t$ · Foreign share$_{t-1}$	0.921***	0.767***
	(0.111)	(0.125)
Time trend	Yes	No
Year dummies	No	Yes
Country fixed effects	No	Yes
Observations	253	421

Notes: Foreign holdings and total debt are measured as a percentage of GDP. Foreign share is our measure of foreign holdings of public debt as a percentage of total public debt. Standard errors in parentheses. $^{*}p<0.10$, $^{**}p<0.05$, $^{***}p<0.01$.

effect of the fiscal shock that causes the high foreign share, and not the other way around.[19] In other words, a positive correlation between the effectiveness of expansions and the ex-post foreign share can be due to reverse causality. Thus, we need an ex-ante measure of the foreign share that is determined prior to the realization of the fiscal shock.

As it turns out, the ex-ante average foreign share B^F_{t-1}/B_{t-1} is both directly observable and a very good proxy for the marginal foreign share. To see this, we run the following regression,

$$\Delta B^F_t = \beta_1 + \beta_2 \cdot \Delta B_t + \beta_3 \cdot X_{t-1} + \beta_4 \cdot X_{t-1} \cdot \Delta B_t + \upsilon_t,$$

where $X_{t-1} = B^F_{t-1}/B_{t-1}$ denotes the average foreign share, $\Delta B^F_t = B^F_t - B^F_{t-1}$, and $\Delta B_t = B_t - B_{t-1}$. The regression results are in Table 1, both for the U.S. and for the cross-section of OECD economies we analyse in Section 6. The table shows that the estimated coefficient on the interaction $X_{t-1} \cdot \Delta B_t$ is statistically significant and close to one. This means that the ex-ante average foreign share is indeed a good proxy for the marginal foreign share. Given this result, from now on whenever we speak of the foreign share we will refer to the ex-ante average foreign share, understanding that it is a proxy for the (unobserved) marginal foreign share.[20]

4. EMPIRICAL METHODOLOGY

Our empirical methodology follows the approach introduced by Ramey and Zubairy (2018a), which conceptually consists of two steps. First, we use both fiscal shocks described above to instrument cumulative shocks to the fiscal variable of interest. Second, we estimate the effects of these instrumented fiscal shocks on cumulative output. The use of cumulative shocks and output allows for a direct interpretation of the IV effects as fiscal multipliers. In both steps we use local projections (Jordà, 2005).

We begin by estimating a baseline specification to obtain unconditional multipliers. We then incorporate the foreign share to estimate conditional multipliers.

19. This concern is especially relevant given the positive correlation between economic conditions and foreign holdings of domestic assets in the data. For evidence of this correlation, see Broner *et al.* (2013) and, for the case of public debt in the context of the recent European crisis, Broner *et al.* (2014).

20. Our result that the average foreign share is a good predictor of the marginal share is consistent with the results on average and marginal international portfolios in Kraay and Ventura (2000).

4.1. *Baseline specification*

We use the defense news shocks and government spending to instrument for the cumulative sum of real government spending between $t+1$ and $t+h$, where h is the horizon of the multiplier:

$$\sum_{j=1}^{h} g_{t+j} = \alpha_h + \beta_h^N \cdot \epsilon_t^N + \beta_h^V \cdot g_t + \phi_h \cdot Z_{t-1} + \upsilon_{t,h}, \tag{14}$$

where ϵ_t^N is the narrative fiscal shock, g_t is government spending, and Z_{t-1} is a vector of controls that includes lags of GDP, of government spending, and of the narrative fiscal shocks. All variables are scaled by potential GDP, computed as HP-filtered real GDP.[21]

It is important to clarify one aspect of equation (14). We have said before that we use both, the narrative and the Blanchard–Perotti shocks to instrument cumulative government spending, yet it would seem that only the narrative shocks appear in equation (14). The reason is that, just as in Ramey and Zubairy (2018a), we capture the Blanchard–Perotti fiscal shocks by including current government spending as a regressor while controlling for lagged GDP and government spending (both of which are included in Z_{t-1}).[22]

From equation (14), we obtain an instrumented measure of the cumulative sum of government spending,

$$G_{t,h} \equiv \alpha_h + \beta_h^N \cdot \epsilon_t^N + \beta_h^V \cdot g_t + \phi_h \cdot Z_{t-1}.$$

Finally, we regress the cumulative sum of real output between $t+1$ and $t+h$ on $G_{t,h}$:

$$\sum_{j=1}^{h} y_{t+j} = \alpha_h^Y + \beta_h^Y \cdot G_{t,h} + \phi_h^Y \cdot Z_{t-1} + \upsilon_{t,h}^Y, \tag{15}$$

where the multiplier at horizon h is given by

$$m_h \equiv \beta_h^Y, \tag{16}$$

so that m_h measures the derivative of the cumulative change in output during the h periods following a fiscal shock, with respect to the same-period cumulative change in government spending. In other words, the cumulative multiplier at horizon h is defined as the integral of the output response over h periods divided by the integral of the change in government spending over the same h periods following the initial shock.[23]

Before concluding, we address one final methodological question: why follow Ramey and Zubairy (2018a) and use both, the narrative and the Blanchard–Perotti fiscal shocks to instrument public spending? As we show in the Supplementary Appendix, our main results remain valid if we use only the Blanchard–Perotti shocks as instruments, but this is not true of the narrative shocks on their own. In fact, even the baseline fiscal multiplier in equation (16) is not statistically significant when government spending is identified using only the narrative shocks.

21. We set the λ-parameter in the HP filter to 25,600. This leads to a similar series for potential GDP as the 6th degree polynomial method employed by Ramey and Zubairy (2018a). Our results are unaffected by the choice of method used to estimate potential output.

22. This is equivalent to regressing directly on the shocks obtained from the VAR system with the same lagged variables and adjusting standard errors for generated regressors. See Ramey and Zubairy (2018a) for a discussion.

23. See Mountford and Uhlig (2009), Uhlig (2010), and Fisher and Peters (2010).

This is recognized by Ramey and Zubairy (2018a), who nonetheless argue that the narrative shocks add valuable information, especially at longer horizons. In particular, they show that the narrative shock is a weak instrument at short horizons but gains relevance at long horizons, whereas the opposite is true of the Blanchard–Perotti shock. In line with our strategy of minimizing methodological deviations from the existing literature, we use both fiscal shocks throughout the article.

4.2. *Foreign share of public debt*

To assess how public debt holdings affect the size of fiscal multipliers, we add the interaction between the instrumented fiscal shock and the foreign share to the baseline regression. The foreign share X_{t-1} is defined as

$$X_{t-1}=\frac{B^F_{t-1}}{B_{t-1}},$$

where B_{t-1} is the total stock of public debt and B^F_{t-1} is public debt held by foreigners.

Formally, the first-stage regressions are now

$$\sum_{j=1}^{h} g_{t+j}=\alpha_h+\beta_h^N\cdot\epsilon_t^N+\beta_h^{NX}\cdot\epsilon_t^N\cdot X_{t-1}+\beta_h^V\cdot g_t+\beta_h^{VX}\cdot g_t\cdot X_{t-1}+ \tag{17}$$
$$\beta_h^X\cdot X_{t-1}+\phi_h\cdot Z_{t-1}+\phi_h^X\cdot Z_{t-1}\cdot X_{t-1}+\upsilon_{t,h},$$

$$\sum_{j=1}^{h} g_{t+j}\cdot X_{t-1}=\alpha_h^I+\beta_h^{IN}\cdot\epsilon_t^N+\beta_h^{INX}\cdot\epsilon_t^N\cdot X_{t-1}+\beta_h^{IV}\cdot g_t+\beta_h^{IVX}\cdot g_t\cdot X_{t-1}+ \tag{18}$$
$$\beta_h^{IX}\cdot X_{t-1}+\phi_h^I\cdot Z_{t-1}+\phi_h^{IX}\cdot Z_{t-1}\cdot X_{t-1}+\upsilon_{t,h}^I,$$

since we need to estimate separately how the fiscal shocks and their interaction with the foreign share affect the cumulative sum of government spending and its interaction with the foreign share. The instrumented variables are now

$$G_{t,h}\equiv\alpha_h+\beta_h^N\cdot\epsilon_t^N+\beta_h^{NX}\cdot\epsilon_t^N\cdot X_{t-1}+\beta_h^V\cdot g_t+\beta_h^{VX}\cdot g_t\cdot X_{t-1}+$$
$$\beta_h^X\cdot X_{t-1}+\phi_h\cdot Z_{t-1}+\phi_h^X\cdot Z_{t-1}\cdot X_{t-1},$$

$$GX_{t,h}\equiv\alpha_h^I+\beta_h^{IN}\cdot\epsilon_t^N+\beta_h^{INX}\cdot\epsilon_t^N\cdot X_{t-1}+\beta_h^{IV}\cdot g_t+\beta_h^{IVX}\cdot g_t\cdot X_{t-1}+$$
$$\beta_h^{IX}\cdot X_{t-1}+\phi_h^I\cdot Z_{t-1}+\phi_h^{IX}\cdot Z_{t-1}\cdot X_{t-1}.$$

Finally, we regress the cumulative sum of real output between $t+1$ and $t+h$ on $G_{t,h}$ and $GX_{t,h}$:

$$\sum_{j=1}^{h} y_{t+j}=\alpha_h^Y+\beta_h^{YG}\cdot G_{t,h}+\beta_h^{YGX}\cdot GX_{t,h}+\beta_h^{YX}\cdot X_{t-1}+ \tag{19}$$
$$\phi_h^Y\cdot Z_{t-1}+\phi_h^{YX}\cdot Z_{t-1}\cdot X_{t-1}+\upsilon_{t,h}^Y,$$

where the multiplier at horizon h is now a function of the foreign share and is given by

$$m_h\left(X_{t-1}\right)\equiv\beta_h^{YG}+\beta_h^{YGX}\cdot X_{t-1}. \tag{20}$$

TABLE 2
Baseline model: U.S. output multiplier

	Quarter t+1	Quarter t+2	Quarter t+3	Quarter t+4
Fiscal shock$_t$	0.91***	0.89***	0.76***	0.62***
	(0.29)	(0.29)	(0.24)	(0.23)
Other controls	Yes	Yes	Yes	Yes
Observations	254	254	253	252
	Quarter t+5	Quarter t+6	Quarter t+7	Quarter t+8
Fiscal shock$_t$	0.52**	0.49*	0.46	0.40
	(0.25)	(0.28)	(0.30)	(0.31)
Other controls	Yes	Yes	Yes	Yes
Observations	251	250	249	248

Notes: The fiscal shock is government expenditure instrumented by the defense news shocks from Ramey and Zubairy (2018b) and the Blanchard–Perotti shocks. Both are normalized by potential GDP. Standard errors in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

5. MULTIPLIERS AND THE FOREIGN SHARE OF U.S. PUBLIC DEBT

In this section, we report the empirical results. We first show that our baseline regressions replicate the results obtained in the literature. We then show how the size of fiscal multipliers depends on the foreign share. We have devoted a significant effort to evaluate the validity of our instruments. Throughout this section, however, we report only the second-stage results, *i.e.*, the estimates of the multiplier. We present all first-stage results, which relate to the effect of fiscal shocks on actual spending, in Appendix B. There we also provide details of the instrument-relevancy tests we conducted.

5.1. *Baseline specification*

Table 2 and Figure 3 respectively show the regression results and the cumulative multipliers that emerge from our baseline regression.[24] Table 2 reports the coefficients β_h^Y for $h \leq 8$ quarters, *i.e.*, up to a two-year horizon, whereas Figure 3 plots the cumulative multipliers for $h \leq 16$ quarters, *i.e.*, up to a four-year horizon. In all figures, we also plot the 90-percent confidence bands.

The estimated multiplier is 0.9 for the first quarter and declines to 0.4 after two years. It is statistically significant at the 1% level for the first four quarters. These results are in line with the existing literature. Applying the same methodology to a longer time sample, Ramey and Zubairy (2018a) also report a cumulative multiplier of 0.4 for a two-year horizon.

5.2. *Foreign share of public debt*

We now turn to our main results on the role of the foreign share, which are obtained by running the regression in equation (19). Table 3 reports the estimated coefficients β_h^{YG} and β_h^{YGX} for $h \leq 8$ quarters. The main result is that the interaction coefficient β_h^{YGX} is statistically significant at the 1% level for $h \leq 5$ quarters and at the 10% level for $h \leq 8$ quarters.

Figure 4 illustrates the corresponding cumulative multipliers $m_h(X_{t-1})$ for $h \leq 16$ quarters. The first panel plots the cumulative multipliers for both a low foreign share, which corresponds to the 10th percentile of foreign holdings in the sample ($X_{t-1} = 3\%$), and a high foreign share,

24. Due to the inherent serial correlation in the local projections approach, we use Newey–West standard errors throughout.

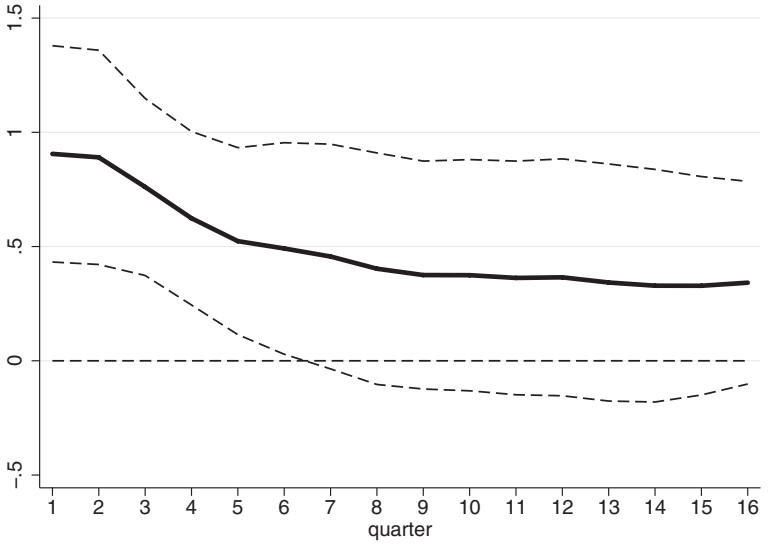

FIGURE 3
Baseline model: U.S. output multiplier

Notes: Cumulative GDP multiplier from a government expenditure shock equal to 1% of GDP. The dashed confidence bands represent significance at the 10% level.

TABLE 3
Foreign share: U.S. output multiplier

	Quarter t+1	Quarter t+2	Quarter t+3	Quarter t+4
Fiscal shock$_t$	0.34	0.35	0.33	0.26
	(0.44)	(0.43)	(0.35)	(0.31)
Fiscal shock$_t$ · Foreign share$_{t-1}$	5.80***	6.26***	5.76***	5.54***
	(1.88)	(1.92)	(1.74)	(1.74)
Other controls	Yes	Yes	Yes	Yes
Observations	254	254	253	252
	Quarter t+5	Quarter t+6	Quarter t+7	Quarter t+8
Fiscal shock$_t$	0.19	0.22	0.25	0.27
	(0.33)	(0.35)	(0.37)	(0.39)
Fiscal shock$_t$ · Foreign share$_{t-1}$	5.64***	5.48**	5.14**	4.57*
	(2.03)	(2.28)	(2.46)	(2.52)
Other controls	Yes	Yes	Yes	Yes
Observations	251	250	249	248

Notes: The fiscal shock is government expenditure instrumented by the defense news shocks from Ramey and Zubairy (2018b) and the Blanchard–Perotti shocks. Both are normalized by potential GDP. Foreign share is our measure of foreign holdings of public debt, as a percentage of total public debt. Standard errors in parentheses. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

which corresponds to the 90th percentile of foreign holdings in the sample ($X_{t-1}=47\%$ of debt held by foreigners). While the cumulative multipliers for a low foreign share are statistically indistinguishable from zero at all horizons, multipliers when the foreign share is high are statistically different from zero at all horizons. The second panel plots the difference between the

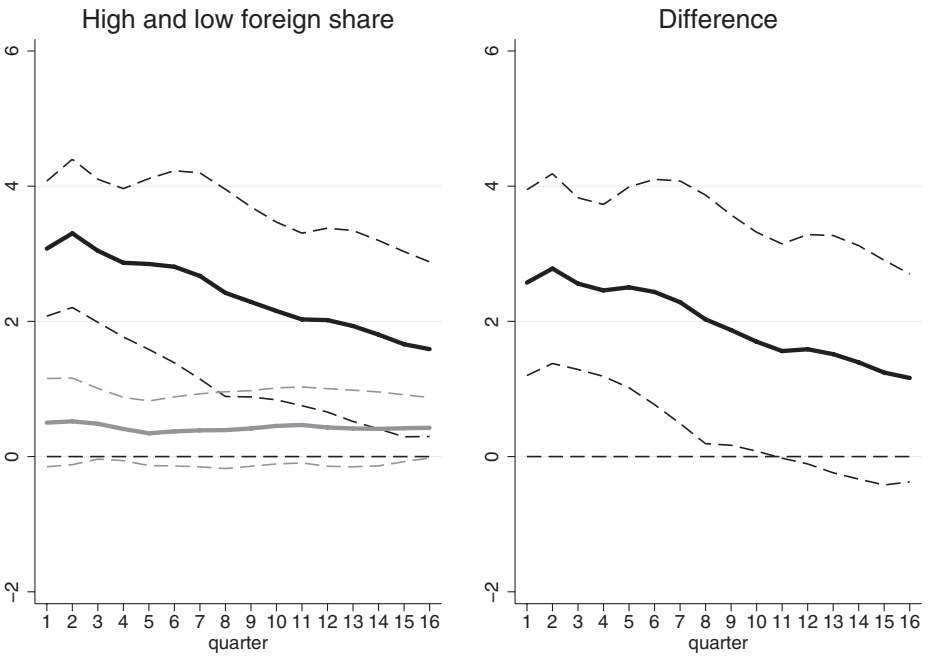

FIGURE 4

Foreign share: U.S. output multiplier

Notes: Cumulative GDP multipliers from a government expenditure shock equal to 1% of GDP with low (10th percentile of foreign holdings in the sample, solid grey line) and high (90th percentile of foreign holdings in the sample, solid black line) foreign share, and the difference between the two multipliers. The dashed confidence bands represent significance at the 10% level.

cumulative multipliers for high and low foreign shares. The panel illustrates the results of Table 3 and shows that the regime-dependent multipliers are statistically different from each other.

From an economic standpoint, the effect of the foreign share on the size of the fiscal multiplier is large. For a low foreign share, the point estimate of the multipliers fall relative to those in our baseline regression. We can say confidently that they are smaller than one but not whether they are positive. For a high foreign share, instead, the point estimate of the multipliers rise relative to those in our baseline regression. Although the standard errors also increase we can say confidently that the multipliers are greater than one for $h \leq 7$ quarters. Coupled with the growth of the foreign share throughout the sample, our estimates imply a significant increase in the fiscal multiplier over time. Figure 5 illustrates this by plotting the implied multiplier over the sample period.

To make sure that our results are not driven by the recent global financial crisis or by the zero lower bound (ZLB) constraint, we repeat our exercise using data only up to the second quarter of 2007 and the third quarter of 2008, respectively.[25,26] Figure 6(a) and (b), which replicate Figure 4

25. The binding ZLB has been associated with higher fiscal multipliers (*e.g.* Mayimoto *et al.*, 2018). In our sample, the ZLB was binding between the fourth quarters of 2008 and 2015.

26. Ramey and Zubairy (2018a) emphasize the need for sufficiently long samples to generate informative estimates of state-dependent multipliers. To ensure our subsample is useful, we conducted the same instrument relevancy tests as for the full sample (see Appendix B). Our pre-crisis subsample passes these tests and is therefore suitable for use.

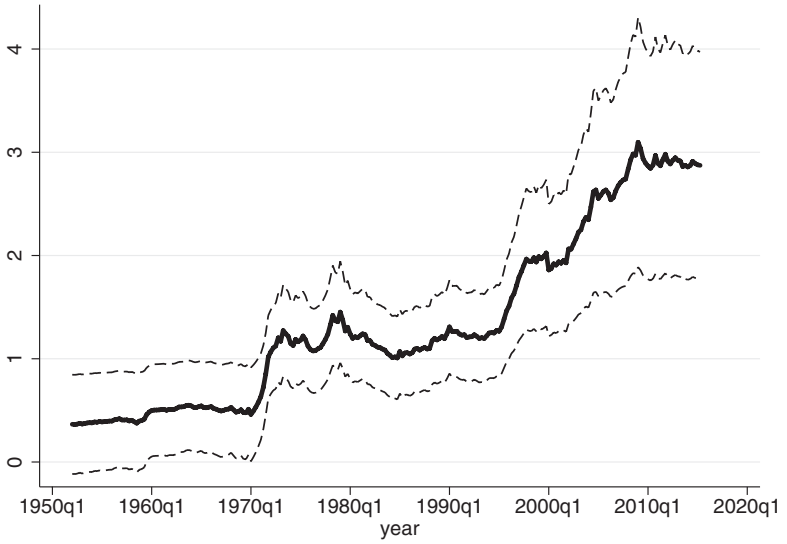

FIGURE 5

Effect on U.S. output of a government expenditure shock after four quarters

Notes: Foreign share-dependent cumulative multiplier after four periods from a government expenditure shock equal to 1% of GDP. The dashed confidence bands represent significance at the 10% level.

for these subsamples, show that our results remain largely unaffected. We present the estimated results in Appendix C.

5.3. *Investment and the current account*

Our findings show that the foreign share of public debt holdings has a large effect on the size of the fiscal multiplier. But why is this the case? In the simple model of Section 3, the underlying narrative was that fiscal expansions lead to larger capital inflows and higher investment when the foreign share is high. To provide further evidence, we analyse next how investment and the current account react to fiscal shocks. In particular, we redo the analysis using investment and the current account as dependent variables. The resulting cumulative multipliers are respectively depicted in Figure 7(a) and (b), which plot these multipliers under a low and a high foreign share, as well as the difference between the two. We present the estimated results in Appendix C.

Figure 7(a) shows that the cumulative multiplier of investment is greater when the foreign share is high. For h=1 quarter, this multiplier is approximately 1.8 for a high foreign share, but it is -0.4 for a low foreign share. The difference between both is statistically significant for $h \leq 4$ quarters. Figure 7(b) shows that the cumulative multiplier of the current account is more negative when the foreign share is high. Specifically, the figure shows that this multiplier is indistinguishable from zero when the foreign share is low, but it is significantly negative when the foreign share is high.

These findings are consistent with the narrative laid out in the model of Section 3. Namely, when foreigners are willing to purchase domestic government debt, fiscal expansions are financed by capital inflows and they do not crowd out domestic investment.

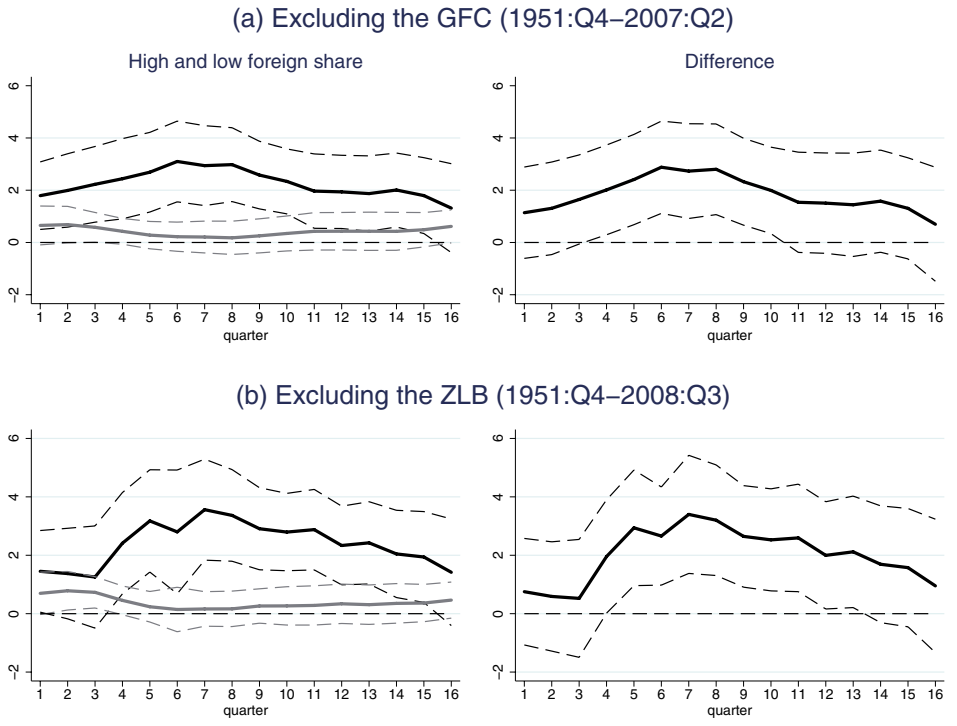

FIGURE 6

Foreign share: pre-crisis U.S. output multiplier

Notes: Pre-crisis period defined as up to and including the second quarter of 2007 (a) or up to and including the third quarter of 2008 (b). Cumulative multipliers from a government expenditure shock equal to 1% of GDP for low (10th percentile of foreign holdings in the sample, solid grey line) and high (90th percentile of foreign holdings in the sample, solid black line) foreign shares, and the difference between the two multipliers. The dashed confidence bands represent significance at the 10% level.

5.4. *Is it really the foreign share of public debt?*

So far we have only considered the foreign share as a possible determinant of the size of the fiscal multiplier. As Figure 1 shows, the foreign share in the U.S. has increased throughout the sample period. But there are other economic variables, such as trade openness, that are believed to influence the fiscal multiplier and that have also changed significantly during this period. How can we know whether it is the foreign share or these other correlated variables that drive our results?

We address this question in two ways. The first is by analysing the role of the foreign share in a large sample of advanced economies, where there is significant heterogeneity in the evolution of the foreign share: we do so in the next section. The second is by performing a sequence of "horse races" for the U.S., between the foreign share and alternative variables. Specifically, we amend equations (17) and (18) to include a competing explanatory variable, denoted by R_{t-1}, so that they are now replaced by:

$$\sum_{j=1}^{h} g_{t+j} = \alpha_h + \beta_h^N \cdot \epsilon_t^N + \beta_h^{NX} \cdot \epsilon_t^N \cdot X_{t-1} + \beta_h^V \cdot g_t + \beta_h^{VX} \cdot g_t \cdot X_{t-1} \tag{21}$$

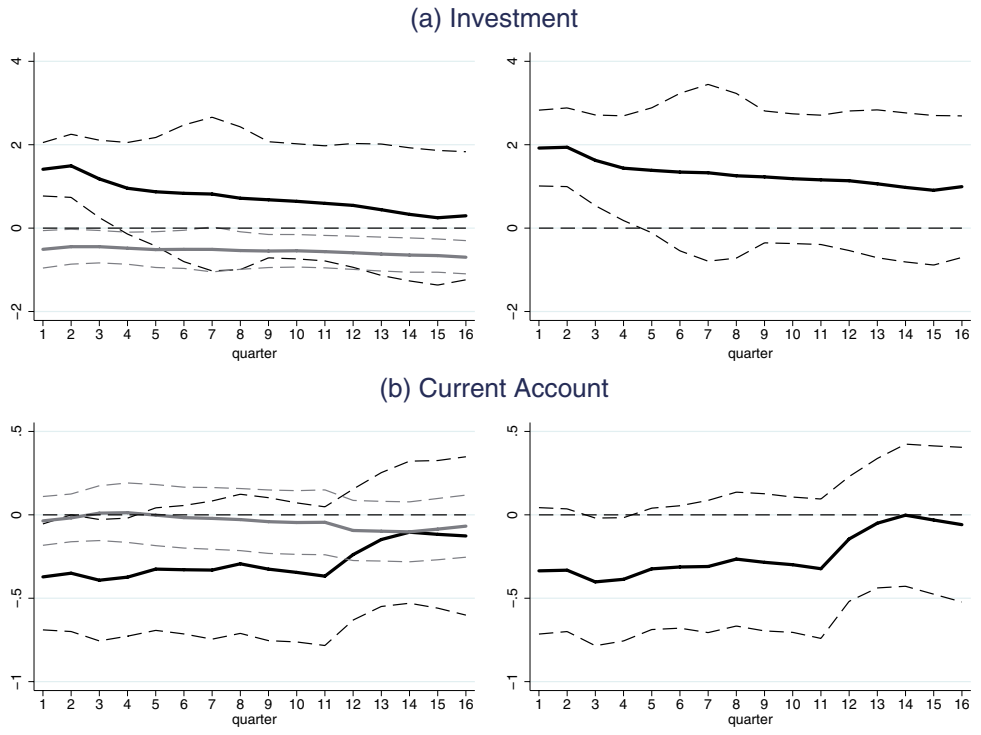

FIGURE 7

Foreign share: U.S. multipliers

Notes: Cumulative investment (a) and current account (b) multipliers from a government expenditure shock equal to 1% of GDP for low (10th percentile of foreign holdings in the sample, solid grey line) and high (90th percentile of foreign holdings in the sample, solid black line) foreign shares, and the difference between the two multipliers. The dashed confidence bands represent significance at the 10% level.

$$+\beta_h^{NR}\cdot\epsilon_t^N\cdot R_{t-1}+\beta_h^{VR}\cdot g_t\cdot R_{t-1}+\beta_h^X\cdot X_{t-1}+\beta_h^R\cdot R_{t-1}$$
$$+\phi_h\cdot Z_{t-1}+\phi_h^X\cdot Z_{t-1}\cdot X_{t-1}+\phi_h^R\cdot Z_{t-1}\cdot R_{t-1}+\upsilon_{t,h},$$

$$\sum_{j=1}^{h} g_{t+j}\cdot X_{t-1}=\alpha_h^I+\beta_h^{IN}\cdot\epsilon_t^N+\beta_h^{INX}\cdot\epsilon_t^N\cdot X_{t-1}+\beta_h^{IV}\cdot g_t+\beta_h^{IVX}\cdot g_t\cdot X_{t-1} \tag{22}$$
$$+\beta_h^{INR}\cdot\epsilon_t^N\cdot R_{t-1}+\beta_h^{IVR}\cdot g_t\cdot R_{t-1}+\beta_h^{IX}\cdot X_{t-1}+\beta_h^{IR}\cdot R_{t-1}$$
$$+\phi_h^I\cdot Z_{t-1}+\phi_h^{IX}\cdot Z_{t-1}\cdot X_{t-1}+\phi_h^{IR}\cdot Z_{t-1}\cdot R_{t-1}+\upsilon_{t,h}^I,$$

and

$$\sum_{j=1}^{h} g_{t+j}\cdot R_{t-1}=\alpha_h^{I'}+\beta_h^{I'N}\cdot\epsilon_t^N+\beta_h^{I'NX}\cdot\epsilon_t^N\cdot X_{t-1}+\beta_h^{I'V}\cdot g_t+\beta_h^{I'VX}\cdot g_t\cdot X_{t-1} \tag{23}$$
$$+\beta_h^{I'NR}\cdot\epsilon_t^N\cdot R_{t-1}+\beta_h^{I'VR}\cdot g_t\cdot R_{t-1}+\beta_h^{I'X}\cdot X_{t-1}+\beta_h^{I'R}\cdot R_{t-1}$$
$$+\phi_h^{I'G}\cdot Z_{t-1}+\phi_h^{I'GX}\cdot Z_{t-1}\cdot X_{t-1}+\phi_h^{I'R}\cdot Z_{t-1}\cdot R_{t-1}+\upsilon_{t,h}^{I'}.$$

Equation (19), in turn, now becomes

$$\sum_{j=1}^{h} y_{t+j} = \alpha_h^Y + \beta_h^{YG} \cdot G_{t,h} + \beta_h^{YGX} \cdot GX_{t,h} + \beta_h^{YGR} \cdot GR_{t,h} + \beta_h^{YX} \cdot X_{t-1} + \beta_h^{YR} \cdot R_{t-1} \tag{24}$$

$$+ \phi_h^Y \cdot Z_{t-1} + \phi_h^{YX} \cdot Z_{t-1} \cdot X_{t-1} + \phi_h^{YR} \cdot Z_{t-1} \cdot R_{t-1} + \upsilon_{t,h}^Y.$$

We consider several such races. The first competing variable is trade openness, which has also increased over time and has been found to significantly influence the fiscal multiplier (*e.g.* Ilzetzki *et al.*, 2013). Note that the consensus in the literature is that trade openness is associated with a lower fiscal multiplier so that, if anything, including it should strengthen our results. Figure 8(a) shows that the inclusion of trade openness does not alter our main findings. Namely, the cumulative fiscal multipliers appear to be closely associated with the foreign share, and the difference between the multipliers at high and low levels of foreign shares remains positive and statistically significant.

A second competing variable is the exchange rate regime, which has also been shown to influence the fiscal multiplier. Like trade openness, however, taking this variable into account should strengthen our results. Indeed, throughout the sample period the U.S. has gravitated towards more flexible exchange rate regimes, which tend to be associated with lower fiscal multipliers (*e.g.* Ilzetzki *et al.*, 2013). Nonetheless, we explicitly introduce the exchange rate regime through a race against a dummy variable that takes the value one whenever the exchange rate is fully flexible (as defined by Ilzetzki *et al.*, 2019a).[27] As Figure 8(b) shows, our main result is robust to the inclusion of this variable.

A third competing variable is government debt, which is also believed to affect the fiscal multiplier (*e.g.* Ilzetzki *et al.*, 2013). Introducing it as a competing explanatory variable, however, does not substantially affect our main results (Figure 8(c)). There is an additional concern related to debt, however, which is that fiscal expansions in the early part of the sample might have been financed largely by raising taxes and not by issuing debt. The Korean and Vietnam wars, for instance, dominate the early part of the sample and were financed with higher taxes. To address this concern, we first run a race against the *ex-post* changes in public debt to capture the financing of fiscal shocks.[28] As Figure 8(d) shows, our main results remain significant. However, as we have already argued, such ex post variables are endogenous. Thus, we also run our baseline regression for the post-1973 subsample, which excludes the Korean and Vietnam wars. Figure 8(e) shows that our results are strongly significant in this subsample.

Another competing variable is private debt, which has increased throughout the sample and appears to be associated with larger fiscal multipliers (*e.g.* Bernardini and Peersman, 2018). To account for this, we run a race against domestic nonfinancial private debt to GDP. As Figure 8(f) shows, doing so does not affect our results.

Finally, there are two additional variables that seem relevant but have received less attention in the literature. The first is financial openness, which has also increased in the U.S. throughout the sample period. Financial openness should be relevant for crowding-out because it could enable domestic residents to finance their purchases of public debt by borrowing abroad. In this case, the crowding-out effect could be weak even if the foreign share is low. The second variable is government solvency or credibility, which might affect both the foreign share (as in Corsetti *et al.*, 2013) and the effectiveness of fiscal expansions.

27. Corsetti *et al.* (2012) employ a similar approach.

28. In particular, for a fiscal shock in period t, we consider the change in public debt between t and $t+4$, normalized by initial GDP.

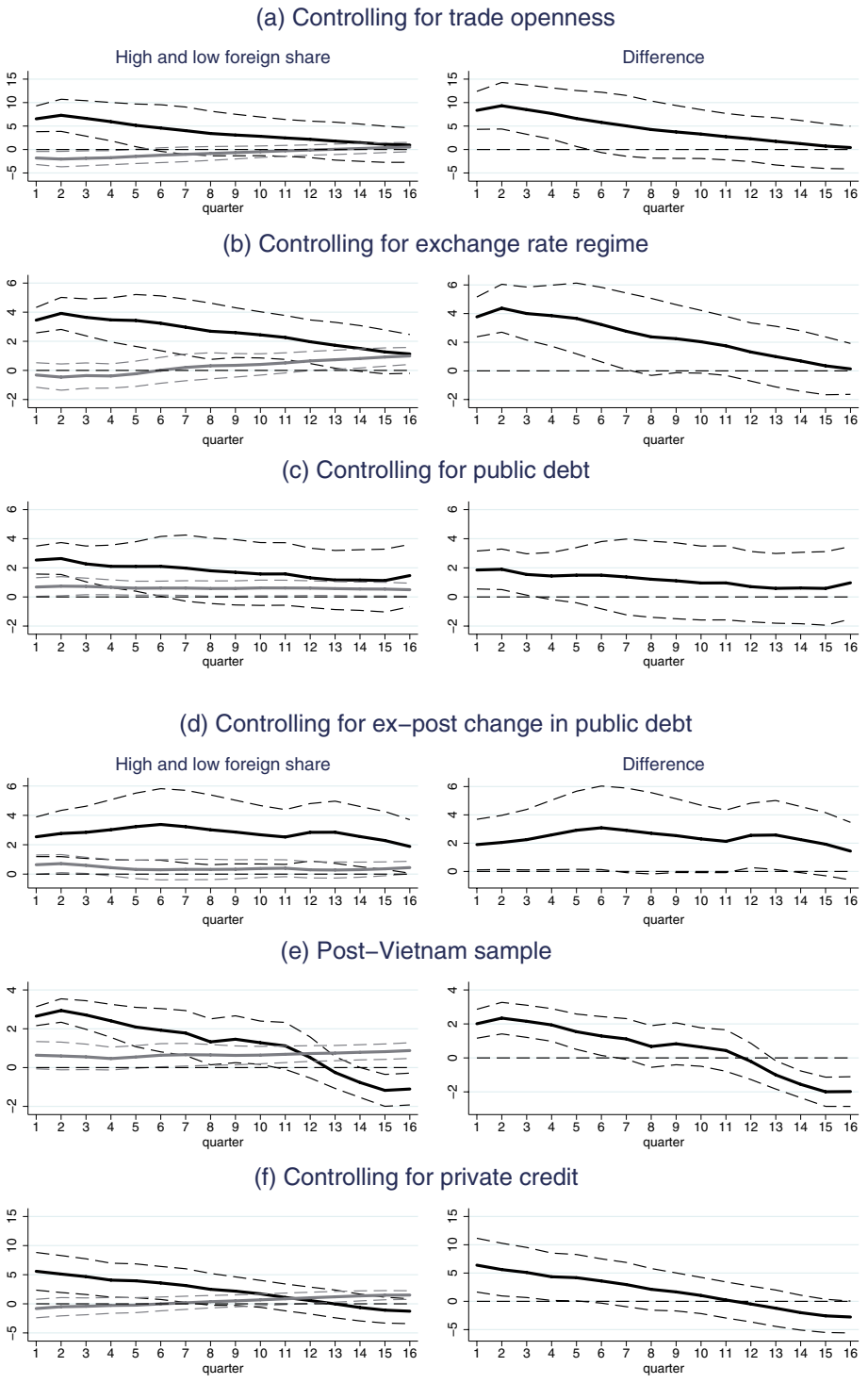

FIGURE 8

Foreign share and alternative explanations: U.S. output multiplier

Notes: Cumulative GDP multipliers from a government expenditure shock equal to 1% of GDP for low (10th percentile of foreign holdings in the sample, solid grey line) and high (90th percentile of foreign holdings in the sample, solid black line) foreign shares when trade openness (a), the exchange rate regime (b) or public debt (c) are included as alternative explanations, and the difference between the two multipliers. The dashed confidence bands represent significance at the 10% level.

These two hypotheses are hard to test for the case of the U.S. The most common measure of financial openness, the ratio of foreign assets and liabilities to GDP, only goes back to the 1970s. As for government credibility, there are no real periods of fiscal stress in our U.S. sample. Thus, we postpone the discussion of both hypotheses to the next section, where we analyse the evolution of the fiscal multiplier for a panel of advanced economies.

6. MULTIPLIERS AROUND THE WORLD

In this section, we extend the analysis to a panel of advanced economies. This allows us to assess the generality of the results reported for the U.S., which admittedly plays a special role in the international financial system. In addition, given the cross-country heterogeneity both in the foreign share of public debt and in other macroeconomic variables, this evidence is useful to further disentangle among potential drivers of fiscal multipliers.

We follow Guajardo *et al.* (2014a) and Jorda and Taylor (2016) and use the change in the cyclically adjusted primary deficit as the fiscal variable. Like them, we also adopt the narrative approach and instrument the primary deficit with announcements of fiscal consolidations. In other respects, the empirical methodology follows Ramey and Zubairy (2018a) as in the previous sections.

We start by describing the data on the foreign share of public debt holdings and fiscal shocks. We then explain how we extend the methodology of the previous sections to a panel context. Finally, we discuss the empirical results.

6.1. *Data*

We construct a novel dataset of public debt holdings for a large set of advanced economies, which we view as an additional contribution of the article. For shocks to fiscal balances, we use the data on fiscal consolidations by Guajardo *et al.* (2014b) and the extension by Katariniuk and Valles (2018b). For a detailed description of the sources used to construct the dataset, see Appendix D.

6.1.1. Foreign share of public debt. The data covers 17 countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, Portugal, Spain, Sweden, the U.K., and the U.S. The data are annual, with a starting year that ranges from the late 1970s to the early 1990s depending on the country. The sample ends in 2014.

Since we are interested in fiscal policy at the consolidated government level, our data are for General Government Debt. The underlying data were collected from public sources, such as the Balance of Payments (Financial Accounts, International Investment Positions) and Monetary Surveys, and provided to us directly by Central Banks, Ministries of Finance and Statistical Offices.[29] To reduce potential distortions associated with valuation effects, we measure debt at face value.[30]

Figure 9 shows the raw data by plotting domestic and foreign holdings of public debt, normalized by GDP. In the figure, each observation corresponds to a given country in a given year. The figure illustrates that there is a large variation both in the levels of debt and in their allocation between domestic and foreign holders.

29. Our dataset significantly expands the time coverage relative to Arslanalp and Tsuda (2012). They provide quarterly data for 24 advanced economies, but only starting in 2004.

30. See Brutti and Saure (2015) for a discussion of potential biases due to price effects.

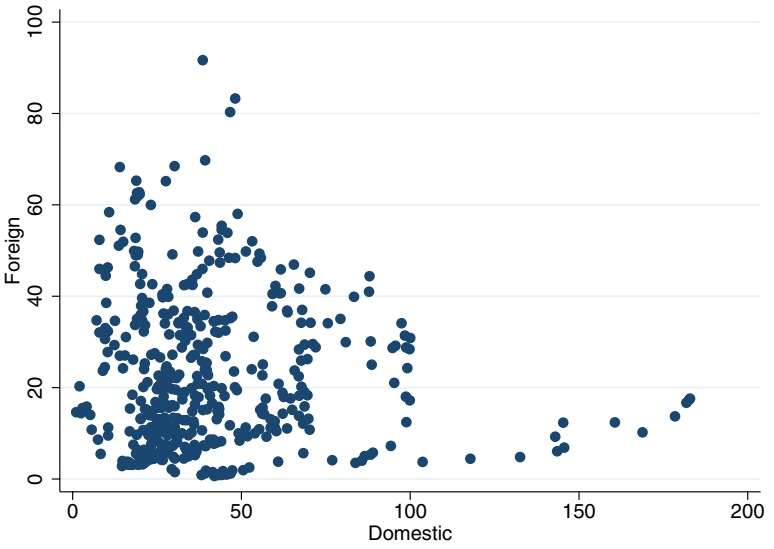

FIGURE 9
Foreign and domestic debt holdings for a panel of OECD economies (as a percentage of GDP)

Figure 10 shows the evolution of the foreign share for all countries in the sample. The foreign share has increased over time in most countries, but this increase has not been uniform over time. For example, foreign shares in the euro periphery declined after the onset of the sovereign debt crisis in 2009.[31] In addition, there is substantial heterogeneity in the level of foreign shares across countries. At one extreme, Japan has a foreign share close to 0% throughout the sample. At the other extreme, several countries in the euro area, such as Austria and Finland, have at some point reached foreign shares above 75%.

6.1.2. Fiscal shocks. To instrument shocks to fiscal balances, we use the data of Guajardo *et al.* (2014b) and the extension by Katariniuk and Valles (2018b). These series are constructed by analysing contemporaneous policy documents to identify discretionary fiscal consolidations, *i.e.*, changes in tax rates and government spending that are not motivated by current or prospective economic conditions. The magnitude of the shocks reflect the expected future budgetary impact of the consolidations.

This approach identifies 230 fiscal consolidations for our sample between 1978 and 2014, depicted in Figure 11 below. The average budgetary impact of these consolidations is −1.1% of GDP, ranging from −6.0% of GDP (Portugal, 2012) to 0.8% of GDP (Portugal, 2003). Negative observations correspond to reductions in the fiscal deficit, while positive ones correspond to expirations of temporary consolidations.[32]

31. For a detailed account of the dynamics of the foreign share of public debt during the European debt crisis see Broner *et al.* (2014).

32. We adopt this sign convention to make the results more comparable to those of the previous sections. Temporary consolidations may be problematic if their expiration is anticipated. As we discuss in Section 6.4, however, there are few such measures and excluding them does not change our results.

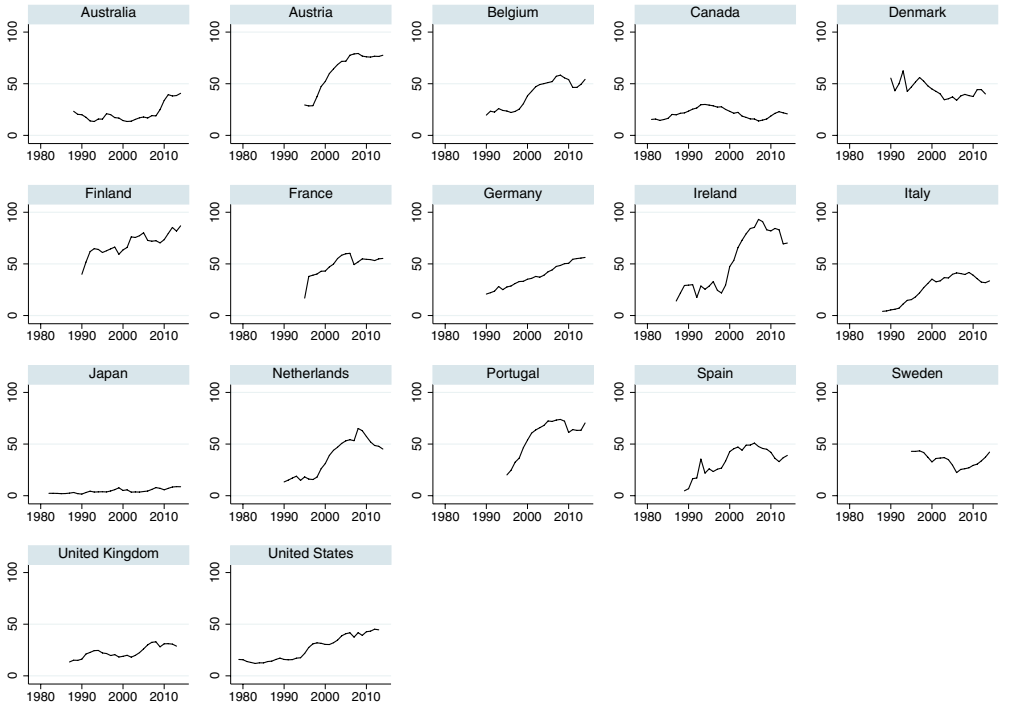

FIGURE 10

Foreign share of public debt holdings over time (as a percentage of total debt)

6.2. *Empirical methodology*

The empirical specification for the panel of advanced economies is similar to the one for the U.S. so we will not write it down explicitly. There are a few differences: (i) we run panel regressions with country and time fixed effects instead of time series regressions; (ii) the data is annual instead of quarterly; (iii) as a result, and following Guajardo *et al.* (2014a) and Jorda and Taylor (2016), we use the contemporaneous instrument instead of lagging it by one period; (iv) the fiscal variable is the change in the cyclically adjusted primary deficit instead of government expenditure; and (v) the instrument is the narrative measure of fiscal consolidations instead of announcement of defense spending and VAR residuals.[33] As in the case of the U.S., we relegate all first-stage results to Appendix E.

6.3. *Results*

The baseline results are reported in Table 4 and Figure 12. They both show the coefficients β_h^Y for $h \leq 4$ years. In the figure, we also plot the confidence bands reflecting significance at the 10% level. The estimated cumulative multipliers are around 0.5 and statistically significant for

33. The changes in the cyclically adjusted primary deficit in Ireland in 2010 and 2011 are extreme outliers. The reported changes are, respectively, +15.6% and −18.1% of GDP, which are over eight standard deviations away from the average change in deficit. To prevent our results from being driven by these two observations, we exclude them from all regressions. Our main results are robust to both the inclusion of these outliers and the exclusion of Ireland entirely.

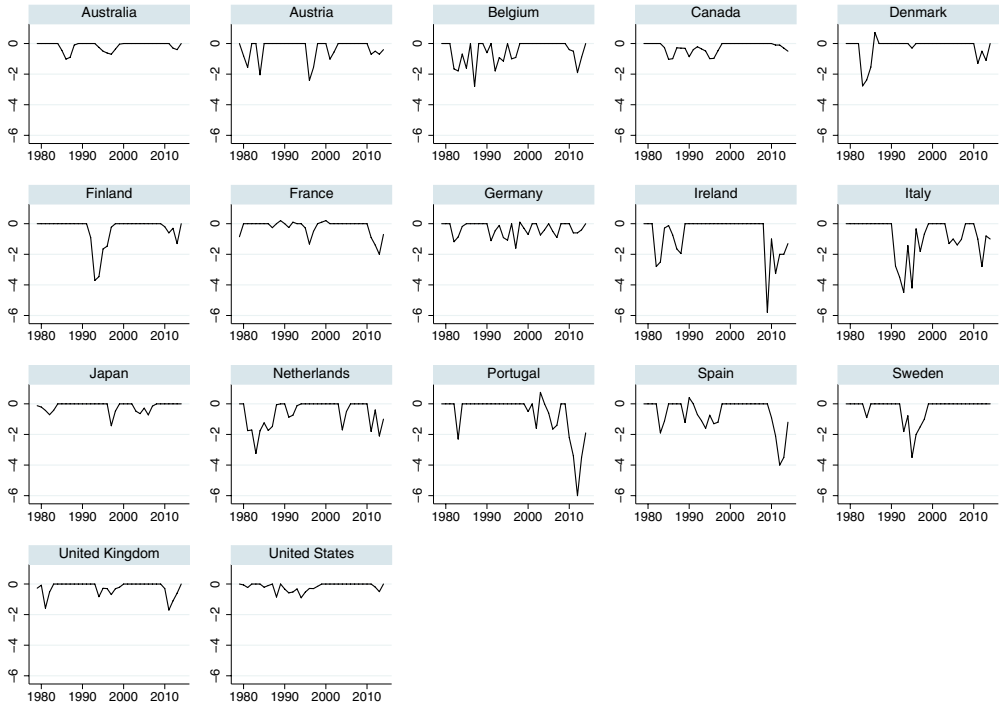

FIGURE 11

International panel: Identified narrative fiscal shocks

Notes: The shocks are from Guajardo *et al.* (2014b), updated by Kataryniuk and Valles (2018b). The magnitudes of the shocks reflect the expected future budgetary impact of the consolidations, as a percentage of GDP.

TABLE 4

International panel baseline model: output multiplier

	Year t+1	Year t+2	Year t+3	Year t+4
Fiscal shock$_t$	0.29*	0.41**	0.50*	0.56
	(0.18)	(0.20)	(0.26)	(0.36)
Other controls	Yes	Yes	Yes	Yes
Observations	576	558	540	523

Notes: The fiscal shock is change in the cyclically adjusted primary deficit instrumented by the narrative shocks from Guajardo *et al.* (2014b), updated by Kataryniuk and Valles (2018b). The magnitudes of the shocks reflect the expected future budgetary impact of the consolidations, as a percentage of GDP. Standard errors in parentheses. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

horizons of up to 3 years. This is similar to the multipliers for government spending shocks in our baseline results for the U.S.[34]

The results on the role of the foreign share are reported in Table 5 and Figure 13 for $h \leq 4$ years. The main finding is that the interaction coefficient β_h^{YGX} is statistically significant at the 5% level for $2 \leq h \leq 4$ years.[35]

34. Note that these results cannot be directly compared to those in Guajardo *et al.* (2014a) and Jorda and Taylor (2016), since their methodology provides dynamic output responses as opposed to multipliers.

35. In Tables 4 and 5, errors are not clustered. There is an ongoing debate on whether clustering is necessary in setups like ours. Cameron and Miller (2015) provide a general defense of the use of clustering while Abadie *et al.* (2017)

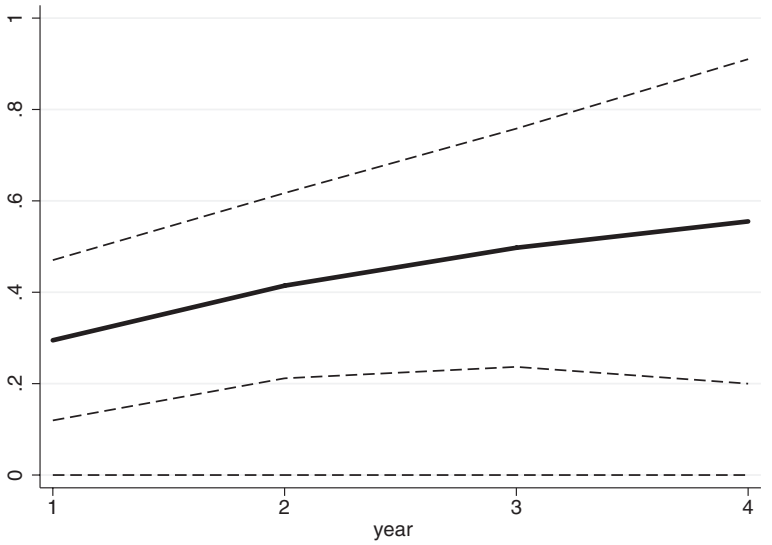

FIGURE 12

International panel baseline model: output multiplier

Notes: Cumulative GDP multipliers from a fiscal shock equal to 1% of GDP. The dashed confidence bands represent significance at the 10% level.

Figure 13 illustrates the corresponding cumulative multipliers $m_h\left(X_{t-1}\right)$. Now that the cumulative multipliers depend on the foreign share of public debt holdings, the figure contains two panels. The first panel plots the cumulative multipliers for a low foreign share, which corresponds to the 10th percentile of foreign holdings in the sample ($X_{t-1}=6\%$), and for a high foreign share, which corresponds to the 90th percentile of foreign holdings in the sample ($X_{t-1}=66\%$ of debt held by foreigners). As in the case of the U.S., the cumulative multipliers when the foreign share is low are statistically indistinguishable from zero at all horizons. Instead, cumulative multipliers when the foreign share is high are statistically different from zero at all horizons and the point estimates are approximately equal to or higher than one. The second panel plots the difference between the cumulative multipliers for high and low foreign shares. The panel illustrates the results of Table 5 and shows that the regime-dependent multipliers are statistically different from each other.

As in the U.S. results, the effect of the foreign share on the size of the fiscal multiplier is large. For a low foreign share, we can say fairly confidently that the fiscal multipliers are smaller than one and might even be zero. For a high foreign share, instead, the point estimates are significant and above one, although given the high standard errors we cannot reject that they are one. As examples, these results suggest that in a country with a low foreign share like Japan ($X_t=8\%$) the multiplier is essentially zero while in a country with a high foreign share like Ireland ($X_t=64\%$) the multiplier is likely above one.

question it in the presence of fixed effects. In the Supplementary Appendix, we show that clustering does not affect the significance of our results.

TABLE 5
International panel foreign share: output multiplier

	Year t+1	Year t+2	Year t+3	Year t+4
Fiscal shock$_t$	−0.67	−0.35	−0.25	−0.61
	(0.55)	(0.46)	(0.40)	(0.67)
Fiscal shock$_t$ · Foreign share$_{t-1}$	2.72	1.87**	2.54**	4.64**
	(1.81)	(0.92)	(1.20)	(2.12)
Other controls	Yes	Yes	Yes	Yes
Observations	405	387	369	352

Notes: The fiscal shock is the change in the cyclically adjusted primary deficit instrumented by the narrative shocks from Guajardo *et al.* (2014b), updated by Kataryniuk and Valles (2018b). The magnitudes of the shocks reflect the expected future budgetary impact of the consolidations, as a percentage of GDP. Foreign share is our measure of foreign holdings of public debt as a percentage of total public debt. Standard errors in parentheses. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

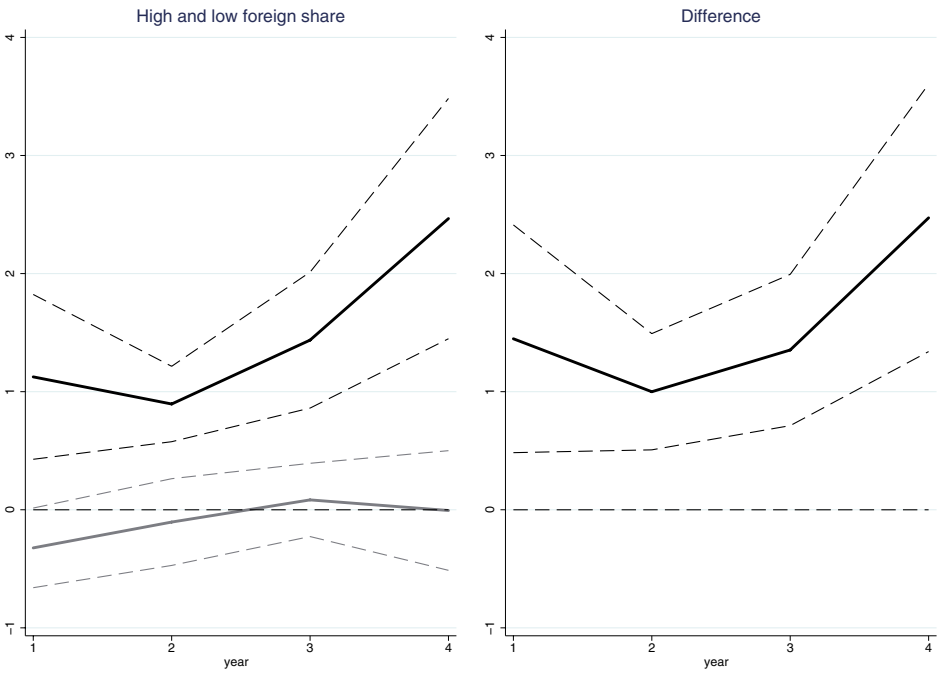

FIGURE 13
International panel foreign share: output multiplier

Notes: Cumulative GDP multipliers from a fiscal shock equal to 1% of GDP for low (10th percentile of foreign holdings in the sample, solid grey line) and high (90th percentile of foreign holdings in the sample, solid black line) foreign shares, and the difference between the two multipliers. The dashed confidence bands represent significance at the 10% level.

6.4. *Robustness and additional results*

We perform several robustness tests. First, we analyse whether our results are driven by the European crisis and/or some of the countries that have carried out the largest fiscal consolidations. To do so we run the regression with data only up to 2007. We also run it excluding Ireland, Spain and Portugal. In both cases our results are unaffected, as shown in Appendix F.

Second, a few consolidations included temporary measures that, at their time of expiration, were reflected in positive values of fiscal shocks. These shocks could have been anticipated, potentially leading to effects different from those of unanticipated shocks. Thus, we run the regressions excluding both the adoption and the expiration of these temporary measures.[36] Our results are unaffected, as shown in Appendix F.

Third, although Guajardo *et al.* (2014b) and Katariniuk and Valles (2018b) exclude consolidations that explicitly reflect current and prospective economic conditions, the remaining ones might not be completely exogenous. Jorda and Taylor (2016) argue that this is likely the case and propose an augmented inverse probability weighting scheme to address this potential problem. We run the regressions following this alternative methodology and, as shown in Appendix F, our results are not affected.[37]

We perform two additional "horse races" that are not feasible for the U.S. sample: financial openness and government credibility.

The most common measure of financial openness is the ratio of foreign assets and liabilities to GDP, as compiled by Lane and Milesi-Ferretti (2018b). Running a race against this variable does not significantly affect our results. In particular, the interaction of the fiscal shock with the foreign share remains positive and—within a two-year horizon—significant, while its interaction with financial openness is not statistically significant. Figure 14(a) illustrates the results of this race.

Another concern is that the foreign share of public debt may be correlated with the government's credibility or solvency, which could be the ultimate driver of high fiscal multipliers (see Corsetti *et al.*, 2013). This is hard to address for the case of the U.S., which did not experience episodes of significant fiscal stress in the sample period. To deal with this concern, we perform a race with sovereign credit ratings in the panel. As Figure 14(b) shows, our main result remains.

7. CONCLUDING REMARKS

This paper explores a natural connection between fiscal multipliers and governments' access to foreign resources when selling their debt. In particular, it shows that fiscal multipliers are increasing in the share of public debt in the hands of foreigners. This result holds both for the United States during the post-war period, and for a panel of advanced economies over the last few decades. In both cases, the estimated multipliers are larger than one in periods and countries with a high foreign share of public debt, and smaller than one in periods and countries with a low foreign share.

These findings have important implications for how we think about fiscal policy in open economies. They challenge the conventional Mundell–Fleming view by suggesting that openness may increase fiscal multipliers. Openness makes it possible to finance fiscal expansions with foreign resources, reducing their crowding-out effects on domestic investment. These results also enrich our understanding of the channels of fiscal spillovers. There is a common perception that fiscal expansions have positive spillovers through trade linkages, because they raise demand for foreign goods. Our findings suggest that fiscal expansions can also have negative spillovers through financial linkages, because they detract from resources available for foreign investment, *i.e.*, their crowding-out effects are partly exported abroad.[38]

36. The excluded consolidations are Denmark (1985), France (1982, 1992, 1999, 2000), Germany (1998), Portugal (2003), and Spain (1990).

37. We find that economic conditions do help predict fiscal consolidations, but the foreign share of public debt does not.

38. For a recent model of such spillovers, see Broner *et al.* (2021).

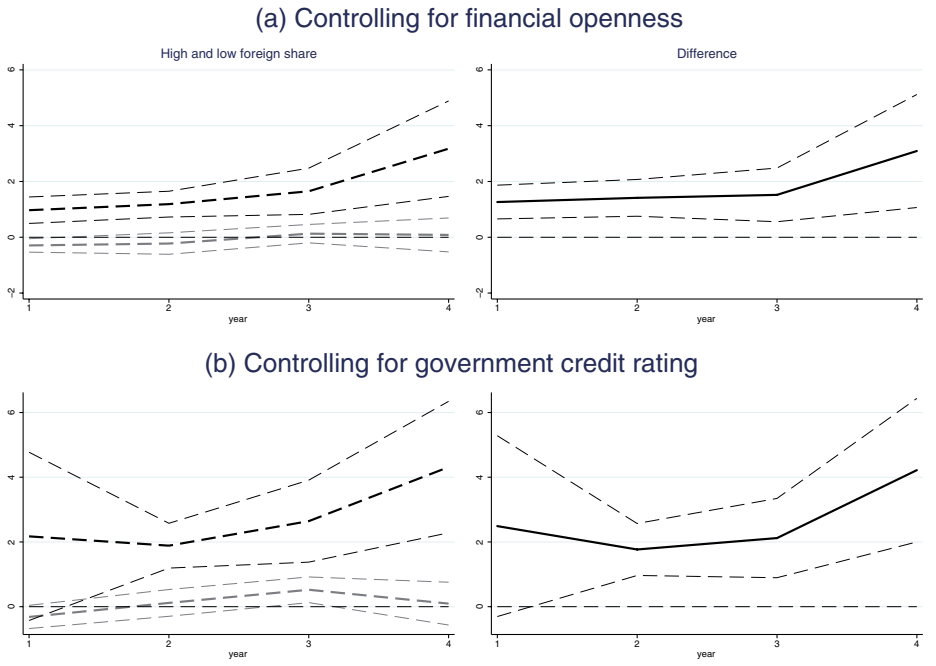

FIGURE 14

International panel foreign share and alternative explanations: output multiplier

Notes: Cumulative GDP multipliers from a fiscal shock equal to 1% of GDP for low (10th percentile of foreign holdings in the sample, solid grey line) and high (90th percentile of foreign holdings in the sample, solid black line) foreign shares when financial openness (a) and sovereign credit ratings (b) are included as alternative explanations, and the difference between the two multipliers. The dashed confidence bands represent significance at the 10% level.

Supplementary Data

Supplementary data are available at *Review of Economic Studies* online. And the replication packages are available at https://dx.doi.org/10.52xx/zenodo.5235355.

Data Availability Statement

The data and code underlying this research is available on Zenodo at https://dx.doi.org/10.5281/zenodo.5235355.

A. DATA DEFINITION AND SOURCES: U.S.

We expand the quarterly dataset compiled by Ramey and Zubairy (2018b) to include our measure of the foreign share, as well as private investment, current account, exports, imports, private credit, and exchange rate classifications. Our sample runs from 1951:Q4 to 2015:Q1. Below we provide a brief overview of the original data sources and their definitions. See the Data Availability Statement in our replication package for more details.

Government spending is government consumption expenditure and gross investment from the BEA (NIPA Table 1.1.5 line 22), divided by the GDP deflator (NIPA Table 1.1.9, line 1); **defense news shocks** comes from Ramey and Zubairy (2018b); **BP shocks** used for the plot in Figure 2 comes from Ramey (2016b); **Nominal Output** is nominal GDP from the BEA (NIPA Table 1.1.5 line 1); **Real Output** is real GDP from the BEA (NIPA Table 1.1.6 line 1); **Potential output** is computed as the HP-filtered real GDP; **Estimated shocks** are the Blanchard–Perotti shocks captured by including government spending as a regressor while controlling for lagged GDP and government spending; **Public debt** is the U.S. federal government's treasury securities liabilities (FRED series: FGTSUSQ027S); **Foreign share** is computed as the rest of the world's treasury securities assets (FRED series: ROWTSEQ027S) as a proportion of the

U.S. public debt; **Private investment** is from the BEA (NIPA Table 1.1.5 line 7), divided by the GDP deflator; **Current account** is the balance on current account from the BEA (NIPA Table 4.1 line 31), divided by the GDP deflator; **Exports** is exports of goods and services from the BEA (NIPA Table 1.1.5 line 16), divided by the GDP deflator; **Imports** is imports of goods and services from the BEA (NIPA Table 1.1.5 line 19), divided by the GDP deflator; **Private credit** is total credit to the private non-financial sector (FRED series: QUSPAM770A); **Exchange rate classifications** are from Ilzetzki *et al.* (2019b).

B. INSTRUMENT RELEVANCE: U.S.

We use instrumental variable regressions to examine how foreign holdings of public debt affect the size of U.S. fiscal multipliers. We report here the first-stage regression results, related to the (second-stage) regression results discussed in Section 5. The results in Tables B1 and B2 correspond to the estimation of the instruments on U.S. government expenditure and U.S. government expenditure interacted with our measure of the foreign share respectively. Ramey and Zubairy (2018a) demonstrate that a combination of the defense news shock and a shock derived from the Blanchard and Perotti (2002) VAR specification delivers the most relevant instruments for the analysis of U.S. government spending multipliers. They find that this holds for both the linear and state-dependent cases. We therefore use both fiscal shocks to instrument government spending. In the tables, "news shock" represents ϵ_t^N and the "BP shock" is g_t (having controlled for lagged GDP and government spending in the regression). When interacted with the foreign share variable they represent the $\epsilon_t^N \cdot X_{t-1}$ and $g_t \cdot X_{t-1}$ terms from the first-stage regressions in Section 4. The first-stage results show that the interaction of the fiscal shocks and the foreign share are statistically significant in both regressions.

However, the instrumental variable approach is invalid if the instruments are irrelevant or have only weak relevance. Tests of under-identification assess whether instruments are relevant, while tests of weak identification examine whether instruments are weak. Although there are many methods to conduct these tests, they are not all appropriate for our analysis. Our use of more than one endogenous variable rules out the Staiger and Stock (1997) test of weak identification, as well as the Olea and Pflueger (2013) test used by Ramey and Zubairy (2018a). Stock and Yogo (2005) provide critical values for multiple endogenous regressors and multiple instruments, but assume conditional homoskedastic error terms.

Instead, we use the test statistics from Kleibergen and Paap (2006) and Sanderson and Windmeijer (2016). The Kleibergen–Paap rk Wald statistic allows for tests of weak identification when there are more than one endogenous variable and the errors are heteroskedastic and serially correlated. This is the test statistic reported in Table B3. This test, however, is only formally justified in the context of under-identified, and not weak, instruments. Sanderson and Windmeijer (2016) provides tests of weak and under-identification for each endogenous regressor seperately.[39] The results for the Sanderson and Windmeijer (2016) weak and under-identification tests are in Tables B4 and B5, respectively. Sanderson and Windmeijer (2016) note that the Stock and Yogo (2005) critical values can be used for their conditional F-statistics. For our case of two endogenous regressors and four instruments, the critical values for the Stock and Yogo (2005) weak ID test are:

- 5% maximal IV relative bias: 11.04
- 10% maximal IV relative bias: 7.56
- 20% maximal IV relative bias: 5.57
- 30% maximal IV relative bias: 4.73
- 10% maximal IV size : 16.87
- 15% maximal IV size: 9.93
- 20% maximal IV size: 7.54
- 25% maximal IV size: 6.28

Taken together, the results in Tables B3, B4, and B5 show that the defense-news and Blanchard–Perotti shocks are jointly relevant instruments for government spending and therefore suitable for use in the empirical analysis.

39. For the weak identification test, the critical values are only available for the i.i.d. case.

TABLE B1
U.S. government spending instruments

	$t+1$	$t+2$	$t+3$	$t+4$	$t+5$	$t+6$	$t+7$	$t+8$
News shock$_t$	−0.00	0.05	0.13**	0.25**	0.44***	0.66***	0.89***	1.11***
	(0.02)	(0.03)	(0.06)	(0.10)	(0.16)	(0.23)	(0.29)	(0.35)
News shock$_t$ · Foreign share$_{t-1}$	−0.01	−0.22	−0.50	−1.00*	−1.79**	−2.65**	−3.49**	−4.29**
	(0.07)	(0.17)	(0.33)	(0.54)	(0.83)	(1.17)	(1.49)	(1.76)
BP shock$_t$	1.95***	2.99***	4.03***	5.12***	6.08***	7.15***	8.08***	8.97***
	(0.08)	(0.21)	(0.33)	(0.50)	(0.75)	(1.04)	(1.39)	(1.75)
BP shock$_t$ · Foreign share$_{t-1}$	0.67	0.65	1.03	2.29	4.26	5.59	7.39	9.92
	(0.52)	(1.09)	(1.84)	(2.93)	(4.49)	(6.13)	(8.05)	(10.05)
Observations	254	254	253	252	251	250	249	248

Notes: The (defense) news shocks are from Ramey and Zubairy (2018b). The BP shocks are the Blanchard–Perotti shocks. Both shocks are normalized by potential GDP. Standard errors in parentheses. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

TABLE B2
Interacted U.S. government spending instruments

	$t+1$	$t+2$	$t+3$	$t+4$	$t+5$	$t+6$	$t+7$	$t+8$
News shock$_t$	−0.01*	−0.01	−0.01	−0.02	−0.02	−0.02	−0.02	−0.02
	(0.00)	(0.01)	(0.01)	(0.02)	(0.02)	(0.03)	(0.03)	(0.04)
News shock$_t$ · Foreign share$_{t-1}$	0.03**	0.06*	0.11*	0.14*	0.13	0.16	0.20	0.25
	(0.01)	(0.03)	(0.06)	(0.08)	(0.09)	(0.12)	(0.15)	(0.17)
BP shock$_t$	−0.00	0.01	0.01	−0.00	−0.00	0.00	0.01	−0.01
	(0.01)	(0.02)	(0.03)	(0.04)	(0.05)	(0.07)	(0.09)	(0.11)
BP shock$_t$ · Foreign share$_{t-1}$	2.06***	2.97***	3.95***	5.21***	6.39***	7.59***	8.76***	10.22***
	(0.08)	(0.17)	(0.28)	(0.39)	(0.50)	(0.70)	(0.89)	(1.10)
Observations	254	254	253	252	251	250	249	248

Notes: The dependent variable is U.S. government spending interacted with our measure of the foreign share. The (defense) news shocks are from Ramey and Zubairy (2018b). The BP shocks are the Blanchard–Perotti shocks. Both shocks are normalized by potential GDP. Standard errors in parentheses. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

TABLE B3
Weak identification test: Kleibergen–Paap rk Wald statistic

h	U.S. government spending F-statistic	Interacted U.S. government spending F-statistic
1	624.0	369.9
2	235.1	81.8
3	149.5	61.7
4	127.1	48.6
5	108.6	45.3
6	90.2	37.6
7	77.5	32.8
8	66.6	28.9
9	57.9	25.9
10	49.3	23.1
11	43.4	21.5
12	37.7	19.8
13	34.7	14.4
14	33.1	10.5
15	31.2	7.6
16	28.9	6.6

Notes: The third column is U.S. government spending interacted with our measure of the foreign share. We use both the defense news and the Blanchard–Perotti shocks as instruments.

TABLE B4
Sanderson and Windmeijer (2016) weak identification test statistics

h	U.S. government spending F-statistic	Interacted U.S. government spending F-statistic	U.S. government spending *p*-value	Interacted U.S. government spending *p*-value
1	483.5	428.7	0.000	0.000
2	118.0	363.6	0.000	0.000
3	87.1	287.7	0.000	0.000
4	69.9	255.9	0.000	0.000
5	63.7	192.2	0.000	0.000
6	53.7	134.4	0.000	0.000
7	46.9	103.4	0.000	0.000
8	42.0	75.0	0.000	0.000
9	37.8	67.0	0.000	0.000
10	33.9	61.8	0.000	0.000
11	31.0	50.8	0.000	0.000
12	27.3	22.6	0.000	0.000
13	26.7	18.7	0.000	0.000
14	26.0	14.4	0.000	0.000
15	25.3	10.7	0.000	0.000
16	24.3	8.9	0.000	0.000

Notes: The second and fourth columns are U.S. government spending interacted with our measure of the foreign share. We use both the defense news and the Blanchard–Perotti shocks as instruments. The *p*-values are from the first-stage regressions and assume i.i.d. errors.

TABLE B5
Sanderson and Windmeijer (2016) underidentification chi-squared statistics

h	U.S. government chi-squared statistic	Interacted U.S. government spending chi-squared statistic	U.S. government spending *p*-value	Interacted U.S. government spending *p*-value
1	1,666.9	1,478.2	0.000	0.000
2	406.7	1253.6	0.000	0.000
3	300.4	992.5	0.000	0.000
4	241.3	883.5	0.000	0.000
5	219.9	663.9	0.000	0.000
6	185.5	464.4	0.000	0.000
7	162.1	357.7	0.000	0.000
8	145.4	259.5	0.000	0.000
9	131.0	231.8	0.000	0.000
10	117.4	214.1	0.000	0.000
11	107.6	176.3	0.000	0.000
12	94.6	78.4	0.000	0.000
13	92.6	64.9	0.000	0.000
14	90.2	50.0	0.000	0.000
15	88.1	37.1	0.000	0.000
16	84.7	31.0	0.000	0.000

Notes: The second and fourth columns are U.S. government spending interacted with our measure of the foreign share. We use both the defense news and the Blanchard–Perotti shocks as instruments. The *p*-values are from the first-stage regressions and assume i.i.d. errors.

C. REGRESSION RESULTS: U.S.

In this section, we provide the regression results underlying all the impulse responses for the U.S. analysis contained in the article.

TABLE C1
Effect on output: foreign share in pre-crisis sample (Q2 2007)

	Quarter t+1	Quarter t+2	Quarter t+3	Quarter t+4
Fiscal shock$_t$	0.55	0.57	0.43	0.25
	(0.53)	(0.50)	(0.41)	(0.36)
Fiscal shock$_t$ · Foreign share$_{t-1}$	3.81	4.37	5.50	6.73*
	(3.55)	(3.60)	(3.46)	(3.49)
Other controls	Yes	Yes	Yes	Yes
Observations	221	220	219	218
	Quarter t+5	Quarter t+6	Quarter t+7	Quarter t+8
Fiscal shock$_t$	0.06	−0.04	−0.04	−0.07
	(0.38)	(0.40)	(0.44)	(0.45)
Fiscal shock$_t$ · Foreign share$_{t-1}$	8.05**	9.63***	9.13**	9.37***
	(3.51)	(3.59)	(3.68)	(3.53)
Other controls	Yes	Yes	Yes	Yes
Observations	217	216	215	214

Notes: The fiscal shock is government expenditure instrumented by the defense news shocks from Ramey and Zubairy (2018b) and the Blanchard–Perotti shocks. Both are normalized by potential GDP. Foreign share is our measure of foreign holdings of public debt, as a percentage of total public debt. Standard errors in parentheses. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

TABLE C2
Effect on output: foreign share in pre-ZLB sample (Q3 2008)

	Quarter t+1	Quarter t+2	Quarter t+3	Quarter t+4
Fiscal shock$_t$	0.64	0.74	0.69*	0.30
	(0.51)	(0.46)	(0.39)	(0.36)
Fiscal shock$_t$ · Foreign Share$_{t-1}$	2.26	1.77	1.57	5.87*
	(3.33)	(3.41)	(3.68)	(3.54)
Other controls	Yes	Yes	Yes	Yes
Observations	226	225	224	223
	Quarter t+5	Quarter t+6	Quarter t+7	Quarter t+8
Fiscal shock$_t$	−0.00	−0.12	−0.11	−0.09
	(0.38)	(0.42)	(0.43)	(0.44)
Fiscal shock$_t$ · Foreign Share$_{t-1}$	8.83**	10.69***	10.21***	9.61***
	(3.61)	(3.84)	(3.69)	(3.46)
Other controls	Yes	Yes	Yes	Yes
Observations	222	221	220	219

Notes: The fiscal shock is government expenditure instrumented by the defense news shocks from Ramey and Zubairy (2018b) and the Blanchard–Perotti shocks. Both are normalized by potential GDP. Foreign share is our measure of foreign holdings of public debt, as a percentage of total public debt. Standard errors in parentheses. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

TABLE C3
Effect on investment: foreign share

	Quarter t+1	Quarter t+2	Quarter t+3	Quarter t+4
Fiscal shock$_t$	−0.63**	−0.57**	−0.55**	−0.57**
	(0.30)	(0.28)	(0.26)	(0.26)
Fiscal shock$_t$ · Foreign share$_{t-1}$	4.32***	4.37***	3.66**	3.24*
	(1.24)	(1.29)	(1.49)	(1.72)
Other controls	Yes	Yes	Yes	Yes
Observations	254	254	253	252
	Quarter t+5	Quarter t+6	Quarter t+7	Quarter t+8
Fiscal shock$_t$	−0.60**	−0.59*	−0.59	−0.62*
	(0.30)	(0.33)	(0.38)	(0.33)
Fiscal shock$_t$ · Foreign share$_{t-1}$	3.12	3.03	2.99	2.83
	(2.05)	(2.59)	(2.90)	(2.70)
Other controls	Yes	Yes	Yes	Yes
Observations	251	250	249	248

Notes: The fiscal shock is government expenditure instrumented by the defense news shocks from Ramey and Zubairy (2018b) and the Blanchard–Perotti shocks. Both are normalized by potential GDP. Foreign share is our measure of foreign holdings of public debt, as a percentage of total public debt. Standard errors in parentheses. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

TABLE C4
Effect on current account: foreign share

	Quarter t+1	Quarter t+2	Quarter t+3	Quarter t+4
Fiscal shock$_t$	−0.02	0.00	0.04	0.04
	(0.10)	(0.09)	(0.11)	(0.11)
Fiscal shock$_t$ · Foreign share$_{t-1}$	−0.76	−0.75	−0.91*	−0.87*
	(0.52)	(0.50)	(0.52)	(0.51)
Other controls	Yes	Yes	Yes	Yes
Observations	254	254	253	252
	Quarter t+5	Quarter t+6	Quarter t+7	Quarter t+8
Fiscal shock$_t$	0.02	0.00	−0.00	−0.01
	(0.12)	(0.11)	(0.12)	(0.12)
Fiscal shock$_t$ · Foreign share$_{t-1}$	−0.73	−0.70	−0.70	−0.60
	(0.50)	(0.50)	(0.54)	(0.55)
Other controls	Yes	Yes	Yes	Yes
Observations	251	250	249	248

Notes: The fiscal shock is government expenditure instrumented by the defense news shocks from Ramey and Zubairy (2018b) and the Blanchard–Perotti shocks. Both are normalized by potential GDP. Foreign share is our measure of foreign holdings of public debt, as a percentage of total public debt. Standard errors in parentheses. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

TABLE C5
Effect on output: foreign share and trade openness

	Quarter t+1	Quarter t+2	Quarter t+3	Quarter t+4
Fiscal shock$_t$	2.55***	2.77***	2.45***	2.08**
	(0.96)	(1.01)	(0.91)	(0.89)
Fiscal shock$_t$ · Foreign share$_{t-1}$	18.80***	21.01***	19.15***	17.28**
	(5.55)	(6.79)	(7.19)	(7.48)
Fiscal shock$_t$ · Trade openness$_{t-1}$	−28.67***	−31.64***	−28.52**	−25.27**
	(10.34)	(12.02)	(11.62)	(11.37)
Other controls	Yes	Yes	Yes	Yes
Observations	254	254	253	252
	Quarter t+5	Quarter t+6	Quarter t+7	Quarter t+8
Fiscal shock$_t$	1.54	1.24	1.01	0.81
	(0.96)	(1.08)	(1.12)	(1.11)
Fiscal shock$_t$ · Foreign share$_{t-1}$	14.88*	13.03	11.35	9.58
	(8.16)	(8.80)	(8.87)	(8.34)
Fiscal shock$_t$ · Trade openness$_{t-1}$	−20.02*	−16.47	−13.76	−11.22
	(11.96)	(12.84)	(12.97)	(12.34)
Other controls	Yes	Yes	Yes	Yes
Observations	251	250	249	248

Notes: The fiscal shock is government expenditure instrumented by the defense news shocks from Ramey and Zubairy (2018b) and the Blanchard–Perotti shocks. Both are normalized by potential GDP. Foreign share is our measure of foreign holdings of public debt, as a percentage of total public debt. Trade openness is the sum of imports and exports divided by GDP. Standard errors in parentheses. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

TABLE C6
Effect on output: foreign share and exchange rate regime

	Quarter t+1	Quarter t+2	Quarter t+3	Quarter t+4
Fiscal shock$_t$	0.62	0.69**	0.68**	0.55
	(0.40)	(0.35)	(0.31)	(0.36)
Fiscal shock$_t$ · Foreign share$_{t-1}$	8.49***	9.85***	9.02***	8.68***
	(1.90)	(2.29)	(2.53)	(2.92)
Fiscal shock$_t$ · Exchange rate$_{t-1}$	−1.17**	−1.42**	−1.29**	−1.17**
	(0.57)	(0.59)	(0.56)	(0.58)
Other controls	Yes	Yes	Yes	Yes
Observations	254	254	253	252
	Quarter t+5	Quarter t+6	Quarter t+7	Quarter t+8
Fiscal shock$_t$	0.41	0.44	0.53	0.63
	(0.46)	(0.54)	(0.58)	(0.57)
Fiscal shock$_t$ · Foreign share$_{t-1}$	8.24**	7.28**	6.22*	5.34
	(3.38)	(3.56)	(3.66)	(3.68)
Fiscal shock$_t$ · Exchange rate$_{t-1}$	−0.87	−0.64	−0.49	−0.46
	(0.65)	(0.71)	(0.75)	(0.73)
Other controls	Yes	Yes	Yes	Yes
Observations	251	250	249	248

Notes: The fiscal shock is government expenditure instrumented by the defense news shocks from Ramey and Zubairy (2018b) and the Blanchard–Perotti shocks. Both are normalized by potential GDP. Foreign share is our measure of foreign holdings of public debt, as a percentage of total public debt. Exchange rate is a dummy for a freefloating rate, as defined by Ilzetzki *et al.* (2019a). Standard errors in parentheses. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

TABLE C7
Effect on output: foreign share and public debt-to-GDP

	Quarter t+1	Quarter t+2	Quarter t+3	Quarter t+4
Fiscal shock$_t$	0.33	0.34	0.49	0.96
	(0.87)	(0.91)	(0.84)	(0.81)
Fiscal shock$_t$ · Foreign share$_{t-1}$	4.17**	4.28**	3.48*	3.24
	(1.78)	(1.91)	(1.94)	(2.22)
Fiscal shock$_t$ · Public debt$_{t-1}$	0.62	0.73	0.35	−1.02
	(2.27)	(2.19)	(1.95)	(1.88)
Other controls	Yes	Yes	Yes	Yes
Observations	254	254	253	252
	Quarter t+5	Quarter t+6	Quarter t+7	Quarter t+8
Fiscal shock$_t$	1.35*	2.04***	2.54***	2.69***
	(0.78)	(0.75)	(0.75)	(0.77)
Fiscal shock$_t$ · Foreign share$_{t-1}$	3.37	3.37	3.09	2.74
	(2.60)	(3.16)	(3.56)	(3.58)
Fiscal shock$_t$ · Public debt$_{t-1}$	−2.21	−3.97*	−5.26**	−5.71**
	(2.01)	(2.09)	(2.23)	(2.33)
Other controls	Yes	Yes	Yes	Yes
Observations	251	250	249	248

Notes: The fiscal shock is government expenditure instrumented by the defense news shocks from Ramey and Zubairy (2018b) and the Blanchard–Perotti shocks. Both are normalized by potential GDP. Foreign share is our measure of foreign holdings of public debt, as a percentage of total public debt. Public debt is in percentage of GDP. Standard errors in parentheses. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

TABLE C8
Effect on output: foreign share and ex-post change in public debt-to-GDP

	Quarter t+1	Quarter t+2	Quarter t+3	Quarter at+4
Fiscal shock$_t$	0.31	0.34	0.35	0.30
	(0.39)	(0.39)	(0.33)	(0.31)
Fiscal shock$_t$ · Foreign share$_{t-1}$	4.28*	4.62*	5.06*	5.82*
	(2.44)	(2.62)	(2.92)	(3.36)
Fiscal shock$_t$ · Ex-post change in public debt$_t$	10.25	11.84	5.24	−0.93
	(12.14)	(15.38)	(16.57)	(18.49)
Other controls	Yes	Yes	Yes	Yes
Observations	250	250	250	250
	Quarter t+5	Quarter t+6	Quarter t+7	Quarter t+8
Fiscal shock$_t$	0.25	0.29	0.34	0.37
	(0.34)	(0.38)	(0.40)	(0.41)
Fiscal shock$_t$ · Foreign share$_{t-1}$	6.56*	6.95*	6.55	6.08
	(3.78)	(4.04)	(4.09)	(3.93)
Fiscal shock$_t$ · Ex-post change in public debt$_{t-1}$	−5.17	−9.14	−9.50	−10.67
	(19.35)	(18.90)	(17.92)	(16.97)
Other controls	Yes	Yes	Yes	Yes
Observations	250	250	249	248

Notes: The fiscal shock is government expenditure instrumented by the defense news shocks from Ramey and Zubairy (2018b) and the Blanchard–Perotti shocks. Both are normalized by potential GDP. Foreign share is our measure of foreign holdings of public debt, as a percentage of total public debt. Ex-post (one-year ahead) change in public debt is in percentage of GDP. Standard errors in parentheses. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

TABLE C9
Effect on output: foreign share in post-Vietnam sample (Q1 1973–Q1 2015)

	Quarter t+1	Quarter t+2	Quarter t+3	Quarter t+4
Fiscal shock$_t$	−0.30	−0.49	−0.45	−0.44
	(0.64)	(0.66)	(0.60)	(0.54)
Fiscal shock$_t$ · Foreign share$_{t-1}$	6.20***	7.21***	6.64***	5.98***
	(1.59)	(1.74)	(1.77)	(1.80)
Other controls	Yes	Yes	Yes	Yes
Observations	166	166	165	164
	Quarter t+5	Quarter t+6	Quarter t+7	Quarter t+8
Fiscal shock$_t$	−0.17	0.03	0.14	0.34
	(0.53)	(0.56)	(0.56)	(0.54)
Fiscal shock$_t$ · Foreign share$_{t-1}$	4.75**	3.97*	3.44	2.07
	(1.95)	(2.14)	(2.24)	(2.30)
Other controls	Yes	Yes	Yes	Yes
Observations	163	162	161	160

Notes: The fiscal shock is government expenditure instrumented by the defense news shocks from Ramey and Zubairy (2018b) and the Blanchard–Perotti shocks. Both are normalized by potential GDP. Foreign share is our measure of foreign holdings of public debt, as a percentage of total public debt. Standard errors in parentheses. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

TABLE C10
Effect on output: foreign share and private debt-to-GDP

	Quarter t+1	Quarter t+2	Quarter t+3	Quarter t+4
Fiscal shock$_t$	3.23	2.44	2.35	1.83
	(2.15)	(2.06)	(1.86)	(1.63)
Fiscal shock$_t$ · Foreign share$_{t-1}$	14.41**	12.65**	11.49*	9.79*
	(6.51)	(6.38)	(6.06)	(5.73)
Fiscal shock$_t$ · Private debt-to-GDP$_{t-1}$	−0.04	−0.03	−0.03	−0.02
	(0.03)	(0.03)	(0.03)	(0.02)
Other controls	Yes	Yes	Yes	Yes
Observations	253	253	252	251
	Quarter t+5	Quarter t+6	Quarter t+7	Quarter t+8
Fiscal shock $_t$	1.58	1.28	0.89	0.45
	(1.53)	(1.48)	(1.56)	(1.57)
Fiscal shock$_t$ · Foreign share$_{t-1}$	9.42*	8.10	6.68	4.78
	(5.62)	(5.36)	(5.36)	(5.04)
Fiscal shock$_t$ · Private debt-to-GDP$_{t-1}$	−0.02	−0.01	−0.01	−0.00
	(0.02)	(0.02)	(0.02)	(0.02)
Other controls	Yes	Yes	Yes	Yes
Observations	250	249	248	247

Notes: The fiscal shock is government expenditure instrumented by the defense news shocks from Ramey and Zubairy (2018b) and the Blanchard–Perotti shocks. Both are normalized by potential GDP. Foreign share is our measure of foreign holdings of public debt, as a percentage of total public debt. Private debt is total credit to the private non-financial sector, as a percentage of GDP. Standard errors in parentheses. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

D. DATA DEFINITION AND SOURCES: INTERNATIONAL PANEL

D.1. *Macroeconomic data*

To maximize consistency across countries, we collect as many macroeconomic variables as possible from the OECD's Economic Outlook No. 95, from November 2015. Due to the availability of the fiscal shock data, our maximum sample period runs from 1978 to 2014.

All countries **Population** is the total population (OECD series: POP); **Narrative fiscal shocks** are from Guajardo *et al.* (2014b) and Kataryniuk and Valles (2018b); **Government spending** is the volume of final government expenditure (OECD series: CGV); **Nominal Output** is nominal GDP (OECD series: NGDP); **Real Output** is nominal output divided by the **GDP deflator** (OECD series: PGDP); **Potential output** is computed as the HP-filtered real GDP; **Budget deficit** is the value of the cyclically adjusted primary balance (OECD series: NLGXA); **Private investment** is the volume of private total fixed capital formation (OECD series: IPV); **Net exports** is the value of exports of goods and services (OECD series: NX) minus the value of imports of goods and services (OECD series: NM); **Total financial assets** are from Lane and Milesi-Ferretti (2018); **Total financial liabilities** are from Lane and Milesi-Ferretti (2018); **Sovereign credit ratings** are the average of the ratings from Fitch, Moody's and S&P; **Bank crises** is a dummy constructed from Laeven and Valencia (2020b)'s systemic bank crises database; textbfExchange rate classifications are from Ilzetzki *et al.* (2019b).

Our data on public debt, foreign holdings of public debt, the current account and exchange rate with the U.S. dollar are from a variety of sources and are discussed next.

D.2. *Public debt*

Where possible, we use total general government debt. We extend the series back by gathering data directly from domestic and international sources.

Australia: Non-consolidated general government debt. Millions of national currency. Final quarter taken as the annual value.
1988–2014: Financial Account by Institutional Sector, Flow of Funds. Haver code: AUNFLGGD@ANZ.

Austria: Sum of government debt held by residents and non-residents. Millions of national currency. European Central Bank Statistical Data Warehouse.
1995–2014: Variable codes:
GFS.A.N.AT.W2.S13.S1.C.L.LE.GD.T._Z.XDC._T.F.V.N._T (residents);
GFS.A.N.AT.W1.S13.S1.C.L.LE.GD.T._Z.XDC._T.F.V.N._T (non-residents).

Belgium: Consolidated gross debt of General Government. Millions of national currency.
1990–2014: National Bank of Belgium. Haver code: BEAFD@BENELUX.

Canada: Gross debt of the general government. Millions of national currency.
1981–2014: International Monetary Fund, World Economic Outlook Database.
Haver code: A156GDS@IMFWEO.

Denmark: 1990–1: Sum of short- and long-term general government debt. Millions of national currency. European Central Bank Statistical Data Warehouse. Variable codes:
GST.A.DK.N.B0X13.MJS.B1300.SA.N_T (short-term debt);
GST.A.DK.N.B0X13.MJM.B1300.SA.N (long-term debt).
1992–2014: Gross debt of the general government. International Monetary Fund, World Economic Outlook Database.
Haver code: A128GDS@IMFWEO.

Finland: Gross debt of the (consolidated) general government. Millions of national currency. 1990–2014: Statistics Finland.

France: Sum of government debt held by residents and non-residents, consolidating for within general government holdings. Millions of national currency.
1995–2014: European Central Bank Statistical Data Warehouse. Variable codes:
GFS.A.N.FR.W2.S13.S1.C.L.LE.GD.T._Z.XDC._T.F.V.N._T (residents);
GFS.A.N.FR.W1.S13.S1.C.L.LE.GD.T._Z.XDC._T.F.V.N._T (non-residents);
GFS.A.N.FR.W2.S13.S13.CI.L.LE.GD.T._Z.XDC._T.F.V.N._T (intra general government).

Germany: Consolidated General Government liabilities. Millions of national currency.
1990–2014: European Central Bank Statistical Data Warehouse.
Variable code: GST.A.DE.N.B0000.MAL.B1300.SA.E.
Data for year 1990 were extracted from the Bruegel dataset on sovereign holdings.

Ireland: Holdings of long-term government bonds by sectors. Millions of national currency.
1987–2014: Central Bank of Ireland, Securities Statistics. Sum of resident sectors holdings and Nonresident sector holdings.

Italy: Consolidated General Government Debt. Millions of national currency.
1980–2014: Banca d'Italia. Sum of government debt held by resident and non-resident sectors. Datastream variable codes: ITNPD6@ITALY (debt held by Banca d'Italia); ITNPD8@ITALY (debt held by Other Resident MFIs); ITNPD8@ITALY (debt held by Other Resident Financial Institutions); ITNPD12@ITALY (debt held by Other Residents); ITNPD14@ITALY (debt held by Nonresidents).

Japan: Sum of government domestic law bonds, foreign law bonds and T-bills. Billions of national currency.
1982–2014: Bank of Japan Database, Public Finance. Data code: PF'PFGD11 (government bonds, domestic law); PF'PFGD12 (government bonds, foreign law); PF'PFGD@01 (government T-bills).

Netherlands: Gross General Government Debt. Millions of national currency.
1990–2014: European Central Bank Statistical Data Warehouse.
Variable codes: GST.A.NL.N.B0000.MAL.B1300.SA.E

Portugal: Gross General Government Debt. Millions of national currency.
1995–2014: European Central Bank Statistical Data Warehouse.
Variable codes: GST.A.PT.N.B0000.MAL.B1300.SA.E

Spain: General Government securities. Millions of national currency.
1989–2014: Statistical Bulletin of Bank of Spain. Financial Accounts: Securities holdings by institutional sectors. Sum of all domestic sectors (code: BE_3_13.4) and Rest of the World (code: BE_3_13.29), minus intra-government holdings (code: BE_3_13.19).

Sweden: Gross General Government Debt. Millions of national currency.
1995–2014: European Central Bank Statistical Data Warehouse. Sum of liabilities vis-a-vis resident and Nonresident sectors. Variable codes:
GFS.A.N.SE.W1.S13.S1.C.L.LE.GD.T._Z.XDC._T.F.V.N._T (Domestic excl. General government);
GFS.A.N.SE.W2.S13.S1.C.L.LE.GD.T_Z.XDC._T.F.V.N._T (Rest of the World);
GFS.A.N.SE.W2.S13.S13.CI.L.LE.GD.T._Z.XDC._T.F.V.N._T (Intra-General government).

United Kingdom: Long-term bonds of the Central Government. Millions of national currency. Fourth quarter taken as the annual value. Office of National Statistics.
1987–2013: Variable code: AF.3321: CP NSA

United States: Federal Government, Treasury securities liabilities. Millions of national currency.
1978–2014: Federal Reserve Bank of St. Louis FRED database. FRED series: FGTSUSQ027S. Fourth quarter taken as the annual value.

D.3. *Foreign share*

This is the foreign holdings of total public debt, as described above. We extend the series back by gathering data directly from domestic and international sources.

Australia: Liabilities of the public sector (general government) held by the rest of the world. Millions of national currency.
1988–2014: Australian Bureau of Statistics, Balance of Payments and International Investment Position, Foreign Debt Levels, Table 30. Series ID: A3374931F.

Austria: General Government debt held by non-residents. Millions of national currency.
1995–2014: European Central Bank Statistical Data Warehouse.
Variable code: GFS.A.N.AT.W1.S13.S1.C.L.LE.GD.T._Z.XDC._T.F.V.N._T.

Belgium: Consolidated gross debt of the general government, held by the rest of the world. Millions of national currency.
1990–4: Bruegel dataset on sovereign bond holdings. Based on data from the European Central Bank Statistical Data Warehouse.
1995–2014: Government debt held by non-residents. European Central Bank Statistical Data Warehouse.
Variable code: GFS.A.N.BE.W1.S13.S1.C.L.LE.GD.T._Z.XDC._T.F.V.N._T

Canada: Portfolio investment in government bonds by foreigners. Millions of national currency.
1981–2014: Statistics Canada, International Investment Position, Table 376-0143.

Denmark: Liabilities of the public sector (general government) held by the rest of the world. Millions of national currency. Statistics Denmark, International Investment Position.
1980–7: annual data. 1999–2014: Final quarter taken as the annual value. 1998: Linear interpolation between the 1997 and 1999 values.

Finland: Consolidated General Government held by the rest of the world. Millions of national currency.
1990–4: Bruegel dataset on sovereign bond holdings. Based on data from the European Central Bank Statistical Data Warehouse.
1995–2014: General Government debt held by non-residents. Millions of national currency. Statistics Finland, annual financial accounts. Sum of bonds (AF32) and loans (AF4).

France: Government debt held by non-residents. Millions of national currency.
1995–2014: European Central Bank Statistical Data Warehouse.
Variable code: GFS.A.N.FR.W1.S13.S1.C.L.LE.GD.T._Z.XDC._T.F.V.N._T.

Germany: General Government Financial stocks at nominal value held by the rest of the world. Millions of national currency.
1990–4: Bruegel dataset on sovereign bond holdings. Based on data from the European Central Bank Statistical Data Warehouse.
1995–2014: European Central Bank Statistical Data Warehouse.
Variable code: GST.A.DE.N.B2000.MAL.B1300.SA.E.

Ireland: Holdings of long-term government bonds by non-residents. Millions of national currency.
1978–2014: Central Bank of Ireland, Securities Statistics.

Italy: General Government Debt held by Nonresidents. Millions of national currency.
1988–2014: Banca d'Italia. Datastream code: ITNPD14@ITALY.

Japan: Sum of foreign holdings of government T-bills, central government securities, local government securities and public corporation securities. Billions of national currency.
1982–2014: Bank of Japan Database, Flow of Funds. Data code: FF'FOF_93FFYS500A310 (government T-bills); FF'FOF_93FFYS500A311 (central government securities); FF'FOF_93FFYS500A312 (local government securities); FF'FOF_93FFYS500A313 (public corporation securities).

Netherlands: Consolidated gross debt of the general government, held by Rest of the world. Millions of national currency.
1990–4: Bruegel dataset on sovereign bond holdings. Based on data from the European Central Bank Statistical Data Warehouse.
1995–2014: European Central Bank Statistical Data Warehouse.
Variable code: GFS.A.N.NL.W1.S13.S1.C.L.LE.GD.T._Z.XDC_R_B1GQ._T.F.V.N._T.

Portugal: Consolidated gross debt of the general government, held by Rest of the world. Millions of national currency.
1995–2014: European Central Bank Statistical Data Warehouse.

Variable code: GFS.A.N.PT.W1.S13.S1.C.L.LE.GD.T._Z.XDC_R_B1GQ._T.F.V.N._T.

Spain: General Government securities held by Rest of the world. Millions of national currency.
1989–2014: Statistical Bulletin of Bank of Spain. Financial Accounts: Securities holdings by institutional sectors.Variable code: BE_3_13.29.

Sweden: Government debt held by non-residents. Millions of national currency.
1995–2014: European Central Bank Statistical Data Warehouse.
Variable code: GFS.A.N.SE.W1.S13.S1.C.L.LE.GD.T._Z.XDC._T.F.V.N._T.

United Kingdom: Long-term bonds of the central government, held by the rest of the world. Millions of national currency.
1987–2013: Office of National Statistics.

United States: Federal government's treasury securities liabilities, held by the rest of the world. Millions of national currency.
1978–2014: Federal Reserve Bank of St. Louis FRED database. FRED series: ROWTSEQ027S.

D.4. *Current account*

Where possible, we collect data in national currency. We extend the series back by gathering data directly from domestic and international sources, and using data in U.S. dollars and from the BMP5 and BMP6 methodologies where necessary.

Australia: Australian Bureau of Statistics.
1978–2014: Current account balance, millions of national currency. Haver code: AUABC@ANZ

Austria: Oesterrichische National bank.
1992–4: Current account balance, millions of national currency. BMP5, Haver code: ATOBC@ALPMED
1980–2014: Current account balance, millions of national currency. BMP6, Haver code: ATNBC@ALPMED

Belgium: National Bank of Belgium.
1995–9: Current account balance, millions of national currency. BMP5, Haver code: BEOBC@BENELUX
1980–2014: Current account balance, millions of national currency. BMP6, Haver code: BEQBC@BENELUX

Canada: International Monetary Fund.
1978–2014: Current account balance, millions of U.S. dollars. Haver code: C156B6CU@IFS

Denmark: International Monetary Fund.
1978–2014: Current account balance, millions of U.S. dollars. Haver code: C128B6CU@IFS

Finland: Statistics Finland.
1980–2014: Current account balance, millions of national currency. Haver code: FINBC@NORDIC

France: International Monetary Fund.
1978–2014: Current account balance, millions of U.S. dollars. Haver code: C132B6CU@IFS

Germany: Deutsche Bundesbank.
1978–2014: Current account balance, millions of national currency. Haver code: DENBCW@GERMANY

Ireland: Central Statistics Office.
1981–2014: Current account balance, millions of national currency. Haver code: IENBC@IRELAND

Italy: International Monetary Fund.
1978–2014: Current account balance, millions of U.S. dollars. Haver code: C136B6CU@IFS

Japan: Bank of Japan.
1985–2014: Current account balance, hundreds of millions of national currency. Haver code: N158BC@G10

Netherlands: International Monetary Fund.
1978–2014: Current account balance, millions of U.S. dollars. Haver code: C138B6CU@IFS

Portugal: International Monetary Fund.
1978–2014: Current account balance, millions of U.S. dollars. Haver code: C182B6CU@IFS

Spain: International Monetary Fund.
1978–2014: Current account balance, millions of U.S. dollars. Haver code: C184B6CU@IFS

Sweden: International Monetary Fund.
1978–2014: Current account balance, millions of U.S. dollars. Haver code: C144B6CU@IFS

United Kingdom: Office of National Statistics.
1978–2014: Current account balance, millions of national currency. Haver code: HBOPQ@UK

United States: Bureau of Economic Analysis.
1978–2014: Current account balance, millions of national currency. Haver code: BSBC@USECON

D.5. *Exchange rates*

For Canada, Denmark, France, Italy, the Netherlands, Portugal, Spain, and Sweden, the longest time series we could find for the current account were in U.S. dollars. We convert to national currency values using the exchange rate with the U.S. dollar provided by the Federal Reserve Board (FRB). We use the average annual exchange rate from the FRB G.5 release. Data for the euro area countries only begin in 1980. Before this, we use the individual national currencies to U.S. dollar exchange rate and divide it by the individual national currency to euro exchange rate. For completeness, we provide the exchange series for all our sample, but only use it for the eight countries mentioned above.

Australia: Federal Reserve Board, Foreign Exchange Rates.
1978–2014: Australian Dollar / U.S. Dollar foreign exchange rate. Haver code: A193@FXRATES

Austria: Federal Reserve Board, Foreign Exchange Rates.
1978–9: Austrian Schilling / U.S. Dollar foreign exchange rate (Haver code: FXAST@USECON) divided by Austrian Schilling / Euro foreign exchange rate (Haver code: X122EXR@EUDATA)
1980–2014: Synthetic Euro / U.S. Dollar foreign exchange rate. Haver code: A124@FXRATES

Belgium: Federal Reserve Board, Foreign Exchange Rates.
1978–9: Belgian Franc / U.S. Dollar foreign exchange rate (Haver code: FXBLG@USECON) divided by Belgium-Luxembourg Franc / Euro foreign exchange rate (Haver code: X126EXR@EUDATA)
1980–2014: Synthetic Euro / U.S. Dollar foreign exchange rate. Haver code: A122@FXRATES

Canada: Federal Reserve Board, Foreign Exchange Rates.
1978–2014: Canadian Dollar / U.S. Dollar foreign exchange rate. Haver code: A156@FXRATES

Denmark: Federal Reserve Board, Foreign Exchange Rates.
1978–2014: Danish Krone / U.S. Dollar foreign exchange rate. Haver code: A128@FXRATES

Finland: Federal Reserve Board, Foreign Exchange Rates.
1978–9: Finnish Markka / U.S. Dollar foreign exchange rate (Haver code: FXFIN@USECON) divided by Finnish Markka / Euro foreign exchange rate (Haver code: X172EXR@EUDATA)
1980–2014: Synthetic Euro / U.S. Dollar foreign exchange rate. Haver code: A172@FXRATES

France: Federal Reserve Board, Foreign Exchange Rates.
1978–9: French Franc / U.S. Dollar foreign exchange rate (Haver code: FXFR@USECON) divided by French Franc / Euro foreign exchange rate (Haver code: X132EXR@EUDATA)
1980–2014: Synthetic Euro / U.S. Dollar foreign exchange rate. Haver code: A132@FXRATES

Germany: Federal Reserve Board, Foreign Exchange Rates.
1978–9: German Deutschmark / U.S. Dollar foreign exchange rate (Haver code: FXGER@USECON) divided by German Deutschmark / Euro foreign exchange rate (Haver code: X134EXR@EUDATA)
1980–2014: Synthetic Euro / U.S. Dollar foreign exchange rate. Haver code: A134@FXRATES

Ireland: Federal Reserve Board, Foreign Exchange Rates.
1978–9: Irish Pound / U.S. Dollar foreign exchange rate (Haver code: FXIRL@USECON) divided by Irish Pound / Euro foreign exchange rate (Haver code: X178EXR@EUDATA)
1980–2014: Synthetic Euro / U.S. Dollar foreign exchange rate. Haver code: A178@FXRATES

Italy: Federal Reserve Board, Foreign Exchange Rates.
1978–9: Italian Lira / U.S. Dollar foreign exchange rate (Haver code: FXITL@USECON) divided by Italian Lira / Euro foreign exchange rate (Haver code: X136EXR@EUDATA)
1980–2014: Synthetic Euro / U.S. Dollar foreign exchange rate. Haver code: A136@FXRATES

Japan: Federal Reserve Board, Foreign Exchange Rates.
1978–2014: Japanese Yen / U.S. Dollar foreign exchange rate. Haver code: A158@FXRATES

Netherlands: Federal Reserve Board, Foreign Exchange Rates.
1978–9: Dutch Guilder / U.S. Dollar foreign exchange rate (Haver code: FXNET@USECON) divided by Dutch Guilder / Euro foreign exchange rate (Haver code: X138EXR@EUDATA)
1980–2014: Synthetic Euro / U.S. Dollar foreign exchange rate. Haver code: A138@FXRATES

Portugal: Federal Reserve Board, Foreign Exchange Rates.
1978–9: Portuguese Escudo / U.S. Dollar foreign exchange rate (Haver code: FXPOR@USECON) divided by Portuguese Escudo / Euro foreign exchange rate (Haver code: X182EXR@EUDATA)
1980–2014: Synthetic Euro / U.S. Dollar foreign exchange rate. Haver code: A182@FXRATES

Spain: Federal Reserve Board, Foreign Exchange Rates.
1978–9: Spanish Peseta / U.S. Dollar foreign exchange rate (Haver code: FXSPA@USECON) divided by Spanish Peseta / Euro foreign exchange rate (Haver code: X184EXR@EUDATA)
1980–2014: Synthetic Euro / U.S. Dollar foreign exchange rate. Haver code: A184@FXRATES

Sweden: Federal Reserve Board, Foreign Exchange Rates.
1978–2014: Swedish Krona / U.S. Dollar foreign exchange rate. Haver code: A144@FXRATES

United Kingdom: Federal Reserve Board, Foreign Exchange Rates.
1978–2014: British Pound / U.S. Dollar foreign exchange rate. Haver code: A112@FXRATES

E. INSTRUMENT RELEVANCE: INTERNATIONAL PANEL

As for the U.S., we use instrumental variable regressions to examine how foreign holdings of public debt affect the size of fiscal multipliers in our panel of advanced economies. We report here the first-stage regression results, related to the (second-stage) regression results discussed in Section 6. The results in Tables E1 and E2 correspond to the estimation of the instruments on the change in the cyclically adjusted primary balance and the change in the cyclically adjusted primary balance interacted with our measure of the foreign share respectively. We use the narrative fiscal shock produced by Guajardo *et al.* (2014b) and subsequently updated by Kataryniuk and Valles (2018b) to instrument the change in the cyclically adjusted primary balance. The first-stage results show that the interaction of the fiscal shocks and the foreign share are statistically significant in both regressions.

To assess the relevance of our instruments, we follow our approach for the U.S. and use the test statistics from Sanderson and Windmeijer (2016). The results for the weak and underidentification tests are in Tables E3 and E4, respectively. Sanderson and Windmeijer (2016) note that the Stock and Yogo (2005) critical values can be used for their conditional F-statistics.

TABLE E1
Panel. First stage— fiscal variable

	Year t+1	Year t+2	Year t+3	Year t+4
Narrative shock$_t$	0.73***	0.50	1.29***	1.18**
	(0.17)	(0.39)	(0.41)	(0.49)
Narrative shock$_t$ · Foreign share$_{t-1}$	−0.44	1.03	−0.51	−0.45
	(0.31)	(0.81)	(0.96)	(1.03)
Observations	405	387	369	352

Notes: The dependent (fiscal) variable is the change in the cyclically adjusted primary balance. The shocks are from Guajardo *et al.* (2014b), updated by Kataryniuk and Valles (2018b). The magnitudes of the shocks reflect the expected future budgetary impact of the consolidations, as a percentage of GDP. Standard errors in parentheses. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

TABLE E2
Panel. First stage—fiscal variable interacted

	Year t+1	Year t+2	Year t+3	Year t+4
Narrative shock$_t$	0.11	−0.17	−0.06	−0.05
	(0.08)	(0.11)	(0.15)	(0.14)
Narrative shock$_t$ · Foreign share$_{t-1}$	0.16	1.57***	1.31**	1.24**
	(0.23)	(0.36)	(0.56)	(0.49)
Observations	405	387	369	352

Notes: The dependent (fiscal) variable is the fiscal variable is the change in the cyclically adjusted primary balance interacted with our measure of the foreign share. The shocks are from Guajardo *et al.* (2014b), updated by Kataryniuk and Valles (2018b). The magnitudes of the shocks reflect the expected future budgetary impact of the consolidations, as a percentage of GDP. Standard errors in parentheses. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

TABLE E3
International panel: Sanderson-Windmeijer (2016) weak identification test statistics

h	Fiscal variable chi-squared statistic	Interacted fiscal variable chi-squared statistic	Fiscal variable p-value	Interacted fiscal variable p-value
1	12.6	4.5	0.000	0.034
2	6.4	13.3	0.012	0.000
3	20.5	19.8	0.000	0.000
4	13.1	18.8	0.000	0.000

Notes: The dependent (fiscal) variable is the change in the cyclically adjusted primary balance. The second and fourth columns are the fiscal variable interacted with our measure of the foreign share. The shocks are from Guajardo *et al.* (2014b), updated by Kataryniuk and Valles (2018b). The p-values are from the first-stage regressions and assume i.i.d. errors.

TABLE E4
International panel: Sanderson–Windmeijer (2016) under-identification test statistics

h	Fiscal variable F-statistic	Interacted fiscal variable F-statistic	Fiscal variable p-value	Interacted fiscal variable p-value
1	11.3	4.0	0.001	0.046
2	5.7	11.8	0.018	0.001
3	18.2	17.6	0.000	0.000
4	11.6	16.6	0.001	0.000

Notes: The dependent (fiscal) variable is the change in the cyclically adjusted primary balance. The second and fourth columns are the fiscal variable interacted with our measure of the foreign share. The shocks are from Guajardo *et al.* (2014b), updated by Kataryniuk and Valles (2018b). The p-values are from the first-stage regressions and assume i.i.d. errors.

For our case of two endogenous regressors and two instruments, the critical values for the Stock and Yogo (2005) weak ID test are:

- 10% maximal IV size: 7.03
- 15% maximal IV size: 4.48
- 20% maximal IV size: 3.95
- 25% maximal IV size: 3.63

Taken together, the results in Tables E3 and E4 show that our instruments are suitable for use in our empirical analysis. We therefore believe they are suitable for use in the empirical analysis.

F. ADDITIONAL ANALYSIS: INTERNATIONAL PANEL

In this section, we provide the impulse responses for the international panel analysis mentioned in the article. In Figure F1, we demonstrate that our result holds in the pre-crisis sample (Figure F1a) and excluding the three countries that received official-sector financial assistance (Figure F1b). In Figure F2, we provide evidence our results are robust to the exclusion of narratively identified fiscal consolidations that are subsequently reversed (Figure F2a) or consolidations that are largely based on expenditure measures (Figure F2b).

Although Guajardo *et al.* (2014a) try to include only consolidations that do not respond to current or prospective economic conditions, Jorda and Taylor (2016) document that the resulting fiscal consolidation shocks are not completely independent from fundamentals. To address this concern, we follow their methodology: namely, we re-run our local

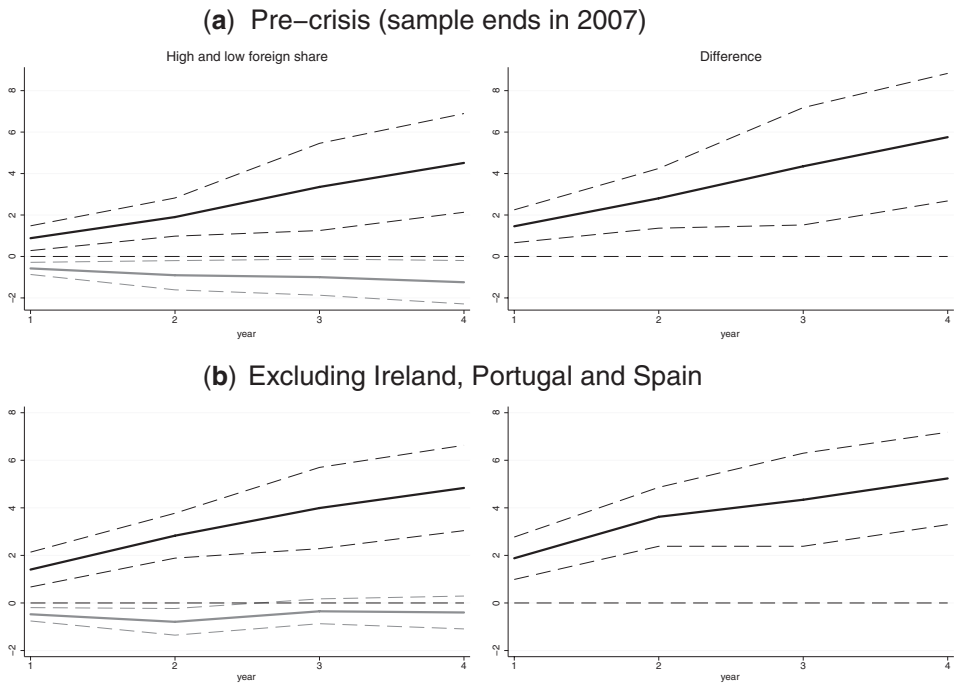

FIGURE F1

International panel foreign share: output multiplier robustness

Notes: Cumulative GDP multipliers from a fiscal shock equal to 1% of GDP for low (10th percentile of foreign holdings in the sample, solid grey line) and high (90th percentile of foreign holdings in the sample, solid black line) foreign shares, and the difference between the two multipliers. Changes in the cyclically adjusted primary deficit are instrumented using the narrative measure on fiscal consolidation episodes by Guajardo *et al.* (2014b), updated by Kataryniuk and Valles (2018b). The dashed confidence bands represent significance at the 10% level.

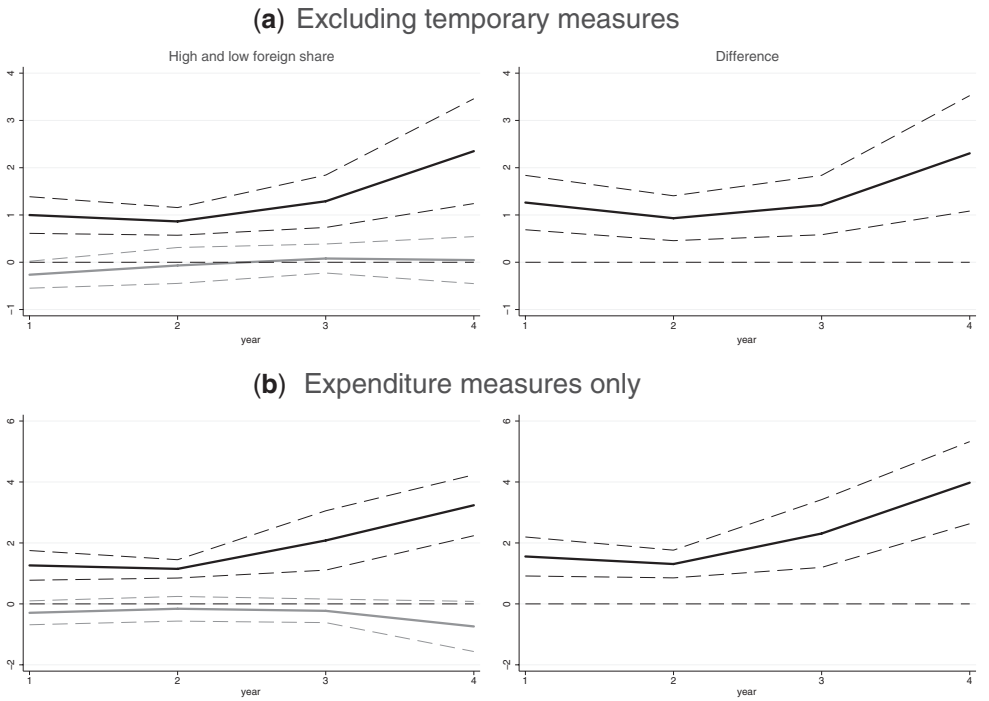

FIGURE F2

International panel foreign share: output multiplier robustness II

Notes: Cumulative GDP multipliers from a fiscal shock equal to 1% of GDP for low (10th percentile of foreign holdings in the sample, solid grey line) and high (90th percentile of foreign holdings in the sample, solid black line) foreign shares, and the difference between the two multipliers. Changes in the cyclically adjusted primary deficit are instrumented using the narrative measure on fiscal consolidation episodes by Guajardo *et al.* (2014b), updated by Kataryniuk and Valles (2018b). The dashed confidence bands represent significance at the 10% level.

projections using an augmented inverse probability weighting scheme (AIPW), which was shown by Jorda and Taylor (2016) to effectively reduce the endogeneity of the narrative fiscal shocks.

This technique uses propensity-scores to reduce the weight in the local projections of those observations which, given fundamentals, are more likely to experience a fiscal consolidation. In the first stage, we estimate propensity scores in the sample, which corresponds to the probability that a consolidation event occurs. We implement this using a probit model of the decision to perform a fiscal consolidation, that allow us to compute the required weights. Interestingly, the first step also allows us to study whether the timing of a fiscal consolidation is dependent on the foreign share. In this way, this exercise also helps addressing concerns regarding endogeneity. The results for the first step are presented in Table F1. The results show that consolidations are effectively driven by fundamentals: real output growth, the cyclical component of the log of output (estimated using a HP filter), the current account deficit and bank distress all increase the likelihood of observing a fiscal consolidation. Instead, the foreign share is, on average, not a major driver of fiscal consolidations. Further confirmation is given by the AUC statistics reported in Table F1.[40] The AUC statistics show a good predictive ability (AUC = 0.85).

The AIPW-corrected impulse responses are presented in Figure F3. The results are very similar and show, again, a strong relation between the size of the foreign share and the size of the output multiplier.

40. AUC stands for area under the curve. The curve usually refers to the receiver operating characteristic (ROC) curve. Under the null that the covariates have no classification ability, AUC = 0.5, while perfect classification ability corresponds to AUC = 1.

TABLE F1
AIPW: first-stage regression

	Treatment (t+1)	Treatment (t+1)	Treatment (t+1)
Public debt-to-GDP$_t$	0.00*	0.00**	0.00**
	(0.00)	(0.00)	(0.00)
Cyclical component of output$_t$	1.76	1.67	1.72
	(1.08)	(1.11)	(1.16)
Real output growth$_t$	−4.65***	−4.69**	−4.82***
	(1.36)	(1.39)	(1.44)
Fiscal consolidation dummy$_t$	0.55***	0.52***	0.52***
	(0.04)	(0.04)	(0.04)
Current account-to-GDP$_t$		−1.35***	−1.41***
		(0.51)	(0.51)
Change in CAPB$_t$		−1.71	−1.75
		(1.28)	(1.30)
Bank crisis$_t$		0.06	0.06
		(0.06)	(0.06)
Fixed exchange rate regime$_t$		0.02	0.03
		(0.04)	(0.05)
Foreign holdings of public debt$_t$			−0.02
			(0.13)
Observations	432	420	414
Classification test: AUC	0.85	0.86	0.86
	(0.02)	(0.02)	(0.02)

Notes: Column (1) shows the probit model employed by Jorda and Taylor (2016). Columns (2) and (3) show the saturated regression, omitting the foreign share in the former. Standard errors in parentheses * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

TABLE F2
International panel foreign share and financial openness: output multiplier

	Year t+1	Year t+2	Year t+3	Year t+4
Fiscal shock$_t$	−0.67*	−0.57	−0.19	−0.56
	(0.40)	(0.51)	(0.45)	(0.90)
Fiscal shock$_t$ · Foreign share$_{t-1}$	2.37**	2.65**	2.85	5.80
	(1.13)	(1.24)	(1.80)	(3.80)
Fiscal shock$_t$ · Financial openness$_{t-1}$	0.03	−0.00	−0.02	−0.05
	(0.05)	(0.05)	(0.05)	(0.08)
Other controls	Yes	Yes	Yes	Yes
Observations	405	387	369	352

Notes: The fiscal shock is the change in the cyclically adjusted primary deficit instrumented by the narrative shocks from Guajardo *et al.* (2014b), updated by Kataryniuk and Valles (2018b). The magnitudes of the shocks reflect the expected future budgetary impact of the consolidations, as a percentage of GDP. Foreign share is our measure of foreign holdings of public debt as a percentage of total public debt. Standard errors in parentheses. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Finally, we provide the regression results for the two races we were unable to conduct with the U.S. sample: financial openness (Table F2) and sovereign credit rating (Table F3). We measure financial openness as the share of total financial assets and liabilities to GDP. We source the financial data from Lane and Milesi-Ferretti (2018). Our sovereign credit rating is an average of the rating provided by the three main agencies: Fitch, Moody's and Standard and Poors. The scale runs between 19 (for highest rating) and 1 (in default). Our results are robust to the inclusion of these two alternative explanations.

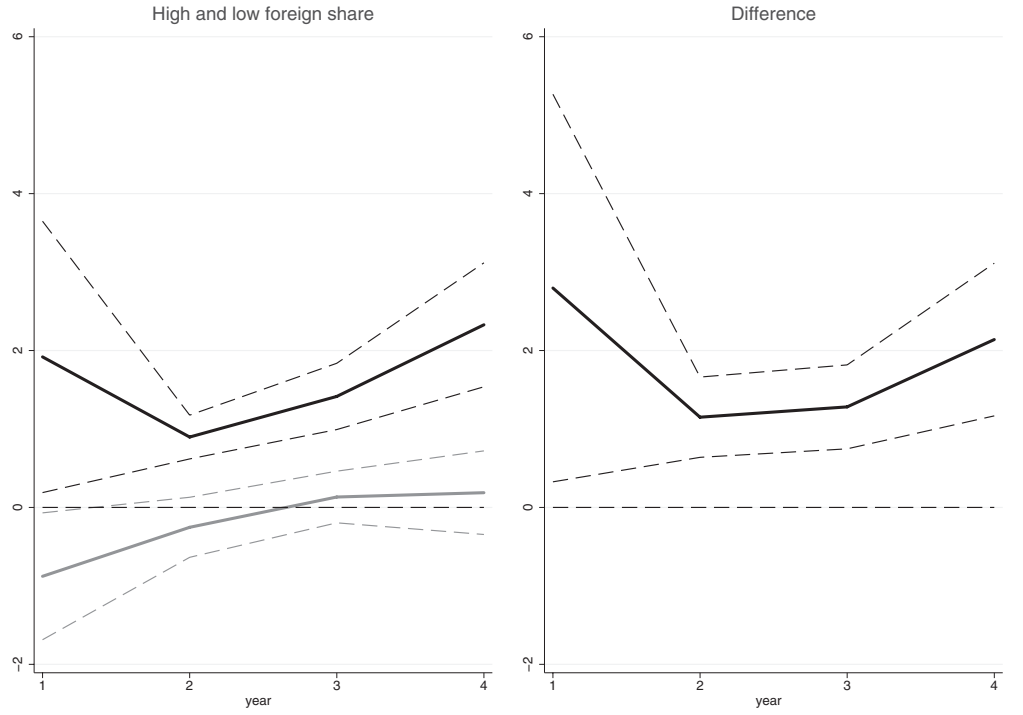

FIGURE F3

International panel foreign share: output multiplier AIPW

Notes: Cumulative GDP multipliers from a fiscal shock equal to 1% of GDP for low (10th percentile of foreign holdings in the sample, solid grey lines) and high (90th percentile of foreign holdings in the sample, solid black lines) foreign shares, and the difference between the two multipliers. Changes in the cyclically adjusted primary deficit are instrumented using the narrative measure on fiscal consolidation episodes by Guajardo *et al.* (2014b), updated by Kataryniuk and Valles (2018b). Following Jorda and Taylor (2016), we run the local projection using an augmented inverse probability weighting scheme (APIW). The dashed confidence bands represent significance at the 10% level.

TABLE F3

International panel foreign share and credit rating: Output multiplier

	Year t+1	Year t+2	Year t+3	Year t+4
Fiscal shock$_t$	−3.47	−5.11***	−7.10**	−7.39
	(4.21)	(1.86)	(3.10)	(5.34)
Fiscal shock$_t$ · Foreign share$_{t-1}$	4.67	3.32**	3.98*	7.91*
	(5.24)	(1.51)	(2.30)	(4.16)
Fiscal shock$_t$ · Credit rating$_{t-1}$	0.13	0.25***	0.37**	0.34
	(0.18)	(0.09)	(0.16)	(0.27)
Other controls	Yes	Yes	Yes	Yes
Observations	405	387	369	352

Notes: The fiscal shock is the change in the cyclically adjusted primary deficit instrumented by the narrative shocks from Guajardo *et al.* (2014b), updated by Kataryniuk and Valles (2018b). The magnitudes of the shocks reflect the expected future budgetary impact of the consolidations, as a percentage of GDP. Foreign share is our measure of foreign holdings of public debt as a percentage of total public debt. Standard errors in parentheses. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

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