International Spillovers of Fiscal Shocks: Evidence from a Cross-border Bank Lending Channel*

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Abstract

This paper investigates the international spillovers of fiscal shocks via the cross-border bank lending channel. We estimate the dynamic response of cross-border bank lending to exogenous fiscal (spending and revenue) shocks by applying the local projection method (Jordà, 2005) to data on cross-border lending from the confidential Bank for International Settlements Locational Banking Statistics, allowing for a cleaner identification of causal effects. We find that expansionary domestic fiscal shocks lead to an economically and statistically significant increase in cross-border bank lending to other counties. These effects depend on the sign of the shocks and the economic conditions of source countries at the time of the shocks. In particular, we find that: (i) fiscal shocks tend to have larger effects during periods of recessions than expansions in the source economy; and (ii) the adverse effect of fiscal consolidation on cross-border banking flows is larger than the positive effect of the same size of fiscal expansion. In contrast, we do not find the systematic and statistically significant difference of the spillover effects across recipient countries depending on their exchange rate regime, although capital controls seem to play some moderating role.

Keywords: Fiscal shocks; Cross-border banking flows; International spillovers; Local projections; Nonlinear effects: Trilemma.

JEL codes: E62; F21; F32; F42.

* The views expressed are those of the authors and do not necessarily represent those of the IMF or its policy. Any remaining errors are the authors' sole responsibility.

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I. INTRODUCTION

Since the Global Financial Crisis (GFC), the binding zero-lower-bound in advanced economies has stimulated a stream of research on the role of fiscal policy as a key stabilization tool and the potential engine of growth of the domestic economy (Christiano et al., 2011; Eggertsson, 2011; DeLong and Summers, 2012). The GFC has also reinvigorated the debate on the potential of fiscal austerity and fiscal stimulus in major economies to affect economic activity in other economies through cross-border spillovers (Gorodnichencko, 2013; Blanchard et al., 2017; IMF, 2017). In particular, the policy debate has focused on the scope of countries with limited fiscal space to be supported by expansionary fiscal policy in countries with a fiscal and external surplus. More recently, the global effects of fiscal policy have been discussed in the context of fiscal expansion in large and systemic economies such as the U.S.

Against this background and increased globalization, it is not surprising that many recent studies have analyzed the spillover effects of fiscal shocks (Auerbach and Gorodnichencko, 2013; Caporale and Girardi, 2013; Faccini et al., 2016; Goujard, 2017; IMF 2017). However, while these studies have typically shown evidence of sizeable fiscal spillovers through trade linkages, less is known about the magnitude of fiscal spillovers through financial linkages. Regarding financial linkages, this paper contributes to the literature particularly by providing the first analysis—to the best of our knowledge—of the international spillovers of domestic fiscal shocks via the cross-border bank lending channel.

While previous studies often focus on the effect of external shocks on net flows, the rapid expansion of gross international asset and liability positions calls for deeper understanding of the spillover effects through gross flows that better reflect the impact on national balance sheets of various economic shocks. Moreover, to the extent that cross-border banking flows have important implications for economic and financial conditions in recipient countries (Borio and Disyatat, 2011; Cetorelli and Goldberg, 2011; Bruno and Shin, 2014), identifying the effect of fiscal shocks in source countries on these flows can shed new light on the overall spillover effects of fiscal policies.

From a theoretical point of view, while fiscal expansion in a source economy may have significant spillover effects in other economies through cross-border bank lending, the sign of these effects is ambiguous *a priori*. For example, by increasing growth, fiscal expansion may lead to global bank operating in the source economy to expand lending to foreign borrowers (see, for example, Bruno and Shin, 2014 and Choi and Furceri 2018). At the same time, a fiscal expansion may lead to a

tightening of monetary policy in the source economy with ambiguous effects on cross-border lending to other economies (see Correa et al., 2017, for a discussion).[1] Thus answering the degree of fiscal spillover through cross-border banking remains largely an empirical task.

This paper examines and quantifies the magnitude of international spillovers of fiscal shocks via the cross-border bank lending channel. It does so by estimating the dynamic response of cross-border bank lending to exogenous fiscal (spending and revenue) shocks by applying the local projection method (Jordà, 2005) to cross-border claims data from the confidential Bank for International Settlements Locational Banking Statistics. The dyadic structure of this dataset allows us to control for the recipient-time fixed effects—that is, any global and country-level shocks affecting credit demand from a recipient country—and helps identify the effect of fiscal shocks in source countries on flows into recipient economies.

Thus, our empirical strategy mitigates a common criticism that countries are often subject to global shocks at the same time, which prevents a proper identification of the role of fiscal shocks in driving international capital flows. In addition, we borrow exogenous measures of fiscal shocks from various sources—Romer and Romer (2010) for revenue and Ramey and Zubairy (2018) for spending shocks in the U.S.; and Auerbach and Gorodnichencko (2012b) for spending shocks in advanced economies—to gauge the causal effect of fiscal shocks on cross-border banking flows. Together with measures of exogenous fiscal shocks from the recent literature, our approach delivers a clear causal identification of international spillovers of fiscal shocks.

Given the empirical evidence of nonlinear effect of fiscal shocks on output (Perotti, 1999; Auerbach and Gorodnichencko, 2012a and 2012b; Caggiano et al., 2015), we further investigate whether the effect of fiscal shocks depends on the underlying economic regimes (good versus bad times) or types of shocks (expansionary versus contractionary). In principle, the rapid increase in the volume of gross-international positions might represent an improving global risk sharing, but recent experience shows that hese positions can lead to the transmission of shocks between countries. Thus we analyze whether certain types of a recipient country' characteristics (such as the exchange rate regime and the degree of capital account openness guided by the trilemma in international finance) amplify or dampen the cross-border spillover of fiscal shocks, which bears significant policy implications.

[1] From a theoretical point of view, changes in the stance of monetary policy affects bank lending through several channels, which tend to produce contrasting effects. For example. under the bank lending channel, monetary tightening is expected to impact credit supply through the banks' cost of funding. As a result, monetary tightening increases banks' cost of funding and lowers the supply of bank loans. In contrast, the portfolio channel predicts that changes in the stance of monetary policy prompt banks to rebalance loan portfolios, with monetary tightening causing reallocations toward relatively safer assets.

The results of the paper can be summarized as follows:

- Expansionary fiscal shocks in a source economy lead to an economically and statistically significant increase in cross-border bank lending to other counties. Interestingly, the effects are larger for revenue than spending shocks. To the extent that the identified fiscal shocks are largely idiosyncratic across countries, our finding implies that domestic fiscal policies can be a source of the so-called "global financial cycles."

- Spillovers tend to be larger in the short-term when fiscal expansion in the source economy is undertaken during the period of slack. This larger effect is consistent with the evidence of larger fiscal multipliers in recessions. The adverse effect of fiscal consolidation on cross-border banking flows is larger than the positive effect of the same size of fiscal expansion.

- There is no systematic and statistically significant difference in the effects across recipient countries depending on their exchange rate regime, supporting the dilemma, not trilemma argument by Rey (2015). On the other hand, there is some evidence that capital controls dampen the spillover effect of fiscal shocks through cross-border banking, although this finding is not always robust.

The remainder of the paper is organized as follows. Section II reviews the related literature. Section III describes the data on cross-border banking flows and exogenous measures of fiscal shocks. Section IV illustrates the empirical methodology and provides an extensive analysis of international spillovers of fiscal shocks, including various robustness tests and additional exercises. Section V concludes.

II. RELATED LITERATURE

This paper contributes to three strands of literature. First, while a large body of earlier studies on fiscal policy transmission focused on the impact of such policy on the domestic economy (Blanchard and Perotti, 2002; Mountford and Uhlig, 2009; Romer and Romer, 2010; Auerbach and Gorodnichencko, 2012a),[2] a more recent stream of research has analyzed the international transmission of fiscal shocks. For example, in the aftermath of the GFC, fiscal consolidation adopted by many advanced economies raises concerns on negative cross-border spillover to their trading partners (Goujard, 2017; Poghosyan, 2017).

[2] We do not intend to summarize a mounting literature regarding fiscal multipliers. See Ramey (2011) for a recent survey of the literature on fiscal multipliers.

The recent literature also focuses on the scope of countries with limited fiscal space to be supported by expansionary fiscal policy in countries with a fiscal and external surplus (Auerbach and Gorodnichencko, 2013; Blanchard et al., 2017; IMF, 2017). While these studies often focus on trade linkages as a channel of transmission, we analyze financial linkages using cross-border banking data, thereby shedding new light on a potential transmission channel of fiscal shocks. Our finding suggests that financial linkages are an important transmission mechanism of domestic fiscal shocks, independent of trade linkage.

Second, our work is closely related to the so-called "twin deficit" literature. While the basic textbook accounting identities predict that fiscal deficits should lead to current account deficits, the empirical evidence suggests widely different estimates, and there is even disagreement about the sign of the effect of a fiscal deficit on the current account balance. For example, Roubini (1988) and Normandin (1999) find that government budget deficits induced a significant deterioration in the trade deficit: a one-dollar increase in the fiscal deficit of the U.S. increased the external deficit between $0.22 and $0.98.

By contrast, Kim and Roubini (2008) find that expansionary U.S. fiscal shocks tend to improve current account by estimating structural VARs and claim that "twin divergence" is a more suitable description of the historical data. More recently, Ilzetzki et al. (2013) and Kim (2015) find that the sign of the effect of a fiscal deficit on current account depends on structural characteristics, such as capital openness and exchange rate regimes by applying a structural VAR analysis on a large group of countries. We find robust evidence of an increase in net foreign claims by the domestic banking sector after fiscal expansion, which has potential to rationalize "twin divergence" found in the empirical studies.

Lastly, using confidential data on cross-border banking flows, our paper sheds new light on the emerging literature of global banking glut (Shin, 2012). Between the early 1990s and the GFC, the global economy has witnessed a marked increase in cross-border banking flows, primarily driven by the expansion of global operations of banks through developing networks of physical branches and subsidiaries in foreign countries. These flows were also most severely affected by the GFC (Milesi-Ferretti and Tille, 2011 and Broner et al., 2013).

While recent studies have tried to examine the driving factors of these flows, they focus mostly on a monetary or financial channel (Cetorelli and Goldberg, 2011; Popov and Udell, 2012; Bruno and Shin, 2014; Cerutti et al., 2017; Correa et al., 2917; Choi and Furceri, 2018). Our

empirical findings emphasize that fiscal policy innovations could be an independent driver of cross-border banking flows, thereby providing insights on factors explaining global banking glut.

III. DATA

A. Data on Cross-border Banking Flows

To identify the bank lending channel of international spillovers of fiscal shocks, we use data on cross-border claims from the Bank for International Settlements (BIS)' Locational Banking Statistics (LBS). This dataset provides the geographical breakdown of banks' counterparties and the information about the currency composition of their balance sheets. The LBS dataset captures outstanding claims and liabilities of internationally active banks located in reporting countries against counterparties residing in more than 200 countries. The data is compiled following the residency principle that is consistent with the balance of payments (BOP) statistics.[3] Banks record their positions on an unconsolidated basis, including intragroup positions between offices of the same banking group. In this regard, the major advantage of the BIS LBS data, compared to the banking flows collected from the Balance of Payments (BoP) statistics, is the detailed breakdown of the reported series by recipient countries.

Currently, banking offices located in 46 countries, including many offshore financial centers, report the LBS. The LBS dataset captures around 93 percent of all cross-border interbank business (Bank for International Settlements, 2017).[4] To the extent that ultimate economic decisions are made in a country where the headquarters of global banks are located (Ehlers and Wooldridge, 2015), one might argue that fiscal shocks in the headquarter country of global banks (i.e., nationality principle) might be more relevant. However, the Consolidated Banking Statistics (CBS) based on the nationality principle does not have information on currency breakdown, while the BIS LBS provides the exchange-rate adjusted flows in cross-border bank claims and liabilities.[5]

The adjustment for exchange rate movements is crucial in our setup because of both theoretical and empirical evidence on the effect of fiscal shocks on the exchange rate, which is tightly

[3] While the data is made public by the BIS at the aggregate level, the data on bilateral claims and liabilities between reporting (source) and counterparty (recipient) countries is available to reporting central banks.

[4] Although there is no similar estimate for the share of cross-border bank lending to non-banks in the LBS, Adjiev et al. (2017) estimate that it is likely to exceed 90 percent of all cross-border bank to non-bank business.

[5] The adjusted change is calculated by first converting U.S. dollar-equivalent amounts outstanding into their original currency using end-of-period exchange rates, then calculating the difference in amounts outstanding in the original currency, and finally converting the difference into a U.S. dollar-equivalent change using average period exchange rates (Bank for International Settlements, 2017).

related to the response of the current account balance in turn (Monacelli and Perotti, 2010; Kim, 2015). Thus, ignoring the valuation effect could bias the effect of fiscal shocks on cross-border banking flows.[6] Because the BIS LBS only reports the exchange rate-adjusted flows, we reconstruct the stock of the cross-border claims by adding the exchange rate-adjusted flows to the initial stock.

Most previous studies on capital flows rely on proxies for net capital flows. However, the dramatic increase in gross capital flows has posed a challenge to the traditional approach to international finance based on net capital flows where financial flows are seen only as the counterpart to the current account (Forbes and Warnock, 2012; Broner et al., 2013; Bruno and Shin, 2014). By looking at gross outflows and inflows separately, we can identify a source of changes in net flows following fiscal shocks.

The time-series coverage of LBS database varies significantly across countries. Some advanced economies such as the U.S. have reported these statistics since 1977, while some emerging market economies such as Mexico started reporting statistics only after 2003. Thanks to the availability of more than three decades of cross-border banking flow data and well-identified exogenous fiscal shock data at a quarterly frequency, we first analyze cross-border spillovers of U.S. fiscal shocks through the bank lending channel. We then move to the analysis of OECD countries using a semi-annual dataset to test whether our findings from the U.S. case can be generalized to other advanced economies.

Throughout the analysis, we drop offshore financial countries from our sample using the IMF classification because their behaviors might differ substantially from the rest of the sample. In the analysis of international panel data—after dropping offshore financial centers—we focus on 17 OECD countries where a measure of fiscal shocks constructed by Auerbach and Gorodnichencko (2012b) is available. Similarly, we are left with 49 recipient countries in the baseline analysis after dropping offshore financial centers. Following Choi and Furceri (2018), we further drop observations with the size of cross-border positions less than $5 million, or with negative total outstanding claims. Dependent variables in the upper and lower one percentile of the distribution are excluded from the sample to eliminate outliers.[7] Table 1 lists the final sample of reporting countries and their counterparties used in the international panel analysis, together with their average status regarding the

[6] Adjusted changes in amounts outstanding are calculated, as an approximation for flows. In addition to exchange rate fluctuations, the quarterly flows in the locational datasets are corrected for breaks in the reporting population. In Table A.1, we summarize the data availability in the BIS International Banking Statistics by reproducing Table 1 in Avdjiev and Elod Takáts (2014). This summary highlights the available information of each statistics, together with their limitations.

[7] We confirm that our main findings are hardly affected by such data-cleaning procedures.

exchange rate regime and capital openness during the sample period.[8] We use these country-specific characteristics to investigate the international transmission channel of fiscal shocks.

We present the size of total cross-border claims and liabilities as a share of the GDP in 2010Q4 for the 17 reporting countries in Table 2 to provide a first look at the data. Table 2 demonstrates the dominance of advanced economies in shaping the cross-border banking system. When normalized to the size of domestic GDP, both cross-border claims and liabilities of emerging market economies are smaller than those of advanced economies almost by two orders of magnitude. For example, cross-border claims and liabilities in Mexico are only five and seven percent of the GDP, while they account for 640 and 380 percent of the GDP in the U.K. The predominant role of European countries in the cross-border banking system is also apparent. European countries engage in cross-border banking much more heavily than the U.S. and other advanced economies relative to the size of the economies. While global banks operating in advanced economies have more cross-border claims than liabilities, this pattern is reversed in emerging market economies.

To provide a further look at the underlying dynamics, we plot aggregate cross-border claims of the U.S. in Figure 1. We show both exchange rate-unadjusted and adjusted claims to demonstrate the importance of accounting for the valuation effect. Although they share a similar time-series pattern for the case of the U.S. (the correlation of 0.75), it is not the case for other countries. In the sample of 17 OECD countries, the correlation between the growth rate of cross-border claims using two measures is only 0.52, suggesting a non-negligible role of the valuation effect. Moreover, even for the case of the U.S. accounting for the valuation effect results in a more pronounced decline in cross-border bank lending during the GFC, suggesting that the appreciation of the USD during this period partially offsets a larger decline in "real" cross-border claims originally denominated in the USD.

We further illustrate the dyadic structure of the data by presenting the examples of bilateral cross-border claims between the U.S. and other six countries in Figure 2. Although we do not reveal the identity of individual counterparty countries, Figure 2 shows some heterogeneity in the pattern of cross-border claims among different country pairs. First four countries are advanced economies, and the last two countries are emerging market economies. First, the different scales of the y-axis in these graphs re-emphasize the dominance of advanced economies in an absolute term. Second, the pattern found in lending towards emerging market economies is substantially different from advanced

[8] For each country, we take the time-series average of each measure to summarize the overall characteristics during the sample period.

economies. Third, even among advanced economies, the pattern of cross-border lending from the U.S. is quite heterogeneous, suggesting that a recipient country's characteristics could play an important role in the cross-border spillover of fiscal shocks.

B. Data on Fiscal Shocks

We borrow the existing measures of exogenous fiscal shocks from various sources to gauge the causal effect of fiscal shocks on cross-border banking flows. For the case of the U.S., we use both exogenous spending and revenue shocks, whereas we use only spending shocks for the analysis of international panel data. We briefly discuss how these measures are constructed.

Measures of exogenous U.S. fiscal shocks

As a baseline measure of U.S. fiscal shocks, we use 'defense news' shocks constructed by Ramey and Zubairy (2018), which are exogenous to business cycles and unpredictable with ex-ante information held by agents (RZ shocks, hereinafter). These shocks are based on a narrative approach, which exploits information from the press (BW, NYT, WP, FY), instead of a commonly used VAR approach, such as Blanchard and Perotti (2002). They are also more refined than the shocks constructed by Ramey and Shapiro (1998), which are based on only a few dummies for war dates or large military buildups.

Under the benchmark neoclassical model where the key effect of government spending is through the wealth effect, RZ shocks measure the expected present discounted value of government spending changes due to foreign political events. The variable used as the shock is the nominal value divided by the one-quarter lag of nominal GDP. By normalizing lagged GDP, we assume that GDP is unchanged by the fiscal shocks, which is largely supported by empirical evidence.[9] The advantages of using RZ shocks are twofold. First, data are available at the quarterly frequency for a very extensive time sample (from 1889 to 2015). Second, the use of fiscal "news" ensures that the shocks are identified well before the spending takes place actually (or before they materialize in the NIPA accounts). This helps reduce the risk of endogeneity problems in the VAR analysis related to the presence of "fiscal foresight"—that is, the possibility that lags between the planning and the actual implementation of fiscal policy lead to anticipation of spending shocks (see Leeper et al., 2013).

[9] For example, Romer and Romer (2010) also find that the impact of tax shocks on output is minor in the first three quarters after the shock.

As a robustness test of our findings, we also use tax shocks identified by Romer and Romer (2010), limiting ourselves to the exogenous ones (RR shocks, hereinafter). Similar to RZ shocks, they are also based on a narrative approach. Romer and Romer (2010) make use of narrative records, such as budget documents and speeches, to identify the size, timing, the principal motivation for fiscal actions, and to separate out tax changes that were made based on attempts to respond to current economic situations from those that are exogenous to current economic conditions.

Exogenous tax changes are those that are not motivated by the objective to influence short-run conditions—such as counteracting influences on the economy or paying for increases in government spending—but those motivated by long-run goals—such as a desire to restore long-run budgetary balance or to spur long-run growth through lower marginal rates—or by a shift in governing ideology. RR shocks cover both expansion and consolidation episodes at a quarterly frequency from 1945 to 2007. Throughout the paper, we reverse the sign of RR shocks so that an increase in this measure indicates a tax cut, which is consistent with an expansionary nature of the baseline measure of RZ shocks.[10] In both cases, shocks are normalized to the GDP so that the impulse response functions track the percentage changes in cross-border bank lending when there is a one percent increase in government spending or tax cut as a share of the GDP. Figure 3 plots the time series of both measures of fiscal shocks as a share of the lagged GDP during our sample period (1990Q1-2012Q4). One should note that expansionary spending shocks are often associated with increases in tax, although we do not account for whether exogenous government spending is deficit-financed or budget-balanced.

A measure of exogenous fiscal shocks for OECD economies

In the extension of our analysis to small open economies, we use spending shock data for 16 OECD countries constructed by Auerbach and Gorodnichenko (2012b) using OECD's Outlook and Projections Database (AG shocks, hereinafter). Auerbach and Gorodnichenko (2012b) conduct a regression analysis for each country, regressing one-period forecast errors for government spending from the OECD projection database on country's key macroeconomic variables, such as output, government spending, exchange rate, inflation, investment, and imports. By taking the residuals of this regression, they identify unanticipated fiscal shocks that are orthogonal (exogenous) to the country's contemporaneous macroeconomic conditions. These residuals are normalized by the

[10] While Romer and Romer (2010) considered the effect of exogenous increases in tax, we adjust the sign so that we consider an exogenous tax cut (or an increase in revenue). Thus we measure the effect of expansionary fiscal shocks in both cases.

nominal GDP of each country. AG shocks are constructed on a semiannual basis since the OECD's forecasts data are available at this frequency and they are available from 1985 to 2010.[11]

IV. EMPIRICAL ANALYSIS

A. Local Projection Method

We use Jordà's (2005) local projection method to assess the dynamic effect of domestic fiscal shocks on cross-border bank lending. The local projection method has been advocated by Auerbach and Gorodnichencko (2012b) and Ramey and Zubairy (2018) among others, as a flexible alternative to VAR specifications because it accommodates state dependence easily and does not impose the implicit dynamic restrictions involved in VARs. The local projection does not constrain the shape of the impulse-response functions, rather than imposing the pattern generated by structural VARs.[12] Particularly in this paper, we adopt the local projection over commonly used VAR models to construct an impulse-response function for four reasons.

First, the exogenous shocks we borrowed from the literature are either constructed by a narrative approach (Romer and Romer, 2010 and Ramey and Zubairy, 2018) or already orthogonalized to the contemporaneous macroeconomic conditions by controlling for macroeconomic forecasts (Auerbach and Gorodnichencko, 2012b). Therefore we do not need to identify fiscal shocks further using restrictions in VAR models—a common approach in empirical analysis. Second, our estimation entails a large bilateral international panel dataset with the constellation of the fixed effects, which prevents a direct application of standard VAR models. Thus the local projection method obviates the need to estimate the equations for dependent variables other than the variable of interest (e.g., cross-border lending), thereby economizing on the number of estimated parameters significantly.

Third, the local projection method is particularly suited to estimating nonlinearities effects (for example, how the effect of fiscal shocks differs during expansions and recessions), as its application is much more straightforward compared to complex non-linear structural VAR models, such as Markov-switching, threshold-, or smooth transition-VAR models. Moreover, we can incorporate directly various features of recipient economies, such as the exchange rate regime or capital account openness into the local projection method. Lastly, the error term in following panel

[11] The OECD's forecasts for major macroeconomic variables such as GDP and government spending are prepared twice a year, June and December. Times series of the forecasts consistently start from 1984 for "old" members of the OECD including the U.S., and from mid-1990s for relatively new members (e.g., Poland).

[12] Under the maintained assumption that the structural VAR is correctly specified, the patterns should be the same.

estimations is likely to be correlated across countries. This correlation would be difficult to address in the context of nonlinear VAR models, but it is easy to handle in a linear estimation by either clustering standard errors by time period or using Driscoll- Kraay (1998) standard errors (Auerbach and Gorodnichencko, 2012b).

The local projection method simply requires estimation of a series of regressions for each horizon *h* for each variable. We first present the general framework in a panel context and then derive the simplified version for the U.S. analysis.

Following Auerbach and Gorodnichencko (2012b) and Auerbach and Gorodnichencko (2013), we run a series of regressions for different horizons, $h = ,1,2, ..., H$ as follows:

$$Y_{i,j,t+h} - Y_{i,j,t-1} = \alpha_{i,j}^{h} + \alpha_{j,t}^{h} + \beta^{h} Fshock_{i,t} + \sum_{p=1}^{n} \gamma^{h} X_{i,j,t-p} + \varepsilon_{i,j,t+h}, \quad (1)$$

where *i* and *j* indicate the reporting ('source') and counterparty ('recipient') countries, respectively; $Y_{i,j,t}$ is the log of cross-border lending from global banks located in a country *i* to borrowers in countries *j* in time *t*; $Fshock_{i,t}$ is a measure of exogenous fiscal shock in a country *i*. $X_{i,j,t}$ is a set of control variables including lags of the dependent variable $Y_{i,j,t}$ and lags of the fiscal shocks; $\alpha_{i,j}^{h}$ is source-recipient country fixed effect and $\alpha_{j,t}^{h}$ is a recipient-time fixed effect. β^{h} is the coefficient of interest. We gauge the dynamic effect of fiscal shocks on cross-border bank lending by tracing β^{h} over *h*-horizons.[13]

The advantages of having a bilateral panel dataset are threefold. First, it mitigates concerns about reverse causality. While it is difficult to identify causal effects of country-specific shocks using aggregate capital flows, it is much more likely that domestic fiscal shocks in a country *i* affect cross-border bank lending towards a particular country *j* than the other way around. Second, the inclusion of the fixed effects $\alpha_{i,j}^{h}$ specific to a country pair of a source country *i* and a recipient country *j* allows us to control for any unobserved time-invariant characteristic between two countries, such as a set of gravity factors widely used in the trade literature.[14] Third, the inclusion of recipient country-time fixed effects allows us to control for any macroeconomic shocks affecting recipient countries, including external and idiosyncratic recipient-specific shocks as well as the indirect impact of fiscal

[13] We also include a linear time trend, but it hardly changes the estimation results.

[14] The inclusion of $\alpha_{i,j}^{h}$ is more flexible than controlling for any set of common time-invariant regressors, as those commonly used in the Gravity model of international finance (Okawa and van Wincoop, 2012) and controls simultaneously for any time-invariant characteristics specific to a country *i* and a country *j*, respectively.

expansion trough other recipient countries. It also maximizes the sample coverage of our analysis because some recipient countries do not necessarily have data on control variables.

Any empirical investigation of international capital flows must note that variations in flows reflect not only supply factors (i.e., push factors) in source countries, but also demand factors (i.e., pull factors) in recipient countries because demand for credit is also responsive to changes in macroeconomic conditions, including fiscal shocks in (especially large) foreign countries. We exploit the dyadic structure of the LBS data—that is, multiple reporting countries linked to multiple counterparties—to control for unobserved time-variant factors in a recipient country, thereby controlling for all possible demand-side factors effectively. Together with the exogenous nature of fiscal shocks that we borrowed from recent studies, the dyadic structure of the LBS data achieves a clean identification of cross-border fiscal spillovers, largely immune to any endogeneity issues.

B. Analysis of Financial Spillover of U.S. Fiscal Shocks

In this section, we analyze the effect of domestic fiscal shocks on cross-border bank lending from the U.S. economy because of its wider coverage of data compared to other advanced economies and its significance in the global economy. We estimate the following model of the U.S. economy, which can be considered as a dynamic version of Feyrer and Shambaugh (2012) who study the cross-border spillover of exogenous U.S. fiscal shocks identified by Romer and Romer (2010) on current account and investment of hundreds of countries in the world:

$$y_{j,t+h} - y_{j,t-1} = \alpha_j^h + \beta^h Fshock_t + \sum_{p=1}^{n} \gamma^h X_{j,t-p} + \varepsilon_{j,t+h}, \quad (2)$$

where $y_{j,t}$ is the log of exchange rate-adjusted cross-border claims from the U.S. located global banks to borrowers in countries *j* in time *t*; $Fshock_t$ is a measure of U.S. fiscal shocks: RZ or RR shocks. $X_{j,t}$ is a set of control variables including lags of the dependent variable $y_{j,t}$, fiscal shock variable $Fshock_t$, and lags of control variables in the recipient country *j*. The inclusion of recipient country macroeconomic variables controls for factors affecting credit demand, thereby further alleviating any remaining endogeneity concerns. We control for real GDP growth and the policy rate in recipient countries.[15] α_j^h is a recipient country-fixed effect, which controls unobserved time-invariant characteristics specific for a country *j*. Following Auerbach and Gorodnichencko (2012b) and Feyrer

[15] When policy rates are not available, we use interbank rates. When interbank rates are not available, we use money market rates.

and Shambaugh (2012), standard errors are clustered by time to account for the fact that the shock is identical for all countries in any given period.

As discussed above, we use two sets of the identified U.S. fiscal shocks from the recent literature. Our benchmark is data on quarterly government spending shocks constructed by Ramey and Zubairy (2018). While we use data on quarterly tax shocks collected by Romer and Romer (2010) for a robustness check, one should note that adjustments in government spending and taxes do not need to have symmetric effects (Mountford and Uhlig, 2009; Alesina and Ardagna, 2010). Following Romer and Romer (2010) and Auerbach and Gorodnichencko (2012b), we normalize the size of fiscal shocks by the size of GDP in the last period to rule out the contemporaneous fiscal multiplier effect. Equation (2) is estimated for h=0, 1, 2, …, 7 so that we trace the dynamic effect of fiscal shocks over two years.

After dropping outliers and missing observations following the criterion explained above, our baseline estimation of the U.S. fiscal shocks includes cross-border lending to 45 recipient countries.[16] In the baseline analysis, we use four lags of control variables in $X_{j,t}$ (i.e., $n = 4$), but the selection of the lag length does not affect our findings in a meaningful way. When using RR shocks, our estimation period covers until 2007Q4. We first present the regression results by estimating equation (2) using both measures of fiscal shocks then plot the impulse-response functions to ease interpretation of our findings.

Baseline results

Table 3 summarizes the regression coefficients with their statistical significance and the goodness of fit of the baseline estimation. For both RZ shocks in panel A and RR shocks in panel B, the inclusion of the recipient country-fixed effect results in quite high R-squared values, which is typical in this type of panel analyses. The coefficients on the lagged dependent variable are negative and highly statistically significant, suggesting that the growth of the dependent variable is mean-reverting. The coefficients on a recipient country's real GDP growth are positive and statistically significant in most cases, which is consistent with the stylized fact that local economic growth is a strong pull factor of international capital flows.

[16] Global banks in the U.S. do not report cross-border claims in Estonia, Latvia, Slovenia, and Ukraine among the countries presented in Table 1.

Somewhat strangely, the sign on a recipient country's policy rate is largely negative and significant, suggesting that global banks in the U.S. lend less to a country with a higher domestic policy rate in response to U.S. fiscal shocks. However, this result is driven by emerging market recipient economies where the interest rate is countercyclical. In such economies, a higher interest rate often signals economic recessions or financial crises due to an increase in the higher risk premium. When we restrict our recipient countries to be advanced economies only, we find a positive and statistical coefficient on the recipient country's policy rate.

Most importantly, we find that expansionary fiscal shocks increase cross-border bank lending from the U.S. and this effect is not only statistically but also economically significant. One percent of GDP increase in RZ's exogenous government spending leads to about a 3.3 percent increase in cross-border bank lending after two quarters. The effect is somewhat larger for revenue shocks, with a decrease in RR's exogenous tax change of one percent of GDP increasing cross-border bank lending by 5.6 percent at the peak (after one year).[17] However, one should note that the size of a typical exogenous spending shock is much larger than a typical exogenous revenue shock as shown in Figure 3, implying that an exogenous tax cut of one percent of GDP is an unusually large shock. Overall, our findings shed new light on the international spillovers of domestic fiscal shocks via cross-border banking flows in the financially-integrated world.

Figure 4 visualizes the dynamic response of cross-border bank lending already presented in Table 3. The left panel in Figure 4 shows the response using RZ's government spending shocks, while the right panel shows the response using RR's exogenous tax shocks. While we obtain a wider confidence band from using RR's exogenous shocks, it is not surprising that we only have nine RR's exogenous shocks during our sample period. For the rest of the paper, we report the impulse response functions rather than estimation tables to ease interpretation.

Robustness checks

In this section, we test the robustness of the finding that expansionary domestic fiscal shocks in the U.S. economy have strong international spillovers via an increase in cross-border bank lending from the U.S. We investigate the sensitivity of our results to (i) the inclusion of domestic control variables, (ii) different lag length selections, (iii) an alternative way of computing standard errors, and

[17] The larger effect on cross-border bank lending of a tax cut than government spending—when they are measured as a share of GDP—is in line with the finding of Mountford and Uhlig (2009) that deficit-financed tax cuts have a larger effect on GDP than deficit-financed spending.

(iv) controlling for bilateral imports. To save space, the impulse response functions are presented in the appendix, and we discuss them only briefly in the main text.

Because our measures of fiscal shocks are purged of their expected components, we do not control for any other macroeconomic variables in the U.S. economy in the baseline analysis. However, we still control for various factors that are known to affect cross-border banking flows to confirm the exogeneity of fiscal shocks. Based on the extensive literature on international capital flows, we consider the four lags of the following set of controls: real GDP growth, stock market growth (S&P500), the CPI inflation rate, the monetary policy rate (Federal Funds rate), and nominal effective exchange rate growth.[18] As shown in Figure B.1 in the appendix, the inclusion of additional control variable does not result in any material changes in the impulse response functions, lending support to the exogeneity of the identified fiscal shocks we used.

We have used four lags of the dependent variables and control variables given the quarterly frequency of the data. We demonstrate that our findings do not depend critically on the selection of lag length by showing the estimation results alternatively using eight lags. Figure B.2 in the appendix confirms that our results hardly change with the selection of lag length.[19]

While we have clustered standard errors at the time level in the baseline specification, we test the robustness of our findings by clustering standard errors at the recipient country level or the multilevel (both the recipient country- and time-level). We also use Driscoll-Kraay standard errors that allow arbitrary correlations of the errors across countries and time. We only report the results from using Driscoll-Kraay standard errors in Figure B.3 in the appendix to save space, but standard errors clustered by the recipient country-level and time-level are largely similar to those clustered by the time-level. In sum, the statistical significance of our findings does not hinge on the way we account for the correlations in the standard errors.

Our use of recipient country-fixed effect and a recipient country's macroeconomic variables cannot fully control for potential time-varying factors affecting cross-border banking flows at the bilateral level. One obvious candidate of such factors is bilateral trade flows between the U.S. and its counterpart countries. This variable is particularly relevant for the study of international capital flows, as the current account and the financial account are tightly related by the accounting identity, and the

[18] See Choi and Furceri (2018) for detailed discussions on choosing control variables.

[19] We also test the robustness of our results using two lags and find that the impulse response functions are very similar. To save space, this result is available upon request.

trade balance is a major determinant of the size of the current account. Moreover, Auerbach and Gorodnichencko (2013) show that a certain factor of government purchases translates (directly or indirectly) into imports from other countries, which stimulate demand in those countries.

While our use of the variable corresponding to only a subset of total capital flows—the sum of direct investment, portfolio equity, and debt, and other investment flows—mitigates this criticism,[20] we test the robustness of our findings by adding extra control variables capturing bilateral trade flows. We take bilateral trade flow data from the IMF Directions of Trade Statistics. We add the growth of U.S. imports (and their lags) from a country *j* and re-estimate equation (1). Figure B.4 shows that our results are nearly identical when controlling for the bilateral import channel, consistent with the finding from Choi and Furceri (2018) that bilateral banking flows are largely independent of trade flows.[21]

What is a cross-border transmission mechanism of fiscal shocks?

How do we interpret a significant increase in cross-border bank lending in response to domestic fiscal shocks? In this section, we investigate the international transmission mechanism of fiscal shocks through the lens of the traditional Mundell-Fleming channel and the monetary accommodation channel. Using a similar local projection approach applied to the U.S. data only, we estimate the effect of exogenous fiscal shocks on the domestic real effective exchange rate and real interest rate, respectively. To the extent that these shocks are orthogonal to the contemporaneous macroeconomic conditions of the U.S. economy, we do not need to control for other variables:

$$y_{t+h} - y_{t-1} = \alpha^h + \beta^h Fshock_t + \sum_{p=1}^{n} \gamma^h X_{t-p} + \varepsilon_{t+h}, \quad (3)$$

where Y_t is either the log of real effective exchange rate or the real policy rate (the Federal Funds rate minus the realized annual CPI inflation rate) in time *t*; X_t is a set of control variables including lags of the dependent variable y_t and fiscal shock variable $Fshock_t$.

Figure 5 shows the dynamic responses of each variable to both fiscal shocks during the sample period. First, we do not find evidence for the traditional Mundell-Fleming channel, as real exchange rate depreciates, not appreciates after expansionary spending and revenue shocks (in Panel A).

[20] The category "other investment" is the residual in the balance of payment statistics and includes in particular loans, currency and deposits, and trade credits.

[21] Our conclusions hardly change when we use export growth instead of import growth.

However, such real depreciation following U.S. fiscal shocks is consistent with many recent studies using structural VARs (Kim and Roubini, 2008; Monacelli and Perotti, 2010; Enders, 2011; Ravn, 2012). On the other hand, we find some evidence for the monetary accommodation channel, as shown in Panel B of Figure 5. Monetary authorities tend to lower the policy interest rate by a cumulative 50 (200) basis points in the year following a spending (or revenue) shock of one percent of GDP.

To shed more light on the transmission channel of fiscal shocks, we re-estimate equation (2) using domestic banks' net foreign asset position, which corresponds to the current account balance conceptually. Thus changes in the net foreign asset position of the domestic banking sectors account for a part of current account dynamics in response to fiscal shocks. We normalize the net foreign asset position (bilateral cross-border claims minus liabilities) by the recipient country's lagged nominal GDP (i.e., $Y_{j,t} = \frac{claims_{j,t} - liabilites_{j,t}}{GDP_{j,t-1}}$), while most empirical studies on the domestic effect of fiscal shocks normalize the current account balance by the size of own GDP.[22]

Figure 6 shows the response of net foreign asset position in response to both types of fiscal shocks. Consistent with the empirical literature finding the improvement in the current account after domestic fiscal expansion, we find that net foreign asset position by the domestic banking sector increases significantly. Figure B.5 in the appendix also plots the response of cross-border borrowing separately by replacing the log of exchange rate-adjusted cross-border claims in equation (2) with the log of exchange rate-adjusted cross-border liabilities. Cross-border borrowing does not respond significantly to fiscal shocks, suggesting that an increase in net foreign asset position found in Figure 6 is mostly driven by an increase in assets.

In sum, the monetary-fiscal policy interaction seems to be the important determinant of the cross-border spillover of fiscal shocks. A decline in the domestic policy rate in response to domestic fiscal expansion makes lending to foreign borrowers more attractive for domestic banks if everything else equal. As a result, cross-border lending (outflows) from the domestic banking sector exceeds cross-border borrowing (inflows) of the domestic banking sector, increasing its net foreign asset position (corresponding to current account improvement) and the real depreciation of the domestic currency. Our results are related to the findings that monetary accommodation plays a crucial role in determining the expansionary effect of fiscal policy. For example, Coenen et al. (2010) find that monetary accommodation is an important determinant of the size of fiscal multipliers in seven

[22] Unlike the previous case of cross-border asset positions, we cannot take the log of net position. Instead, we normalize the net position by the size of a recipient country's GDP: $Y_{j,t} = \frac{claims_{j,t} - liabilites_{j,t}}{GDP_{j,t-1}}$ and $Y_{j,t+h} = \frac{claims_{j,t+h} - liabilites_{j,t+h}}{GDP_{j,t-1}}$.

different structural models used in policymaking institutions. Davig and Leeper (2011) also show in a DSGE model with nominal rigidities that the effect of fiscal policy differs substantially depending on whether monetary policy is active or passive.

Sign of the shocks, recessions vs. expansions

So far we have found robust evidence that an expansionary U.S. fiscal shock increases cross-border bank lending from the U.S. However, there is vast empirical evidence that the effect of fiscal shocks on output (i.e., fiscal multipliers) is nonlinear (Perotti, 1999; Auerbach and Gorodnichencko, 2012a and 2012b; Caggiano et al., 2015). Thus, the average response of cross-border bank lending we found may mask substantial heterogeneity depending on the underlying economic regime (good vs. bad times) or a type of shocks (fiscal stimulus vs. fiscal austerity). We estimate various nonlinear versions of equation (2) to account for this possibility. For the remaining exercises, we focus on the measure of RZ shocks, as it allows more data to estimate nonlinear models with a larger set of parameters to be estimated and it is conceptually consistent with AG's spending shocks used in the analysis of small open economies. The results obtained with RR's revenue shocks are qualitatively similar and available upon request.

We estimate the following equation in which the dynamic response is allowed to vary with the state of the economy:

$$y_{j,t+h} - y_{j,t-1} = \alpha_j^h + F(z_t)\left(\sum_{p=1}^{n} \gamma_R^h X_{j,t-p} + \beta_R^h Fshock_t\right) + (1 - F(z_t))\left(\sum_{p=1}^{n} \gamma_E^h X_{j,t-p} + \beta_E^h Fshock_t\right) + \varepsilon_{j,t+h} \quad (4)$$

with $F(z_t) = \frac{exp(-\theta z_t)}{1+exp(-\theta z_t)}$ and $\theta > 0$,

where z_t is an indicator of the state of the economy normalizd to have zero mean and unit variance. The estimated parameters depend on the average behavior of the economy in the historical sample between *t* and $t+h$, given the shock, the initial state, and the control variables. The parameter estimates on the control variables incorporate the average tendency of the economy to evolve between states. Therefore, the estimates incorporate both natural transitions and endogenous transitions from one state to the other that occur on average in the data. The indicator of the state of the economy is the five-quarter moving average of real GDP growth and $F(z_t)$ is a smooth transition function used to estimate the effect of fiscal shocks in expansions versus recessions.[23] We choose $\theta = 1.5$ following

[23] The results, available upon request, are similar when considering a measure of output gap instead.

Auerbach and Gorodnichencko (2012a) so that the economy spends about 20 percent of the time in a recessionary regime.

This approach is equivalent to the smooth transition autoregressive model developed by Granger and Terävistra (1993) and has following advantages. First, compared with a model in which each dependent variable would interact with a measure of the business cycle position, it permits a direct test of whether the effect of fiscal shocks on cross-border banking flows varies across different regimes. Second, compared with estimating structural VARs for each regime, it allows the effect of fiscal shocks to change smoothly between recessions and expansions by considering a continuum of states to compute the impulse response functions, thus making the response more stable and precise. Third, we can use our full sample for estimation, which makes our estimates as precise and robust as possible. As shown in Figure 7, the probability of a recession regime we estimate using a smooth transition function captures well the official NBER recession dates.

The coefficients β_E^h and β_R^h trace the dynamic response to fiscal shocks when the economy is in recessions and expansions, respectively. Figure 8 contrasts the dymaic responses during recessions and expansions using RZ's spending shocks. Consistent with the existing empirical evidence regarding the size of fiscal multipliers, the average response of cross-border bank lending to an increase in government spending in Figure 4 also masks substantial heterogeneity depending on the underlying economic regime. Spillovers tend to be larger in the short-term when fiscal expansion in the source economy is undertaken during the period of slack. This larger effect is consistent with the prevailing empirical evidence of larger fiscal multipliers in recessions.

In principle, expansionary fiscal shocks do not need to be symmetric to contractionary fiscal shocks. In other words, the adverse effect of fiscal consolidation on cross-border banking flows may be larger than the positive effect of the same size of fiscal expansion. To test whether the effect is different between an increase and a decrease in government spending we estimate the following specification:

$$y_{j,t+h} - y_{j,t-1} = \alpha_j^h + \beta_+^h D_t Fshock_t + \beta_-^h (1 - D_t) Fshock_t + \sum_{p=1}^{n} \gamma^h X_{j,t-p} + \varepsilon_{j,t+h}, \qquad (5)$$

where D_t is a dummy variable that takes a value of one for an increase in government spending, and zero otherwise. Then we trace the coefficients β_+^h and β_-^h to gauge the effect of fiscal expansion and consolidation, respectively. The strong asymmetric responses are presented in Figure 9: the adverse effect of fiscal consolidation on cross-border bank lending is larger than the positive effect of the

same size of fiscal expansion in an absolute term, suggesting that fiscal consolidation in the U.S. has a more negative spillover effect into other countries than the one implied by the baseline estimation.

Recipient countries' status

In this section, we focus on a recipient country's status and ask whether certain types of status amplify or dampen the positive effect on cross-border bank lending of expansionary fiscal shocks we found in the previous section. Although previous studies have analyzed the role of a country's own characteristics in determining its size of fiscal multipliers (Ilzetzki et al., 2013; Kim, 2015), we contribute to the literature by offering the first kind of evidence on the role of counterparty characteristics in determining the size of cross-border fiscal spillovers.

Guided by the well-known trilemma in international finance that countries can pursue two of three options, fixed exchange rates, domestic monetary autonomy, and capital mobility (Mundell, 1963; Obstfeld et al., 2005), we ask whether the exchange rate regime and capital openness affect the size of international fiscal spillovers. Although international fiscal spillovers *per se* could be beneficial for recipient countries without own fiscal space in stimulating aggregate demand, they might equally have a de-stabilizing effect if fiscal consolidation in a large and systematic economy is directly exported to a country in needs of external financing. The fact that recipient countries can experience volatility for reasons independent of domestic policies makes answering this question particularly relevant from a policymaker's point of view.

Again, compared to structural VARs, the local projection method allows for a straightforward interaction between fiscal shocks and recipient country characteristics. We estimate the following equation with a minor variation from equation (5):

$$y_{j,t+h} - y_{j,t-1} = \alpha_j^h + \beta_1^h D_{j,t} Fshock_t + \beta_2^h (1 - D_{j,t}) Fshock_t + \sum_{p=1}^{n} \gamma^h X_{j,t-p} + \varepsilon_{j,t+h}. \quad (6)$$

The only difference from equation (5) is that now we interact $Fshock_t$ with an indicator variable regarding the status of each recipient country in time *t* ($D_{j,t}$) and $X_{j,t}$ also includes the four lags of $D_{j,t}$. For example, when testing the role of exchange rate regimes, $D_{j,t}$ takes a value of one if a recipient country *j* is classified as a fixed exchange rate regime (peg) with respect to the U.S. in time *t*, and zero, otherwise.

We use the updated version of binary regime classification by Shambaugh (2004) to sort out *de facto* pegged and floating countries. In Shambaugh's classification, a country is classified as

pegged if its official nominal exchange rate stays within ±2 perecentage bands over the course of the year against the base country. The base country is chosen based on the declared base, the history of a countries' exchange rate, by comparing its exchange rate to a variety of potential bases, and by looking at dominant regional currencies. Non-pegs are also assigned a base determined by the country they peg to when they are pegging at other times in the sample. The floating regime does not necessarily include pure floats only but includes all sorts of non-pegged regimes.[24] In the analysis of the international panel data in the following section, we also consider country-specific base currencies other than the dollar and the introduction of the euro.[25]

For the case of capital account openness, we use the updated version of Chinn-Ito index (Chinn and Ito, 2008). This index is a widely-used *de facto* measure of the country's capital controls and available back to 1970 for a large number of countries. We focus on the KAOPEN measure of capital controls in Chinn and Ito (2008), updated in July 2017. KAOPEN is based on the four binary dummy variables that codify the tabulation of restrictions on cross-border financial transactions reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions: (i) capital account openness; (ii) current account openness; (iii) the stringency of requirements for the repatriation and/or surrender of export proceeds; and (iv) the existence of multiple exchange rates for capital account transactions. KAOPEN index's main merit is that it attempts to measure the intensity of capital controls insofar as the intensity is correlated with the existence of other restrictions on international transactions.

Figure 10 reports the spillover effects of U.S. fiscal shocks across recipient countries depending on their exchange rate regime. If anything, the results suggest that the short-term response (after a quarter) tend to be larger in countries with currencies pegged to the U.S. dollar. However, the standard errors for pegged countries are fairly large,[26] leaving the difference between the two groups statistically insignificant. Overall, these results are consistent with Rey (2015), which argues that

[24] We download the updated annual dataset from Shambaugh Exchange Rate Regime Classification and use the most basic measure of the exchange rate regime employed in Shambaugh (2004). https://www2.gwu.edu/~iiep/about/faculty/jshambaugh/Shambaughexchangerate.pdf provides further details on the construction of the dataset.

[25] The base countries for pegs are obvious; the base for nonpegs, while conceivably difficult to isolate, are in fact almost equally obvious. Most countries generally only peg to one country during the sample and nearly all peg at some point, thus revealing the base. Further, those that do switch bases, tend to switch directly from one peg to another (e.g., Ireland in 1979), so no ambiguous middle float exists. For the few countries that do not peg, currency history is used and the dollar in very rare cases (Japan) where no obvious other choice exists. After the introduction of the euro, all euro-zone countries in our sample are treated as pegged to each other.

[26] Only a quarter of recipient country-time observations is classified as a pegged regime.

cross-border financial spillovers are *similar* for fixed and flexible exchange rate countries—implying the irrelevance of the exchange rate regime in determining the size of capital flows.

Figure 11 presents the results for capital account openness. As the trilemma in international finance predicts, the effect is smaller for countries with a relatively low degree of current account openness, indicating that capital controls can dampen cross-border spillovers of fiscal shocks. Lastly, we test whether the spillovers differ depending on the level of development of a recipient country: advanced vs. emerging market economies.[27] Interestingly, the difference in the impulse response functions between advanced and emerging market economies (shown in Figure B.6 in the appendix) is similar to that between financially open and closed countries in Figure 11. Indeed, capital openness for advanced economies is on average is twice higher than emerging market economies during our sample period, suggesting that it is difficult to identify the relevance of the level of development from the capital openness channel within our empirical framework separately.

C. Analysis of Fiscal Shocks for other Small Open Economies

We test whether the spillover-effect of domestic fiscal shocks via the cross-border bank channel can be generalized to a group of small open economies using the semi-annual data of exogenous government spending shocks by Auerbach and Gorodnichencko (2012b). While the textbook theory predicts a stark difference between closed and open economies regarding the effect of fiscal expansion on domestic economic variables, such as the interest rate, private investment, the exchange rate, and net exports, the impact on cross-border banking flows falls into an area of empirical questions.

In the baseline analysis, we estimate equation (1) using the dyadic data between 16 source countries and their (maximum of) 49 recipient countries. Again, Table 1 lists both source and recipient countries and their relevant characteristics for our analysis. In the baseline analysis, we use two lags of control variables in $X_{i,j,t}$ (i.e., $n = 2$). Our baseline estimation covers an unbalanced panel of 624 reporter-counterparty country pairs from 1990 to 2010. Figure 12 plots the distribution of exogenous government spending shocks in 16 OECD countries, showing that positive and negative exogenous spending shocks exist nearly equally in the data. Table 4 shows the average size and standard deviation of country-specific exogenous spending shocks, together with the correlation with U.S. exogenous spending shocks. The size of exogenous spending shocks—measured by the standard deviation—is quite similar across countries, while the correlation with U.S. fiscal shocks is fairly

[27] The classification of counties in advanced and merging market economies follows the IMF World Economic Outlook.

heterogenous—ranging from -0.445 in the U.K. to 0.413 in Denmark—, suggesting an idiosyncratic nature of the identified shocks.

Baseline results

Figure 13 shows the response of cross-border lending to their exogenous spending shocks. Consistent with the U.S. evidence, we find positive and significant effects of an exogenous increase in government spending on cross-border bank lending in the case of 16 OECD countries. One percent of GDP increase in exogenous government spending leads to an about 9 percent increase in cross-border bank lending after two years, suggesting that the effect of fiscal spillovers on cross-border bank lending is not only statistically but also economically significant among small open economies.[28] We check the role of the various fixed effects in estimating the above impulse response functions by re-estimating the equation with (i) the source-recipient fixed effect only and (ii) the recipient-time fixed effect only. Figure B.7 in the appendix shows that an increase in cross-border bank lending is very robust to the different combination of the fixed effects.

Similar to the analysis of U.S. fiscal shocks, we conduct the following sensitivity tests: (i) controlling for other domestic macroeconomic variables, such as real GDP growth, stock market growth, the CPI inflation rate, the monetary policy rate, and nominal exchange rate growth; (ii) alternative standard error clustering; (iii) including more lags; and (iv) controlling for bilateral import growth. Our findings are largely unaffected by these alternative specifications, and the results are available upon request.

We also investigate potential nonlinearities in international fiscal spillovers by estimating dyadic versions of nonlinear equations (4) and (5) in turn. Following Auerbach and Gorodnichencko (2012b), we use 1.5 year moving average of real GDP growth to construct $z_{i,t}$, a country-specific indicator of the state of the economy in the case of semi-annual international panel data. Again, we trace the coefficients β_E^h and β_R^h to measure the dynamic response to fiscal shocks when the economy is in recessions and expansions, respectively. Figure 14 contrasts the dymaic responses during recessions and expansions using AG fiscal shocks, which share a similar pattern found in the analysis of the U.S. economy using RZ shocks: short-run positive spillovers are stronger during recessions

[28] One should note that the nature and the size of AG's exogenous shocks differ from those of RZ's exogenous shocks. As shown in Table 4, the typical AG's spending shock among 16 OECD countries is much smaller than RZ's US's spending shocks.

than expansions. Nevertheless, we cannot provide a definite answer due to the large confidence intervals surrounding the estimates

Figure 15 also confirms the finding from the analysis of the U.S. economy where the negative effect of fiscal consolidation on cross-border bank lending is larger than the positive effect of the same size of fiscal expansion in an absolute term. To the extent that most countries in our sample are European countries, this finding corroborates the concerns over the negative cross-border spillover to their trading partners by recent fiscal consolidation adopted by many European economies (Goujard, 2017; Poghosyan, 2017). Our contribution is to highlight financial linkages as a transmission channel, in addition to trade linkages emphasized in the previous studies.

Figure 16 and 17 report the results from estimating small open economies counterpart to the results from the U.S. economy presented in Figure 10 and 11. The specification we use here mirrors the earlier ones. In Figure 16, we do not find strong statistical evidence that the effects depend on the recipient countries' exchange rate regime, consistent with the evidence from the U.S. Figure 17 presents the results for capital account openness. In this case, the effects are not statically different between countries with relatively high and low degree of current account openness. While it may seem odd that even countries with relatively high capital controls are affected by changes in foreign fiscal policies, it is also the case that few countries with capital controls truly shut off access to capital markets. In addition, the results are consistent with some studies suggesting that capital controls tend to have a significant effect on the composition of capital flows but more limited effects on the overall magnitude (e.g., Edwards, 2007).

V. CONCLUSION

The Global Financial Crisis re-enkindled the debate on the role of fiscal policy as a key stabilization tool and on the potential of fiscal policy to affect economic activity in other economies through cross-border spillovers. To what extent fiscal policies spill over into other countries is a key question in the current context of fiscal expansion in large and systemic economies such the U.S. While previous studies have typically analyzed the existence of fiscal spillovers through trade linkages, less is known about the magnitude of fiscal spillovers through financial linkages. This paper contributes to this literature by providing the first analysis—to the best of our knowledge—of the international spillovers of domestic fiscal shocks via the cross-border bank lending channel. Our analysis on both gross flows and net flows allows us to identify a potential source of current account improvement following an expansionary fiscal shock and contributes to the emerging literature

emphasizing gross capital flows as a new determinant of global financial stability (Obstfeld, 2012; Broner et al., 2013).

By investigating the cross-border spillovers of exogenous fiscal shocks in both the U.S. and 16 other small open economies, we document that fiscal policies in one country have economically and statistically significant effects on cross-border bank lending to other economies and these effects are largely independent of trade linkages. Overall, the strength of the short-term spillovers is larger when fiscal expansion in source countries is undertaken during periods of weak economic activity. In addition, the effect of fiscal consolidation is typically larger than that of same-magnitude fiscal expansion. These results suggest that coordination of fiscal policies is more valuable than previously thought.

The results of the paper also speak to the policy debate on the ability of the economies to dampen capital inflows, thereby mitigating potential negative externalities. We find some suggestive evidence that capital controls are effective in moderating capital inflows, although no definitive statements can be made due to large standard errors. We also find that spillovers tend to be similar between recipient countries' exchange rate regime, suggesting—as argued by Rey (2015)—that the exchange rate regime is mostly irrelevant for cross-border financial spillovers. Overall, the relatively symmetric responses across different country types corroborate the conclusion of Caselli and Feyrer (2007) that financial returns to capital are largely equalized across countries.

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Tables and Figures

Table 1. List of countries in the international panel analysis

Source countries	=1 if advanced economy	=1 if open	=1 if peg	Recipient countries	=1 if advanced economy	=1 if open	=1 if peg
Australia	1	0.85	0.00	Argentina	0	0.85	0.00
Austria	1	0.92	1.00	Australia	1	0.85	0.00
Belgium	1	0.90	0.95	Austria	1	0.92	1.00
Canada	1	0.37	0.09	Belgium	1	0.90	0.95
Denmark	1	0.95	0.95	Brazil	0	0.18	0.00
Finland	1	0.92	0.55	Bulgaria	0	0.37	0.50
Germany	1	1.00	0.00	Canada	1	1.00	0.09
Italy	1	0.85	0.64	Chile	0	0.37	0.00
Japan	1	0.99	0.00	China	0	0.12	0.77
Korea	1	0.36	0.14	Colombia	0	0.19	0.00
Mexico	0	0.57	0.09	Czech Republic	1	0.75	0.00
Netherlands	1	1.00	1.00	Denmark	1	0.95	0.95
Portugal	1	0.80	0.59	Estonia	1	0.99	1.00
Spain	1	0.80	0.59	Finland	1	0.92	0.55
Sweden	1	0.89	0.09	France	1	0.85	0.95
United Kingdom	1	1.00	0.00	Germany	1	1.00	0.00
United States	1	1.00	0.00	Greece	1	0.61	0.45
				Hungary	0	0.45	0.00
				India	0	0.17	0.09
				Indonesia	0	0.84	0.09
				Israel	1	0.52	0.00
				Italy	1	0.85	0.64
				Japan	1	0.99	0.00
				Korea	1	0.36	0.14
				Latvia	0	0.96	0.19
				Lithuania	0	0.99	0.82
				Malaysia	0	0.66	0.45
				Mexico	0	0.57	0.09
				Netherlands	1	1.00	1.00
				New Zealand	1	1.00	0.00
				Norway	1	0.79	0.09
				Pakistan	0	0.16	0.23
				Peru	0	0.73	0.00
				Philippines	0	0.40	0.09
				Poland	0	0.22	0.00
				Portugal	1	0.80	0.59
				Romania	0	0.31	0.00
				Russia	0	0.33	0.00
				Slovak Republic	1	0.34	0.00
				Slovenia	1	0.68	0.29
				South Africa	0	0.15	0.00
				Spain	1	0.80	0.59
				Sweden	1	0.89	0.09
				Thailand	0	0.40	0.41
				Turkey	0	0.26	0.00
				Ukraine	0	0.15	0.38
				United Kingdom	1	1.00	0.00
				United States	1	1.00	0.00
				Venezuela	0	0.43	0.32

Note: We compute the time-series average of the status regarding capital openness and exchange rate regime.

Table 2. Total cross-border claims and liabilities as a share of GDP

	Total cross-border claims as a share of GDP	Total cross-border liabilities as a share of GDP
Australia	65.20	165.13
Austria	382.88	227.47
Belgium	571.81	441.18
Canada	88.99	66.26
Denmark	197.52	229.40
Finland	502.87	595.53
Germany	289.92	130.79
Italy	101.95	127.21
Japan	162.92	72.29
Korea	31.03	71.46
Mexico	5.44	7.32
Netherlands	524.19	469.70
Portugal	224.71	184.77
Spain	135.20	171.35
Sweden	278.91	169.49
United Kingdom	643.95	379.29
United States	63.55	49.65

Note: Total cross-border claims and liabilities as a share of the domestic GDP in 2010Q4 under locational banking statistics with the residency principle.

Table 3. Baseline estimation results from a dynamic framework

A) Results using RZ spending shocks

	h=0	h=1	h=2	h=3	h=4	h=5	h=6	h=7
log cross-border claims (-1)	-20.669***	-25.949***	-30.738***	-25.116***	-27.173***	-34.676***	-39.455***	-34.739***
	(2.902)	(3.078)	(3.534)	(2.978)	(3.610)	(3.999)	(3.971)	(3.570)
log cross-border claims (-2)	10.430***	8.650**	17.530***	12.175***	9.892**	7.984	18.373***	10.541**
	(2.501)	(3.668)	(3.903)	(3.955)	(4.129)	(4.983)	(4.966)	(4.048)
Fiscal shock	2.581***	2.272***	3.271***	1.895	1.156	0.836	1.731	0.783
	(0.485)	(0.585)	(0.712)	(1.187)	(1.521)	(1.439)	(2.484)	(2.407)
Fiscal shock (-1)	0.874	1.617**	-0.005	-0.481	-0.861	0.208	0.421	0.703
	(0.564)	(0.659)	(1.019)	(1.525)	(1.521)	(2.403)	(1.921)	(2.076)
Fiscal shock (-2)	0.660	-0.381	-1.311	-1.448	-1.02	-1.415	-0.123	-0.943
	(0.493)	(0.535)	(1.036)	(1.314)	(2.048)	(1.829)	(2.170)	(2.145)
Recipient GDP growth	0.765**	0.544	1.083**	1.416**	1.393**	2.020***	2.249**	1.700*
	(0.307)	(0.451)	(0.472)	(0.626)	(0.684)	(0.755)	(0.859)	(0.917)
Recipient GDP growth (-1)	-0.051	0.521	0.638	0.428	1.218*	1.487*	0.942	1.357*
	(0.331)	(0.373)	(0.506)	(0.543)	(0.661)	(0.755)	(0.822)	(0.788)
Recipient GDP growth (-2)	0.411	0.970**	0.745	1.322**	1.577**	1.077	1.216	1.745**
	(0.277)	(0.374)	(0.497)	(0.627)	(0.691)	(0.721)	(0.803)	(0.740)
Recipient interest rate	-0.074***	-0.095***	-0.122***	-0.132**	-0.184***	-0.231***	-0.323***	-0.356**
	(0.022)	(0.031)	(0.044)	(0.055)	(0.063)	(0.074)	(0.112)	(0.144)
Recipient interest rate (-1)	-0.000**	-0.002***	-0.001***	-0.002***	0.000	0.000	-0.001	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Recipient interest rate (-2)	-0.002***	-0.001***	-0.002***	0.000	-0.001	-0.001***	0.000	-0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Obs	3,216	3,173	3,133	3,091	3,048	3,005	2,962	2,921
R-squared	0.082	0.095	0.117	0.109	0.132	0.156	0.191	0.207
Recipient country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

B) Results using RR revenue shocks

	h=0	h=1	h=2	h=3	h=4	h=5	h=6	h=7
log cross-border claims (-1)	-23.382***	-20.951***	-30.149***	-23.419***	-26.078***	-30.803***	-33.234***	-26.776***
	(2.909)	(2.718)	(4.011)	(3.133)	(3.591)	(4.245)	(3.452)	(3.752)
log cross-border claims (-2)	14.402***	5.152**	19.838***	14.611***	14.988***	8.822*	16.238***	3.832
	(2.881)	(2.403)	(3.862)	(3.841)	(4.229)	(5.154)	(3.618)	(5.314)
Fiscal shock	4.068**	3.400	5.151*	5.577	5.588*	1.291	2.674	2.869
	(1.569)	(3.200)	(3.102)	(4.556)	(3.021)	(3.799)	(3.880)	(6.439)
Fiscal shock (-1)	2.449	2.698	2.495	0.642	-0.023	-0.554	-1.513	0.487
	(2.634)	(2.757)	(3.954)	(2.580)	(2.826)	(3.333)	(5.326)	(5.909)
Fiscal shock (-2)	1.203	1.256	-1.553	0.168	-2.819	0.26	-1.956	-3.283
	(2.044)	(2.157)	(2.560)	(2.740)	(2.690)	(4.902)	(4.540)	(5.322)
Recipient GDP growth	0.184	-0.368	0.306	0.792	0.649	1.018	1.459**	1.083
	(0.303)	(0.496)	(0.451)	(0.536)	(0.615)	(0.663)	(0.734)	(0.812)
Recipient GDP growth (-1)	-0.263	0.195	0.462	0.365	0.863*	1.275**	0.959*	1.068
	(0.339)	(0.386)	(0.480)	(0.458)	(0.497)	(0.565)	(0.572)	(0.691)
Recipient GDP growth (-2)	0.477	0.906**	0.846	1.237**	1.817***	1.493***	1.541**	2.194***
	(0.295)	(0.392)	(0.519)	(0.538)	(0.549)	(0.549)	(0.636)	(0.614)
Recipient interest rate	-0.082***	-0.104***	-0.127***	-0.132**	-0.199***	-0.236***	-0.322**	-0.367**
	(0.025)	(0.039)	(0.048)	(0.054)	(0.076)	(0.088)	(0.131)	(0.175)
Recipient interest rate (-1)	-0.000**	-0.002***	-0.001***	-0.001***	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Recipient interest rate (-2)	-0.001***	-0.001***	-0.001***	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000	(0.000	(0.000)	(0.000)	(0.000)	(0.001)
Obs	2,746	2,747	2,749	2,747	2,745	2,744	2,738	2,741
R-squared	0.085	0.075	0.104	0.098	0.109	0.123	0.152	0.148
Recipient country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

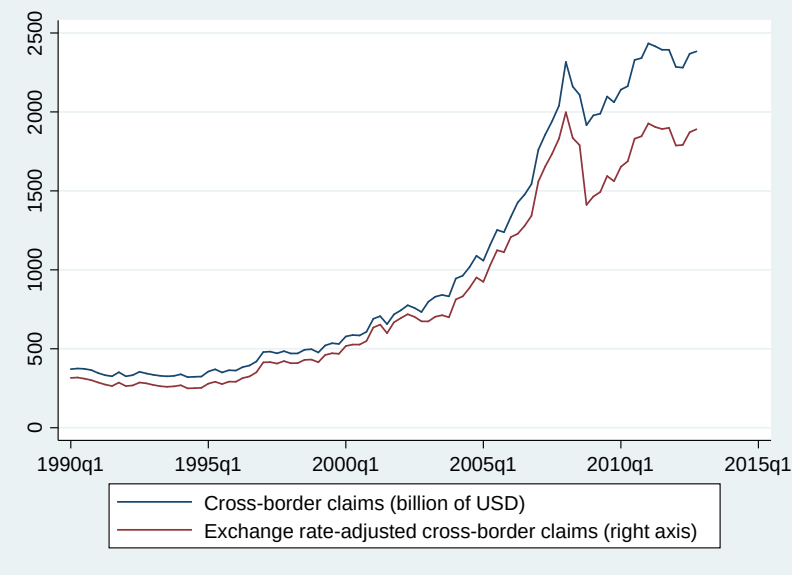
Note: Estimates are based on equation (2). Autocorrelation and heteroskedasticity-consistent standard errors are clustered at the time levels. *** denotes 1% significant level, ** denotes 5% significance level, and * denotes 10% significance level. To save space, we only report the estimation results for the first two lags out of the four lags used in the estimation.

Table 4. Summary of exogenous spending shocks in 16 OECD countries: 1990-2010

Source country	Mean	Standard deviation	Correlation with U.S. shocks	Obs
Australia	-0.004	0.189	0.083	29
Austria	0.001	0.240	-0.012	17
Belgium	0.002	0.089	0.237	29
Canada	-0.043	0.174	-0.059	41
Denmark	0.001	0.185	0.413	28
Finland	0.001	0.214	0.349	29
Germany	0.013	0.186	-0.346	41
Italy	0.010	0.124	0.348	40
Japan	0.010	0.123	-0.047	41
Korea	-0.009	0.206	0.029	28
Mexico	-0.008	0.279	-0.144	29
Netherlands	-0.002	0.214	0.043	29
Portugal	-0.003	0.144	-0.252	29
Spain	-0.004	0.163	-0.056	29
Sweden	0.000	0.331	-0.045	29
United Kingdom	-0.014	0.241	-0.445	41
United States	0.003	0.132	1	41

Note: The exogenous spending shocks are taken from Auerbach and Gorodnichencko (2012b) and normalized by the lagged nominal GDP.

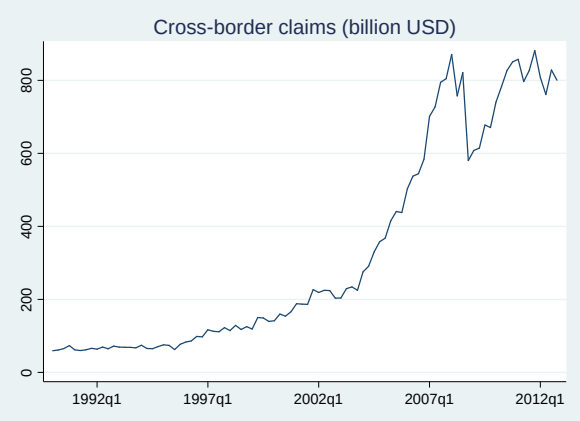
Figure 1. Total U.S. cross-border bank claims: raw stock vs. exchange rate-adjusted stock



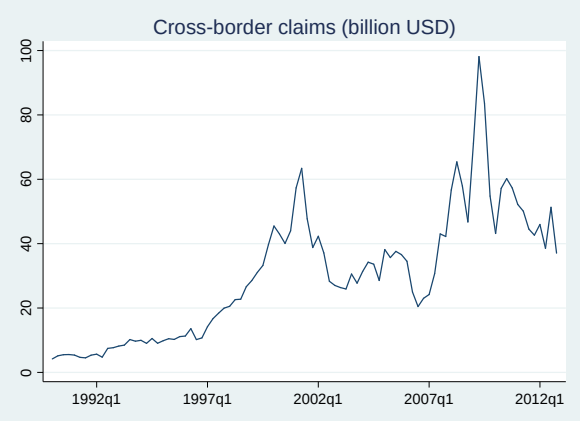
Note: The left panel shows total U.S. cross-border bank claims (exchange rate-unadjusted) and the right panel shows exchange rate-adjusted U.S. cross-border bank claims from 1990Q1 to 2012Q4.

Figure 2. Exchange-rate adjusted U.S. cross-border bank claims to individual countries

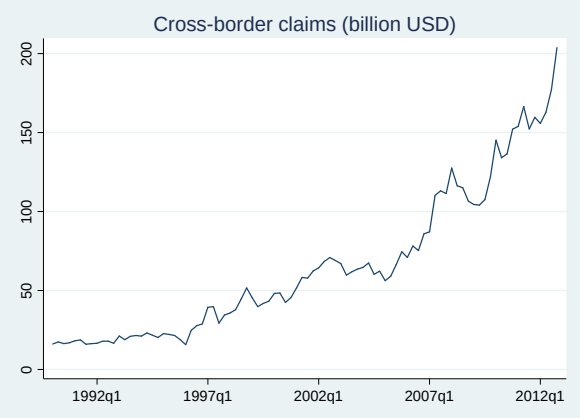
a) country A



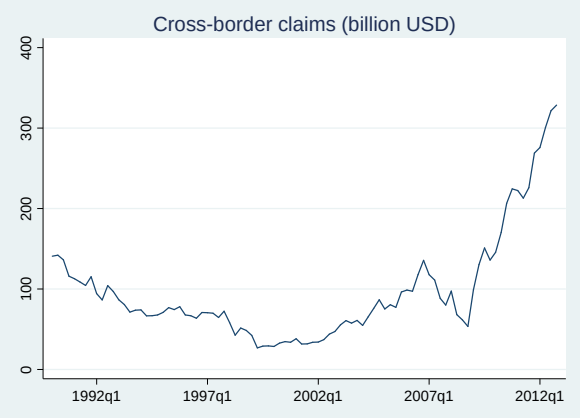
b) country B



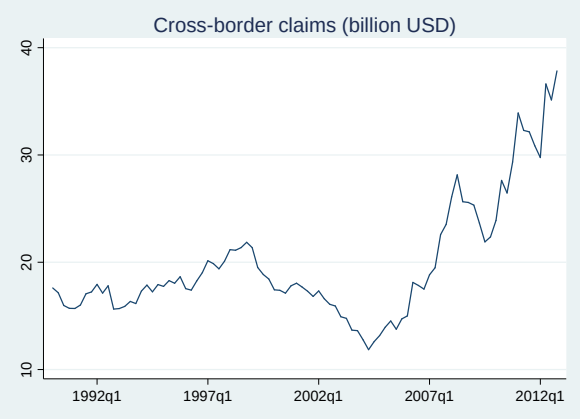
c) country C



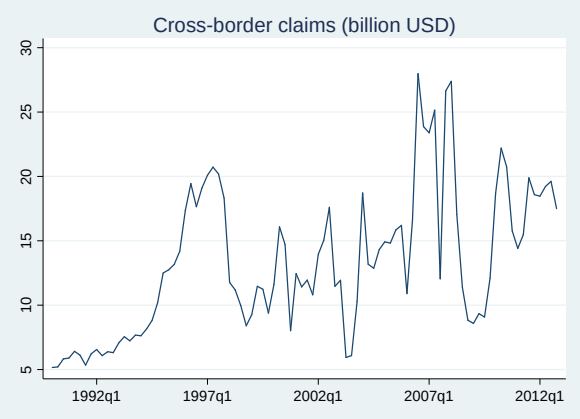
d) country D



e) country E

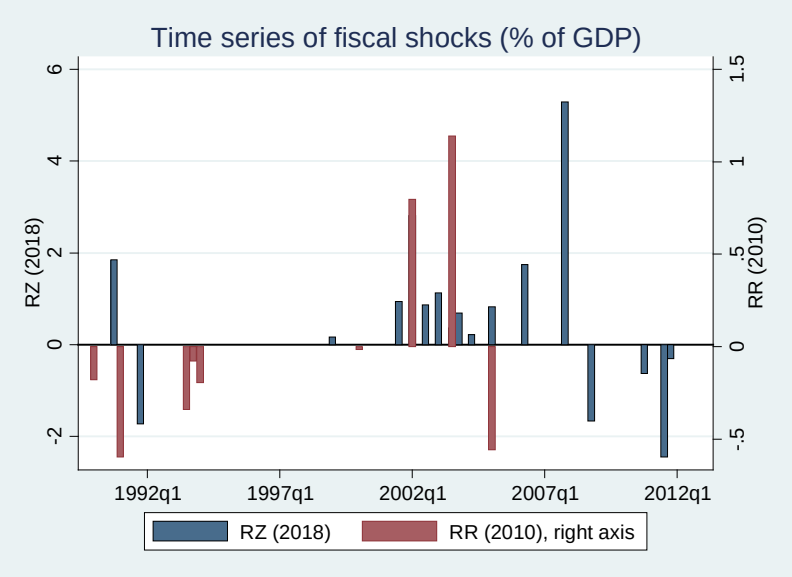


f) country F



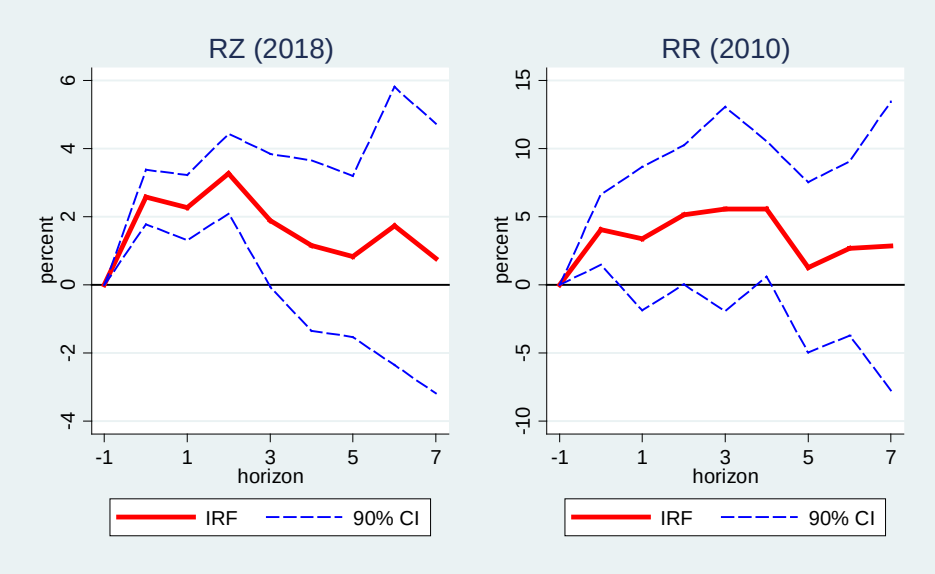
Note: Each graph shows bilateral exchange rate-adjusted cross-border claims between the U.S. and the corresponding recipient country from 1990Q1 to 2012Q4.

Figure 3. Time series of exogenous fiscal shocks in the U.S. (% of GDP)



Note: The left axis denotes the time series of exogenous government spending shocks from Ramey and Zubairy (2018), while the right axis denotes the time series of exogenous tax shocks from Romer and Romer (2010). Both measures are in percentage of GDP, and the tax shocks from Romer and Romer (2010) are available until 2007Q4.

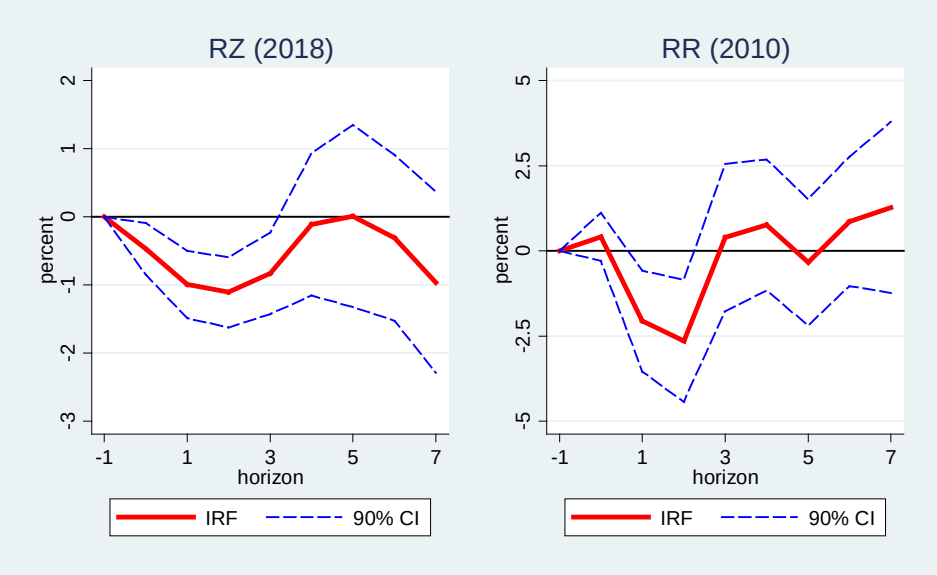
Figure 4. Estimated effect of a U.S. expansionary fiscal policy shock (1 percent of GDP) on cross-border bank lending



Note: The left panel shows the response of cross-border bank lending to a U.S. expansionary fiscal policy shock (1 percent of GDP) using exogenous government spending shocks from Ramey and Zubairy (2018), while the right panel shows the response to exogenous tax shocks from Romer and Romer (2010). Horizon h=0 captures the impact of the shock, and the units are in percentage.

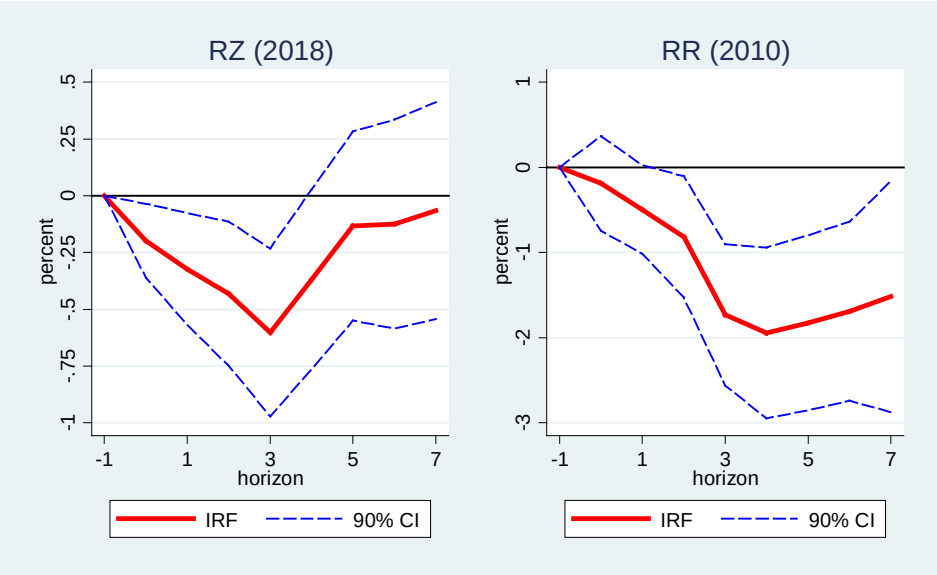
Figure 5. Transmission channel of U.S. fiscal shocks

A) Response of the real effective exchange rate



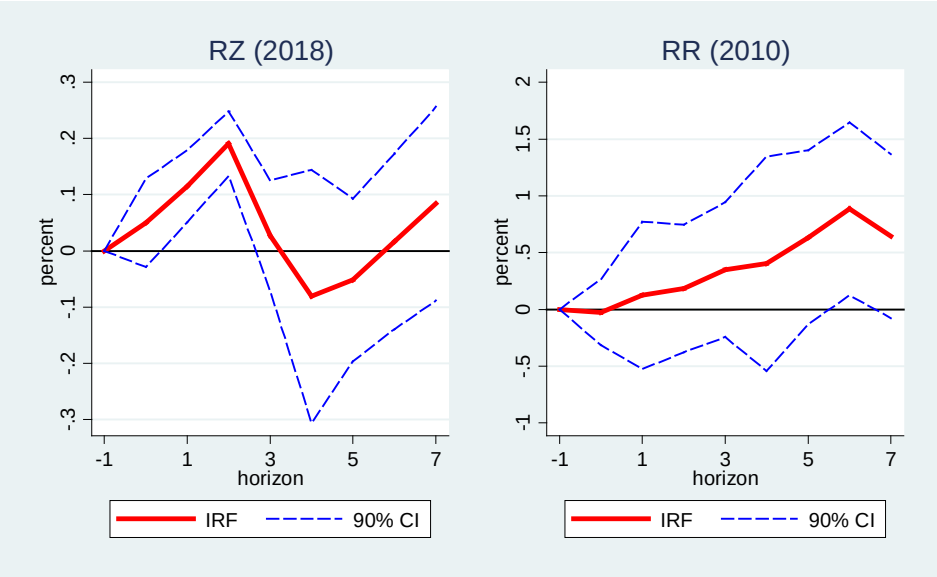
Note: The left panel shows the response of the real effective exchange rate to a U.S. expansionary fiscal policy shock (1 percent of GDP) using exogenous government spending shocks from Ramey and Zubairy (2018), while the right panel shows the response to exogenous tax shocks from Romer and Romer (2010). Horizon *h*=0 captures the impact of the shock, and the units are in percentage.

B) Response of the real interest rate



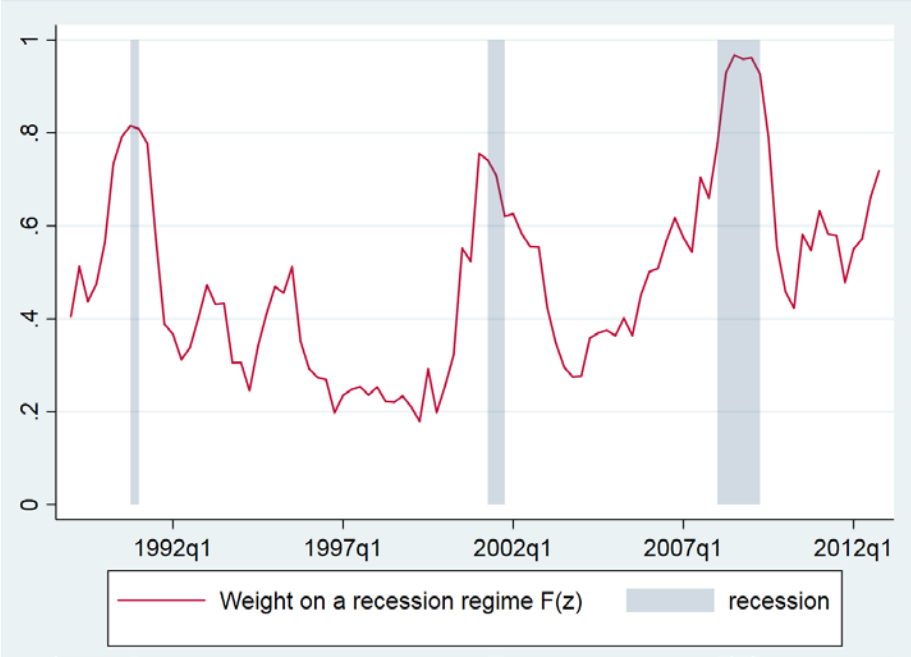
Note: The left panel shows the response of the real interest rate to a U.S. expansionary fiscal policy shock (1 percent of GDP) using exogenous government spending shocks from Ramey and Zubairy (2018), while the right panel shows the response to exogenous tax shocks from Romer and Romer (2010). Horizon *h*=0 captures the impact of the shock, and the units are in percentage.

Figure 6. Estimated effect of a U.S. expansionary fiscal policy shock (1 percent of GDP) on cross-border bank net lending



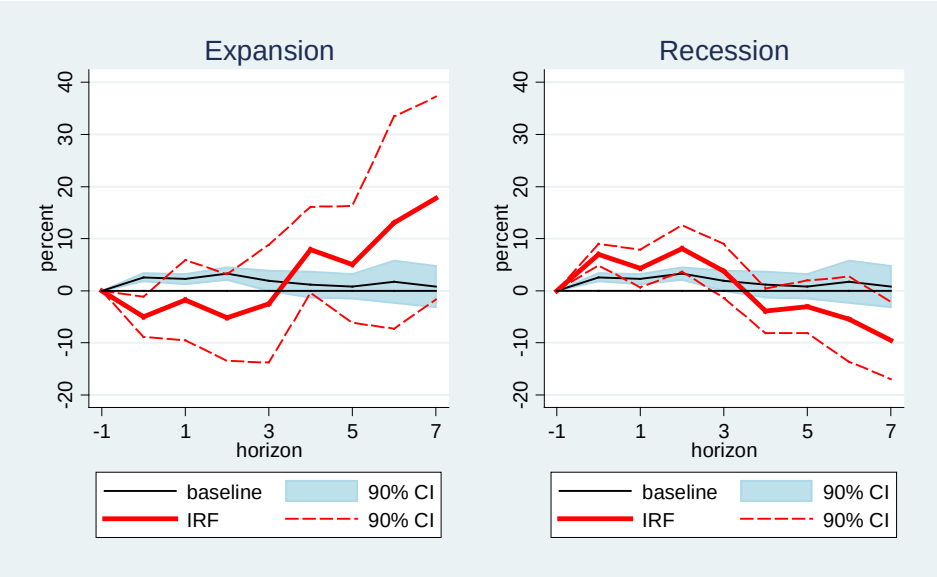
Note: The left panel shows the response of cross-border bank net lending to a U.S. expansionary fiscal policy shock (1 percent of GDP) using exogenous government spending shocks from Ramey and Zubairy (2018), while the right panel shows the response to exogenous tax shocks from Romer and Romer (2010). Horizon h=0 captures the impact of the shock, and the units are in percentage.

Figure 7. NBER recession dates and the weight on a recession regime



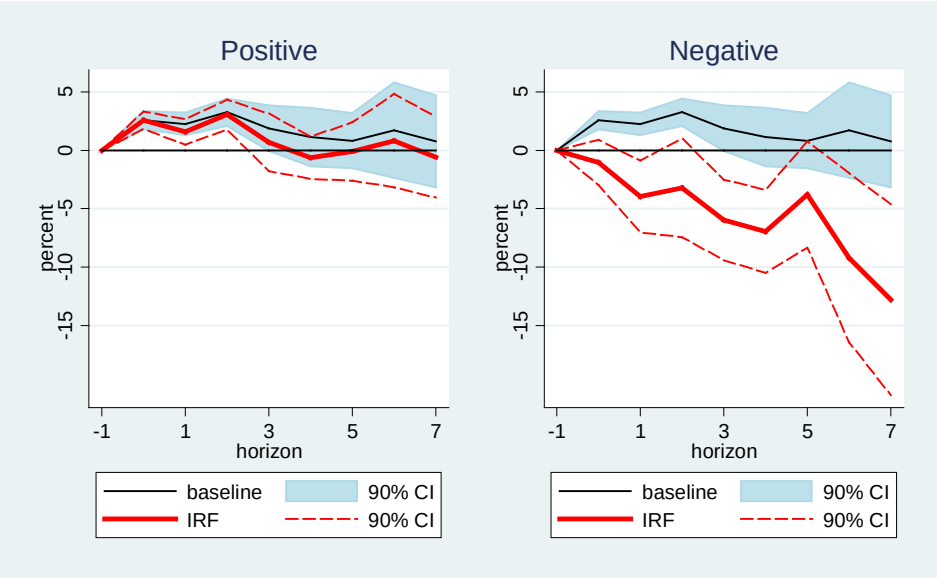
Note: The shaded areas indicate NBER recessions, while the red solid line denotes the weight on a recession regime.

Figure 8. Estimated effect of a U.S. expansionary fiscal policy shock (1 percent of GDP) on cross-border bank lending: expansions vs. recessions



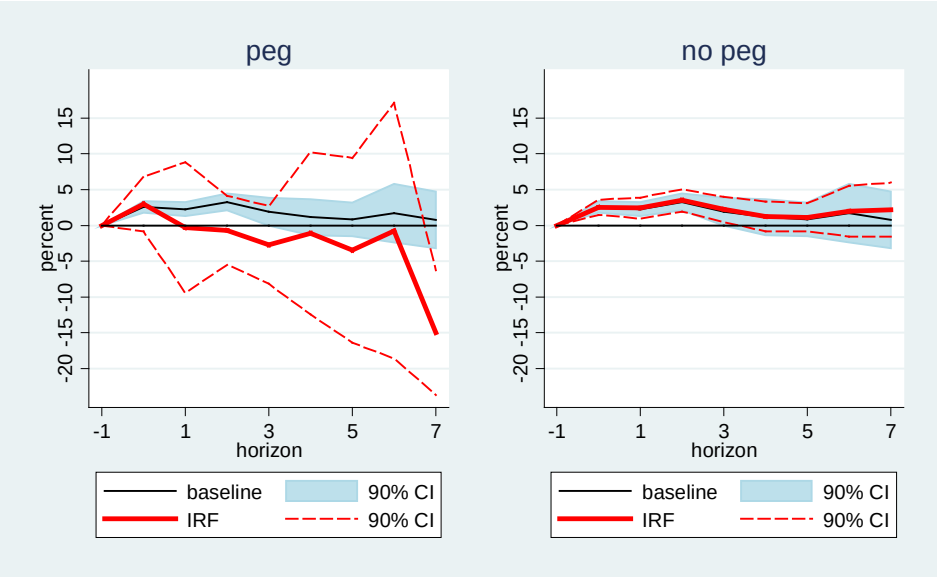
Note: The left (right) panel shows the response of cross-border bank lending to exogenous government spending shocks from Ramey and Zubairy (2018) during expansions (recessions). Horizon h=0 captures the impact of the shock, and the units are in percentage.

Figure 9. Estimated effect of a U.S. expansionary fiscal policy shock (1 percent of GDP) on cross-border bank lending: expansionary vs. contractionary shocks



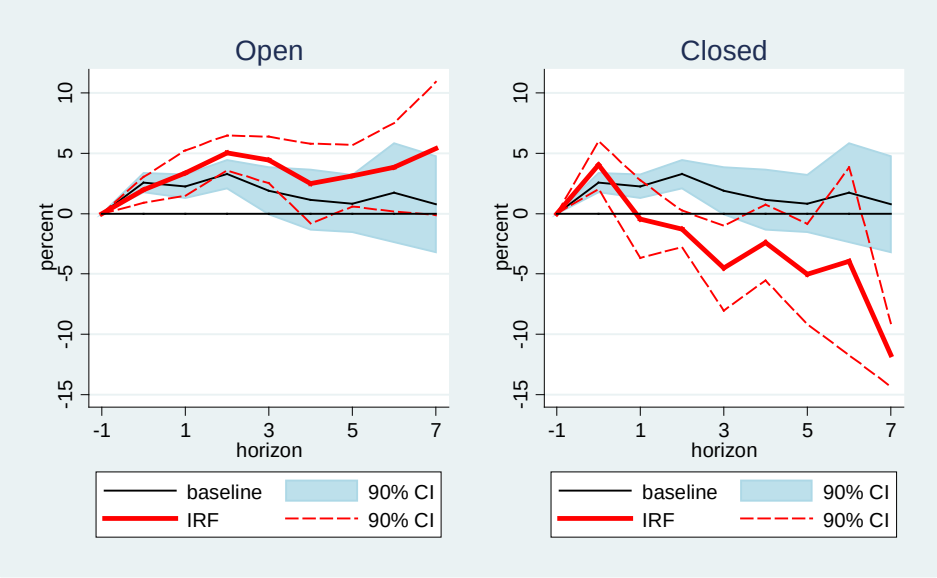
Note: The left (right) panel shows the response of cross-border bank lending to expansionary (contractionary) exogenous government spending shocks from Ramey and Zubairy (2018). Horizon h=0 captures the impact of the shock, and the units are in percentage. The sign of the response to contractionary shocks is adjusted so that the response is negative in this case.

Figure 10. Estimated effect of a U.S. expansionary fiscal policy shock (1 percent of GDP) on cross-border bank lending: pegged vs. non-pegged recipients



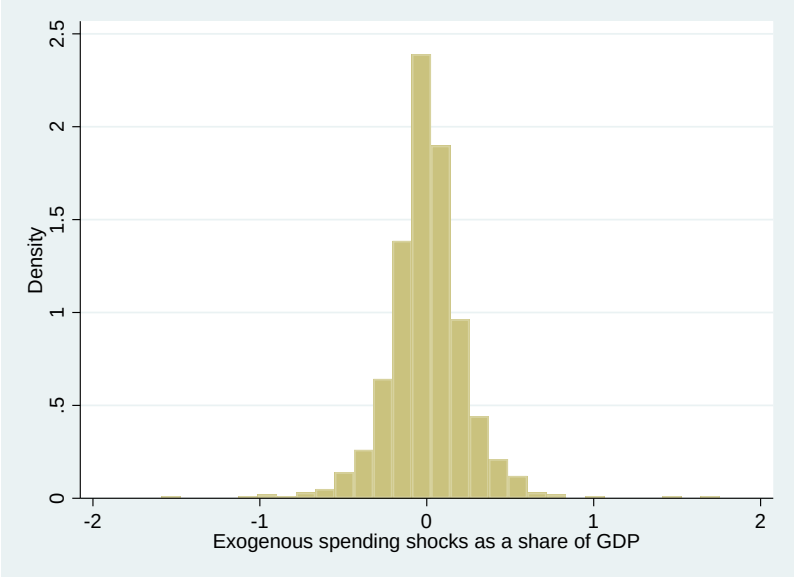
Note: The left (right) panel shows the response of cross-border bank lending to exogenous government spending shocks from Ramey and Zubairy (2018) when the recipient country is pegged (non-pegged). Horizon h=0 captures the impact of the shock, and the units are in percentage.

Figure 11. Estimated effect of a U.S. expansionary fiscal policy shock (1 percent of GDP) on cross-border bank lending: financially open vs. closed recipient countries



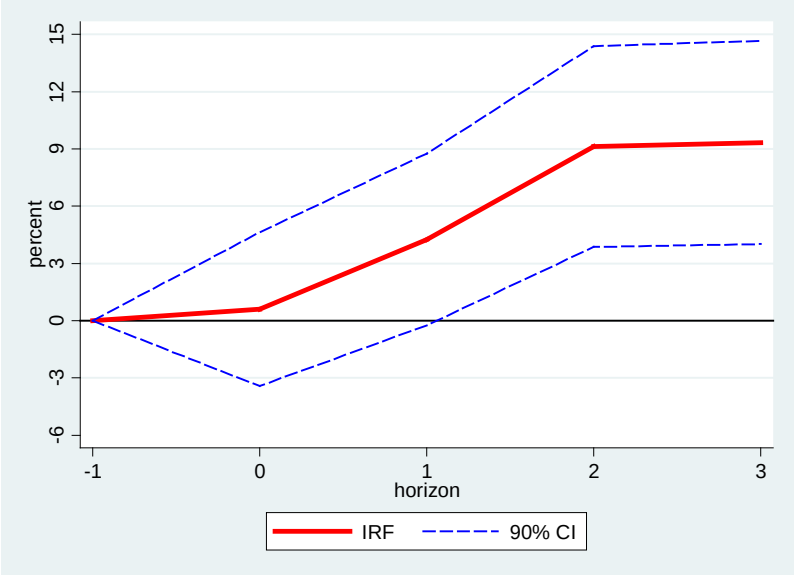
Note: The left (right) panel shows the response of cross-border bank lending to exogenous government spending shocks from Ramey and Zubairy (2018) when the recipient country is financially open (closed). Horizon h=0 captures the impact of the shock, and the units are in percentage.

Figure 12. Distribution of fiscal policy shock as a share of GDP in 16 OECD countries from 1990 and 2010



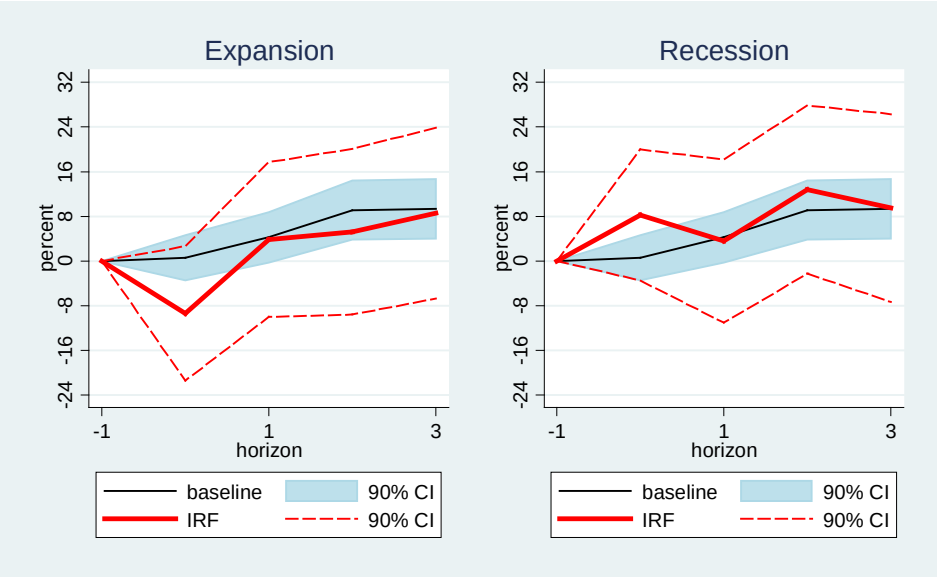
Note: The graph shows the distribution of exogenous government spending shocks normalized by the lagged nominal GDP in 16 OECD countries from Auerbach and Gorodnichencko (2012b).

Figure 13. Estimated effect of expansionary spending shock (1 percent of GDP) on cross-border bank lending using 16 OECD countries



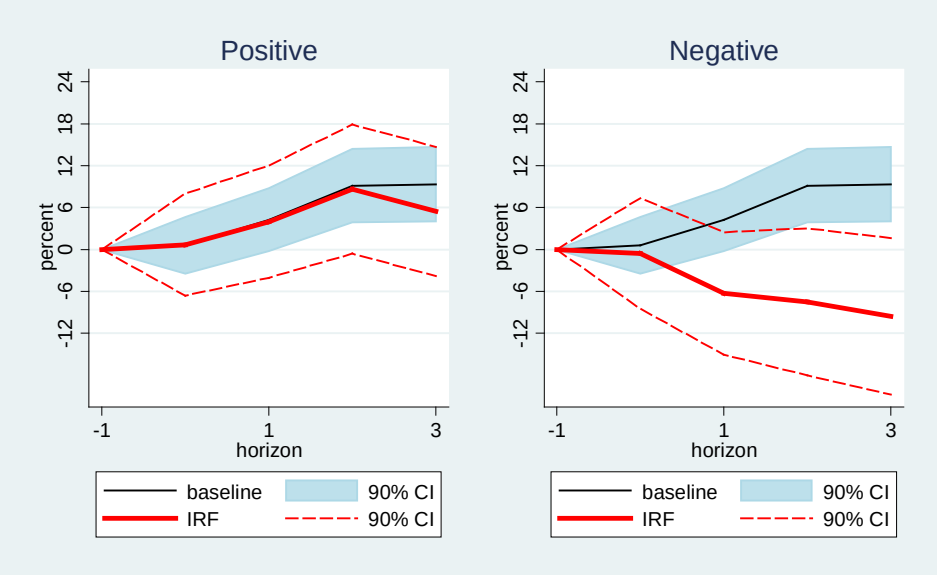
Note: The graph shows the response of cross-border bank lending to exogenous government spending shocks from Auerbach and Gorodnichencko (2012b). Horizon *h*=0 captures the impact of the shock, and the units are in percentage.

Figure 14. Estimated effect of expansionary fiscal policy shock (1 percent of GDP) on cross-border bank lending using 16 OECD countries: expansions vs. recessions



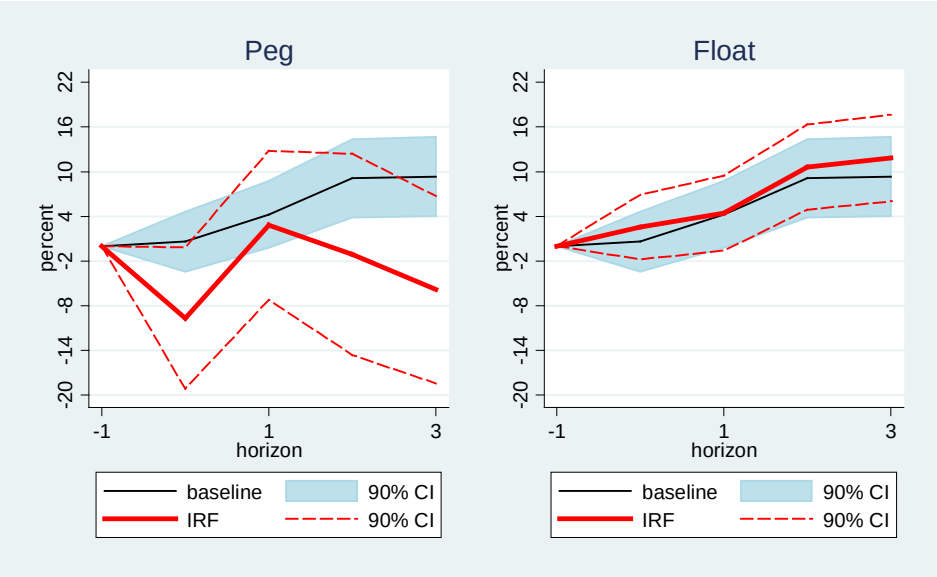
Note: The left (right) panel shows the response of cross-border bank lending to exogenous government spending shocks from Auerbach and Gorodnichencko (2012b) during expansions (recessions). Horizon *h*=0 captures the impact of the shock, and the units are in percentage.

Figure 15. Estimated effect of expansionary fiscal policy shock (1 percent of GDP) on cross-border bank lending using 16 OECD countries: expansionary vs. contractionary shocks



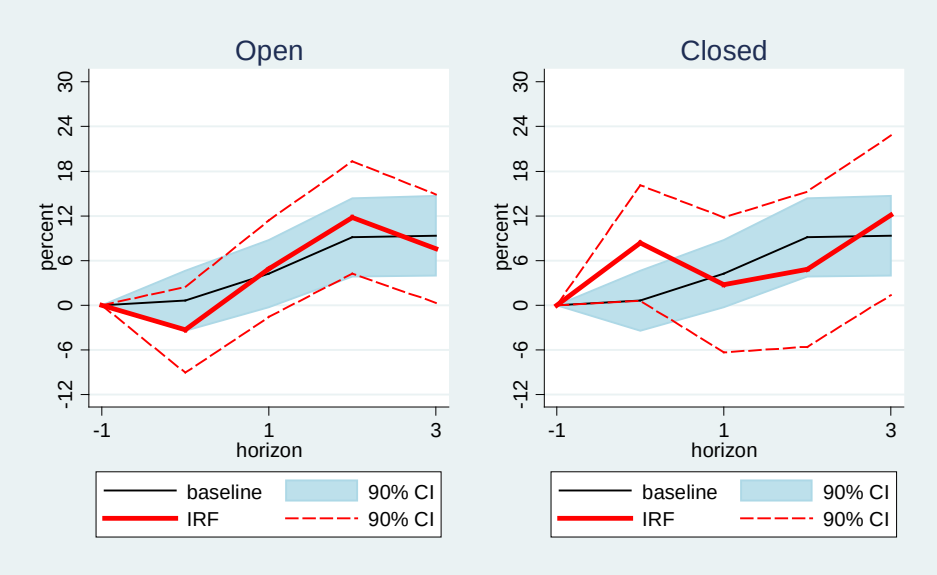
Note: The left (right) panel shows the response of cross-border bank lending to expansionary (contractionary) exogenous government spending shocks from Auerbach and Gorodnichencko (2012b). Horizon *h*=0 captures the impact of the shock, and the units are in percentage. The sign of the response to contractionary shocks is adjusted so that the response is negative in this case.

Figure 16. Estimated effect of expansionary fiscal policy shock (1 percent of GDP) on cross-border bank lending using 16 OECD countries: pegged vs. non-pegged



Note: The left (right) panel shows the response of cross-border bank lending to exogenous government spending shocks from Auerbach and Gorodnichencko (2012b) when the recipient country is pegged (non-pegged). Horizon *h*=0 captures the impact of the shock, and the units are in percentage.

Figure 17. Estimated effect of expansionary fiscal policy shock (1 percent of GDP) on cross-border bank lending using 16 OECD countries: open vs. closed recipient countries



Note: The left (right) panel shows the response of cross-border bank lending to exogenous government spending shocks from Auerbach and Gorodnichencko (2012b) when the recipient country is financially open (closed). Horizon *h*=0 captures the impact of the shock, and the units are in percentage.

Appendix A. Additional Figures and Tables

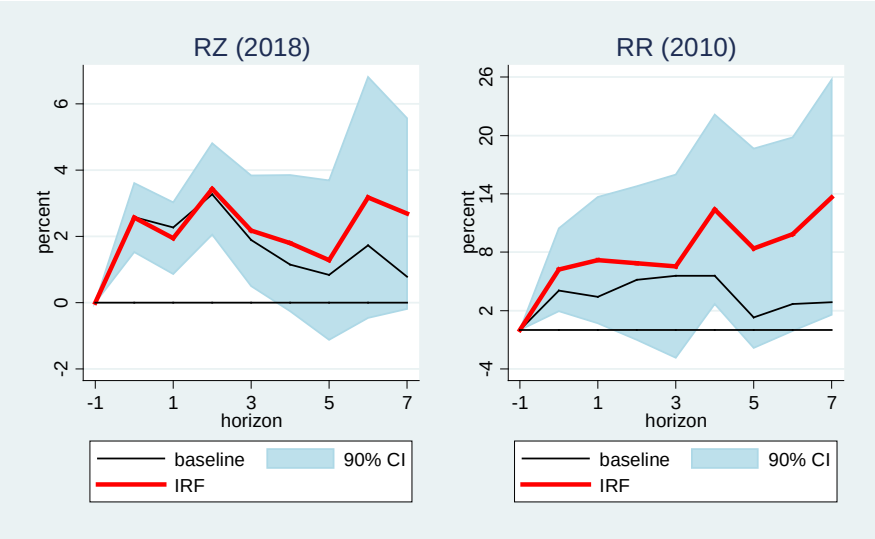
Table A.1. Data availability on cross-border flows in the BIS International Banking Statistics

	Nationality of lending bank	Residence of borrowers	Currency composition
Consolidated banking statistics	Yes	Yes	No
Locational banking statistics			
by residence	No	Yes	Yes
by nationality	Yes	No	Yes
stage 1 data	Yes	Yes	Yes

Note: This table is reproduced from Table 1 in Avdjiev and Takáts (2014). In addition to exchange rate fluctuations, the quarterly flows in the locational datasets are corrected for breaks in the reporting population. The BIS consolidated banking statistics group claims according to the nationality of banks (i.e., according to the location of banks' headquarters), netting out inter-office positions. The BIS locational banking statistics define creditors and debtors according to their residence, consistently with national accounts and balance of payments principles. The Stage 1 enhanced data are the first consistent data set to provide all three dimensions at the same time, but the construction of comprehensive time series data is still in progress.

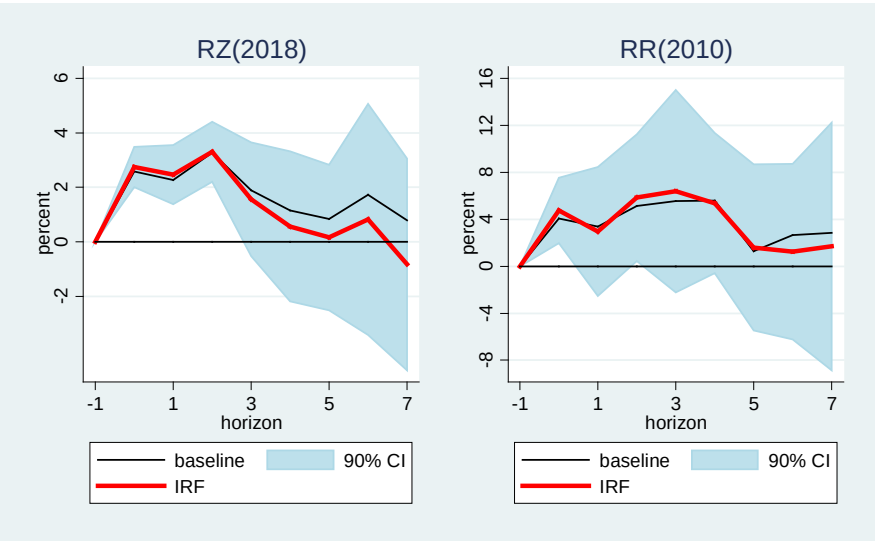
Appendix B. Robustness Checks

Figure B.1. Estimated effect of a U.S. expansionary fiscal policy shock (1 percent of GDP) on cross-border bank lending: controlling for other macroeconomic variables



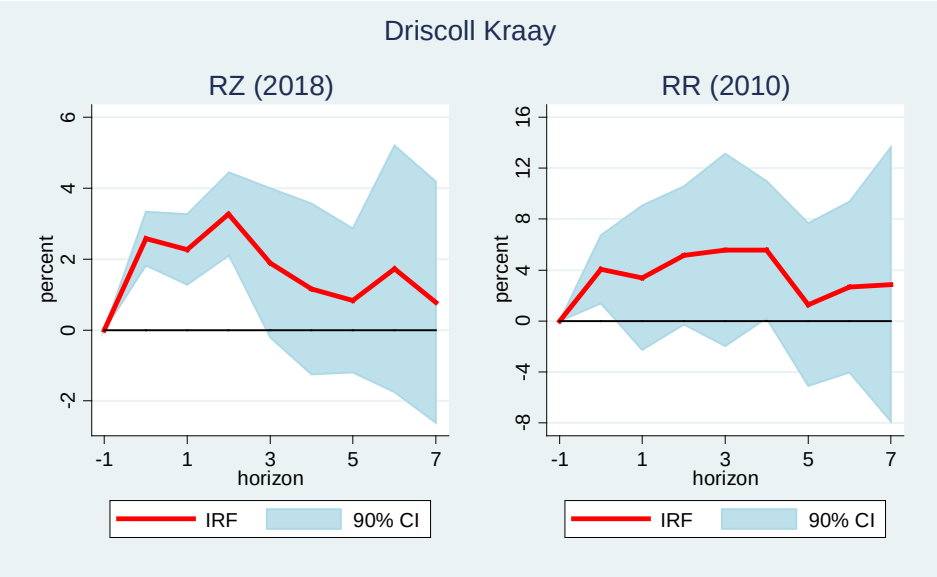
Note: The left panel shows the response of cross-border bank lending to a U.S. expansionary fiscal policy shock (1 percent of GDP) using exogenous government spending shocks from Ramey and Zubairy (2018), while the right panel shows the response to exogenous tax shocks from Romer and Romer (2010). Horizon *h*=0 captures the impact of the shock, and the units are in percentage.

Figure B.2. Estimated effect of a U.S. expansionary fiscal policy shock (1 percent of GDP) on cross-border bank lending: using eight lags instead



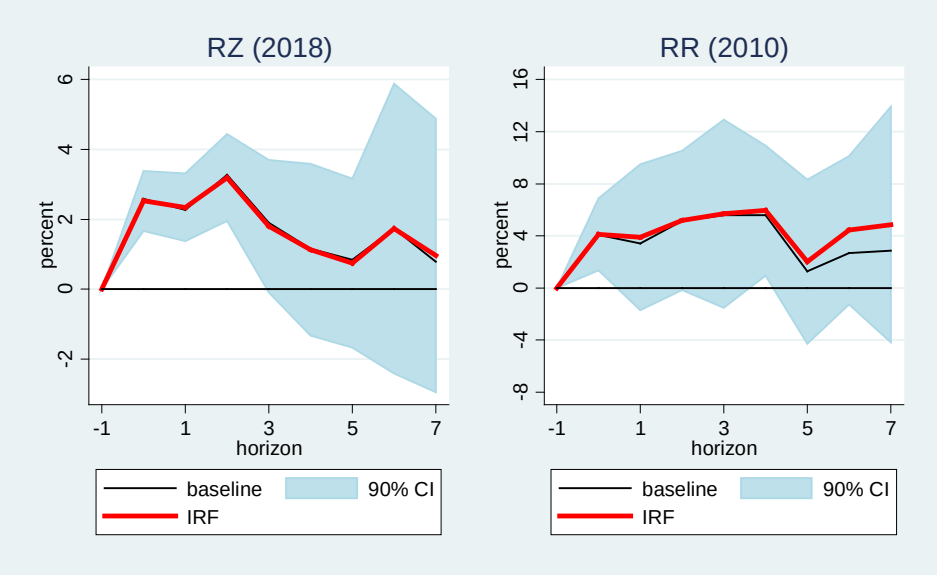
Note: The left panel shows the response of cross-border bank lending to a U.S. expansionary fiscal policy shock (1 percent of GDP) using exogenous government spending shocks from Ramey and Zubairy (2018), while the right panel shows the response to exogenous tax shocks from Romer and Romer (2010). Horizon *h*=0 captures the impact of the shock, and the units are in percentage. Eight lags of dependent and control variables are used in the estimation.

Figure B.3. Estimated effect of a U.S. expansionary fiscal policy shock (1 percent of GDP) on cross-border bank lending: using Driscoll-Kraay standard error



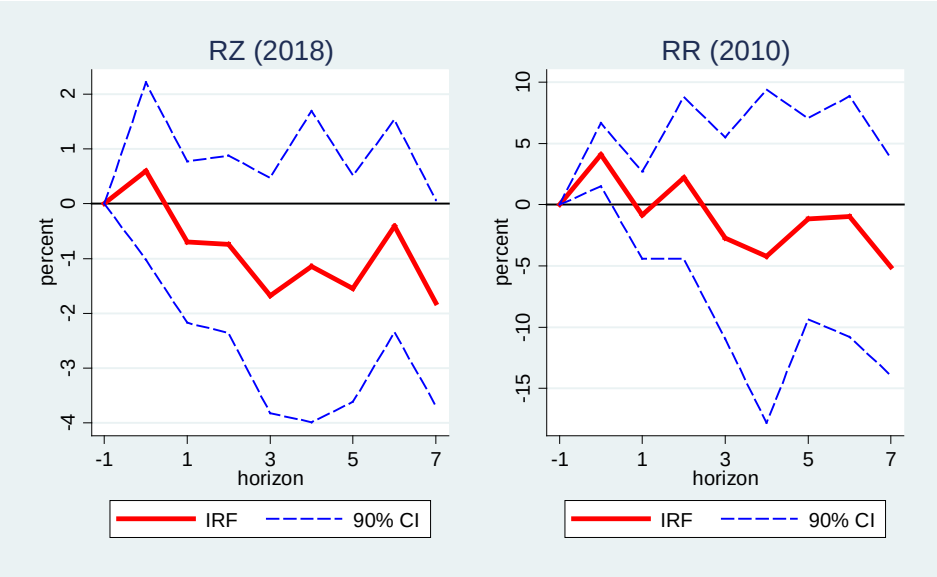
Note: The left panel shows the response of cross-border bank lending to a U.S. expansionary fiscal policy shock (1 percent of GDP) using exogenous government spending shocks from Ramey and Zubairy (2018), while the right panel shows the response to exogenous tax shocks from Romer and Romer (2010). Horizon *h*=0 captures the impact of the shock, and the units are in percentage. Driscoll-Kraay standard errors are used to construct confidence intervals.

Figure B.4. Estimated effect of a U.S. expansionary fiscal policy shock (1 percent of GDP) on cross-border bank lending: controlling for bilateral imports



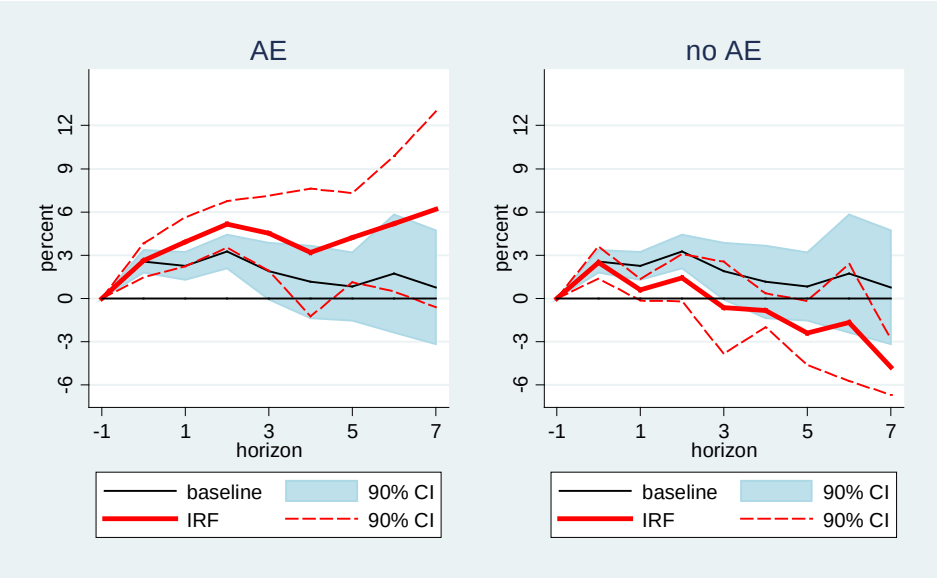
Note: The left panel shows the response of cross-border bank lending to a U.S. expansionary fiscal policy shock (1 percent of GDP) using exogenous government spending shocks from Ramey and Zubairy (2018), while the right panel shows the response to exogenous tax shocks from Romer and Romer (2010). Horizon *h*=0 captures the impact of the shock, and the units are in percentage.

Figure B.5. Estimated effect of a U.S. expansionary fiscal policy shock (1 percent of GDP) on cross-border bank borrowing



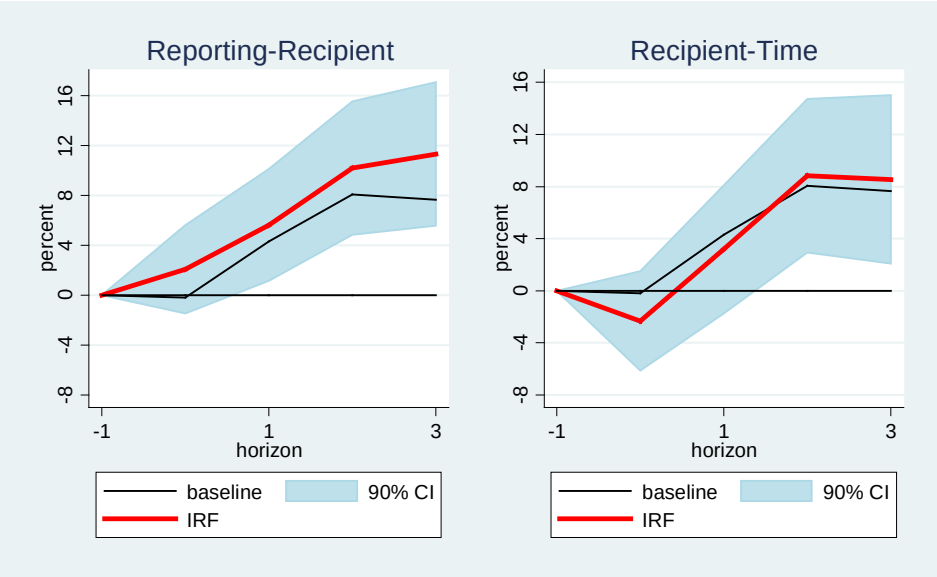
Note: The left panel shows the response of cross-border bank borrowing to a U.S. expansionary fiscal policy shock (1 percent of GDP) using exogenous government spending shocks from Ramey and Zubairy (2018), while the right panel shows the response to exogenous tax shocks from Romer and Romer (2010). Horizon h=0 captures the impact of the shock, and the units are in percentage.

Figure B.6. Estimated effect of a U.S. expansionary fiscal policy shock (1 percent of GDP) on cross-border bank lending: advanced vs. emerging market recipient countries



Note: The left (right) panel shows the response of cross-border bank lending to exogenous government spending shocks from Ramey and Zubairy (2018) when the recipient country is an advanced (emerging market) economy. Horizon h=0 captures the impact of the shock, and the units are in percentage.

Figure B.7. Estimated effect of expansionary spending shock (1 percent of GDP) on cross-border bank lending using 16 OECD countries: alternative fixed effects



Note: The graph shows the response of cross-border bank lending to exogenous government spending shocks from Auerbach and Gorodnichencko (2012b). Horizon *h*=0 captures the impact of the shock, and the units are in percentage.