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Fiscal spillover in emerging economies: Real versus financial channels

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ABSTRACT

Fiscal policy is an important tool for business cycle stabilization and has significant spillover through real and financial channels. This paper estimates the spillover of US fiscal policy shock in emerging economies which is distinct from US monetary policy spillover. We find that - similar to its effect in advanced economies as documented in the literature - the shock lowers both the nominal and real policy rates in emerging economies. Results suggest a disconnect between long-term and policy rates that leads to the steepening of the yield curve in emerging economies in the medium term due to the shock. Most of these effects of US government expenditure shock on the policy rate and the yield curve in emerging economies are direct effects (financial channel) and not indirectly driven by the effect of this shock on GDP growth and inflation (real channel). Contrary to its effect in the US, we find that this shock leads to a prolonged appreciation of real effective exchange rates in emerging economies, hurts their external competitiveness, and leads to a contraction in output in emerging economies. As expected, countries having higher exports and trade-to-GDP ratio experience a bigger decline in output.

1. Introduction

Fiscal policy is an important instrument for business cycle stabilization and zero lower bound on interest rates in developed countries in the aftermath of the global financial crisis, which increased its importance even further. Fiscal policy was also at the center of sovereign responses to the COVID-19 pandemic in both developed and emerging economies especially in the US where a massive fiscal stimulus contributed to inflation and the extent of that is still being debated. Fiscal policy is a tool for demand management and in open economies the stimulus is likely to increase the demand for imported goods as well and there could be a significant amount of fiscal spillover. Because of this, the issue of fiscal spillover has been researched extensively in the recent years for advanced economies and most of the existing studies suggest that fiscal expansion leads to depreciation of the real exchange rate in the US (see Kim and Roubini, 2008; Monacelli and Perotti, 2010; and Enders et al., 2011).

The evidence related to the spillover of demand is mixed. Corsetti and Müller (2006) and Kim and Roubini (2008) suggest that the trade balance improves in the US, consistent with the depreciation of the real exchange rate, while Monacelli and Perotti (2010), Ravn et al. (2012) and Garcia-Solanes et al. (2011) suggest that it tends to worsen. In a recent work, Faccini et al. (2016) suggest that spillover of US fiscal policy works mainly through the financial channel, not the trade channel. They argue that the spillover of the US fiscal policy on real variables such as output and consumption in other advanced economies mainly works through lowering

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real interest rate in these countries. Although there has been significant improvement in the understanding of US fiscal spillover in advanced economies, there is not enough literature on US fiscal spillover in emerging economies.

Also, it is not obvious that the real interest rate channel would be operative for emerging economies as in the case of advanced economies. Recent literature suggests that there is a policy rate disconnect in emerging economies and the short-term treasury yields and policy rates move in opposite directions due to countercyclical risk in emerging economies (see De Leo et al., 2022; Kalemli-Ozcan, 2019). De Leo et al. (2022) argue that the policy rate and the short-term treasury yield respond differently to US monetary tightening, in emerging economies. The policy rate decreases due to weak domestic and global demand, as the central banks lower policy rates. But the short-term treasury and money market rates increase. They argue that the countercyclical risk premium in emerging economies leads to an increase in short-term treasury and money market rates. Kalemli-Ozcan (2019) also argues that countercyclical risk premium in emerging economies leads to short-rate disconnect and the correlation between policy rate and short-term treasury rate is not close to 1, unlike advanced economies. This policy rate disconnect may make the real interest rate channel inoperative in emerging economies.

In this paper, we estimate the spillover of US government expenditure shock in twenty emerging economies. We estimate the US government expenditure shock using Cholesky factorization which is similar to the approach in Blanchard and Perotti (2002). We also estimate the government expenditure shock using max share identification as in Kumar and Mallick (2024). Cholesky factorization assumes that government expenditure in a quarter does not respond to the real GDP and real tax of that quarter. Max share identification does not assume such restriction and identifies government expenditure shock as the shock that explains the maximum forecast error variance of the government expenditure shock and is orthogonal to the shock associated with real GDP and real tax. With both these methods, we estimate two types of government expenditure shock. The first shock is obtained using real government expenditure, real GDP, and real tax. The second shock is obtained using real defense expenditure instead of real government expenditure following Ramey (2011, 2016). Thus, we have four US government expenditure shocks and we estimate the response of nominal policy rate, real policy rate, slope of the yield curve, and real effective exchange rate in the US and a set of emerging economies based on IMF classification.[1]

Results suggest that both nominal and real policy rates decline in the emerging economies due to the US government expenditure shock. These rates can decline due to the direct effect (financial channel) of US government expenditure shock or indirectly due to the differences in GDP growth and inflation in emerging economies which may be caused by the fiscal spillover as well (real channel). We control for these indirect effects and a comparison of results with and without indirect effect suggests that most of these declines in policy rates in emerging economies are independent of the movement in the real variables in these economies. But this shock has negligible effect on these rates in the US.[2] The US government expenditure shock leads to the steepening of the yield curve in the emerging economies in the medium term, whereas it has negligible effect in the US economy. This suggests that US government expenditure shock also induces policy rate disconnect argued by Kalemli-Ozcan (2019). The policy rate declines but the yield on government bonds changes very little compared to the movement in the policy rate and hence the yield curve steepens. Further, most of the increase in the slope of the yield curve are direct consequences of the US government expenditure shock and due to the financial channel and are not driven by the effect of US government expenditure shock on GDP growth and inflation in these economies, i.e. real channel.

We also find that US government expenditure shock leads to prolonged depreciation of the real effective exchange rate in the US. Hence this shock improves external competitiveness and is similar to the results reported by Kim and Roubini (2008), Monacelli and Perotti (2010); Ravn et al. (2012), and Enders et al. (2011). On the other hand, the US government expenditure shock leads to a prolonged appreciation of real effective exchange rates in emerging economies and hurts their external competitiveness. The US government expenditure shock leads to a lowering of the real rate in emerging economies which is similar to the effect found in Faccini et al. (2016) and could be expansionary or it could be contractionary due to its effect on the real effective exchange rate in the emerging economies. We estimate the response of real GDP in emerging economies due to the US government expenditure shock and find that the shock leads to a persistent decline in real GDP in emerging economies. This suggests that the external demand channel dominates the domestic demand channel arising due to the movement in real rates and that leads to a decline in output in emerging economies. To explore this further, we make two groups of countries based on four indicators obtained from the World Bank. We classify countries into high and low trade, exports, domestic credit and external debt-to-GDP ratio. Results suggest that the negative effect of US government expenditure shock on output is higher and more persistent in countries having high trade, exports, and external debt-to-GDP ratio compared to the countries having low trade, exports, and external debt-to-GDP ratio. Also we find that the negative effect of US government expenditure shock on output is higher and more persistent in countries with low domestic credit-to-GDP ratio compared to the countries having high domestic credit-to-GDP ratio. These results are expected given the financial risk and decline in global demand associated with US government expenditure shocks.

The plan of the paper is as follows. Section 2 gives a brief overview of the data, methodology related to the identification of the US government expenditure shock, and empirical framework to estimate the response of nominal and real policy rates, slope of the yield curve, and real effective exchange rate due to US government expenditure shock. Section 3 presents the results and is followed

[1] https://www.imf.org/external/pubs/ft/fandd/2021/06/the-future-of-emerging-markets-duttagupta-and-pazarbasioglu.htm.

[2] One can argue that both monetary and fiscal policies are used for stabilizing business cycle and hence the spillover of government expenditure shock studied in this paper may be confounded by the monetary policy spillover documented in De Leo et al. (2022) and Kalemli-Ozcan (2019). But the government expenditure shock has negligible effect on the policy rate in the US and hence we conclude that this shock is distinct from the monetary policy shock and hence the spillover studied in this paper is distinct from the monetary policy spillover.

by concluding remarks. The appendix at the end contains the description of variables with their sources and further results on the spillover of US government expenditure shock in emerging economies.

2. Data and methodology

2.1. Data

We use quarterly data of real gross domestic product, real government consumption expenditure & gross investment, real defense expenditure, federal government current receipts (tax) to estimate government expenditure shock in the US for the period 1947:Q1 to 2023:Q4.[3] Government consumption expenditure & gross investment, defense expenditure, and federal government current receipts (tax) are deflated by gross domestic product deflator to obtain real variables. We estimate the response of Wu-Xia shadow federal funds rate, real Wu-Xia shadow federal funds rate (Wu-Xia shadow federal funds rate-consumer price inflation), the slope of the yield curve (difference between ten-year government bond yield and Wu-Xia shadow federal funds rate), and real broad effective exchange rate (REER) for the US due to US government expenditure shock. We use data after 1990 to obtain responses for the US to maintain comparability with responses from emerging economies of the same variables. All variables except Wu-Xia shadow federal funds rate and federal government current receipts are obtained from the Federal Reserve Bank of Saint Louis. Wu-Xia shadow federal funds rate is obtained from the Federal Reserve Bank of Atlanta and federal government current receipts are obtained from the Bureau of Economic Analysis.

Data for twenty emerging economies are obtained from International Financial Statistics (IMF), Federal Reserve Bank of Saint Louis, Bloomberg and website of country specific central banks and statistical agencies. We use real gross domestic product, consumer price, monetary policy rate, yield on ten year government bond and real effective exchange rate from emerging economies and obtain the response of nominal and real policy rates, slope of the yield curve, real effective exchange rate and gross domestic product. Table A.1-A.5 in the appendix gives the time period and sources for these variables for different countries. We use data after 1990, because before 1990 the quarterly data is very sparsely available for emerging economies and hence not suitable for the analysis. We also use annual data from 1990 onwards of debt, exports, domestic credit and external debt to GDP ratio to create country groups based on these variables.

2.2. US government expenditure shock

A general structural vector autoregression model is given by

$$A_0 y_t = a + \sum_{j=1}^{p} A_j y_{t-j} + \epsilon_t$$

The reduced form model is given by

$$y_t = b + \sum_{j=1}^{p} B_j y_{t-j} + u_t$$

Where $b = A_0^{-1} a$, $B_j = A_0^{-1} B_j$ and $u_t = A_0^{-1} \epsilon_t$. The reduced form model can be estimated by ordinary least squares and reduced form residuals can be obtained. The covariance matrix of the reduced form shocks $E(u_t, u_t') = \sum = \left(A_0^{-1}\right)\left(A_0^{-1}\right)'$ is known. We can write the impulse response matrix at horizon h

$$IR^h = C(h) A_0^{-1}$$

Where $C(h)$ is the h^{th} element in the expansion $\left[I_n - \sum_{j=1}^{p} B_j L^j\right]^{-1}$. The element in row (i) and column (j) denotes the response of i^{th} variable due to shock associated with j^{th} variable. The matrix A_0^{-1} is unknown and needs to be estimated to calculate the structural impulse response IR^h. The reduced form covariance matrix is known and one can do Cholesky decomposition of the same

$$\sum = PP'$$

and that implies $A_0^{-1} = P$. Once P is known, we can obtain the structural shock $\epsilon_t = P^{-1} u_t$. We obtain the first measure of government expenditure shock using Cholesky factorization as explained above which is similar to the approach in Blanchard and Perotti (2002). We order real government expenditure shock as the first variable followed by the real GDP and real tax revenue. The intuition is that government expenditure does not respond to within-quarter movement in real GDP and real tax revenue. We obtain another measure of government expenditure shock using max share identification. In this approach, the government expenditure shock explains the maximum share of forecast error variance of the government expenditure. We start with Cholesky decomposition but as shown by

[3] Most of the responses in this paper are calculated for the time period after 1990 for both emerging economies and the US but we use a long series to estimate the government expenditure shocks as this gives more precise estimate of the shocks. Shocks obtained using a recent sample (after 1990) give qualitatively similar results as presented in this paper and are available upon request.

Uhlig (2004), the matrix P obtained by Cholesky decomposition is not the only matrix that satisfies the $\sum = PP'$ as we can always write:

$$\sum = PQQ'P'$$

For any orthonormal matrix Q ($QQ' = I$). This gives us $A_0^{-1} = PQ$ and hence the structural impulse response can be written as

$$IR^h = C(h)PQ$$

The response of the i^{th} variable due to a shock associated with j^{th} variable is

$$IR^h(i,j) = e_i' C(h)PQe_j = e_i' C(h)Pq_j = c_{ih}' q_j$$

Where q_j is j^{th} column of Q and c_{ih}' is i^{th} column of $C(h)P$. The important point is that $Q = I_n$ gives the identification based on Cholesky decomposition, and the additional identification based on sign restrictions can be achieved by imposing restrictions on Q. We identify multiple shocks including government expenditure shock based on their share in forecast error variance decomposition. This method is purely agnostic and driven by data. We put very minimal restrictions on identification. Unlike the Bayesian approach of Baumeister and Hamilton (2019), our method is not subject to issues with prior and hyper-parameters, which often make Bayesian inference problematic. The forecast error variance of the i^{th} variable due to a shock associated with j^{th} variable at horizon h is given by

$$\sum_{h=0}^{h=h} IR^h(i,j) IR^h(i,j)' = \sum_{h=0}^{h=h} q_j' c_{ih} c_{ih}' q_j = q_j' \left(\sum_{h=0}^{h=h} c_{ih} c_{ih}' \right) q_j$$

The forecast error variance of the i^{th} variable due to all shocks is given by $\sum_{h=0}^{h=h} c_{ih}' c_{ih}$. Hence the share of j^{th} variable in the forecast error variance of i^{th} variable is given by

$$FEV(i,j,h) = \frac{q_j' \left(\sum_{h=0}^{h=h} c_{ih} c_{ih}' \right) q_j}{\sum_{h=0}^{h=h} c_{ih}' c_{ih}}$$

We define

$$FEV(i,h) = \frac{\left(\sum_{h=0}^{h=h} c_{ih} c_{ih}' \right)}{\sum_{h=0}^{h=h} c_{ih}' c_{ih}}$$

We identify multiple columns (all columns as well) of Q using the following optimization problem

$$Q_{1,k}^* = \arg\max_{Q_{1:k}} \sum_{i=1}^{k} q_i' FEV(i,h) q_i$$

Subject to

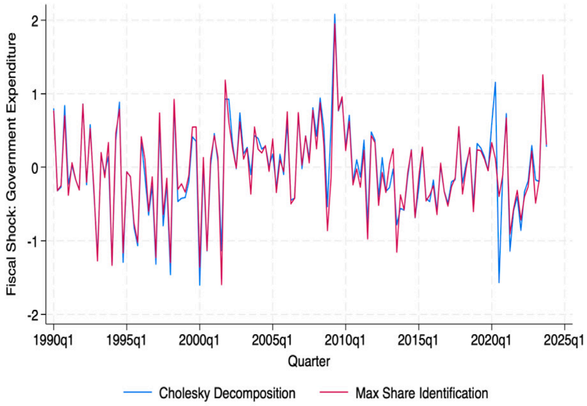
$$q_j' FEV(j,h) q_j \geq q_j' FEV(i,h) q_j \quad \text{for} \quad j = 1, \dots, k, \forall i \in I_{-j}$$

$$Q_{1:k}' Q_{1:k} = I_n$$

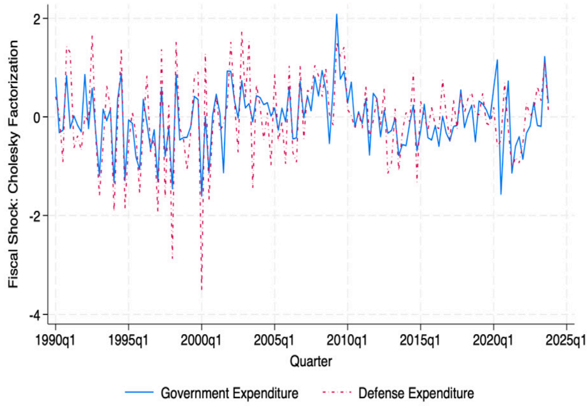
This effectively implies that we maximize the sum of the share of each shock in the forecast error variance of the respective variables. We put very reasonable restrictions. These constraints imply that each shock explains a higher forecast error variance of the variable associated with it, compared to the other variables. For example, the first shock explains a higher share of the forecast error variance of the first variable than its share in the forecast error variance of the second and third variables. The same is true for the remaining shocks. Using the fact $\sum_{i=1}^{k} q_i' FEV(i,h) q_i = \sum_{i=1}^{k} trace(q_i' FEV(i,h) q_i)$, we write the above problem as a minimization problem and solve it using the fmincon function in Matlab with nonlinear constraints. We do not face any situation of the constraints not being satisfied. Once Q is known, we can obtain the structural shock $\epsilon_t = (PQ)^{-1} u_t$. This gives the second measure of government expenditure shock max share identification. Further, using Ramey (2011, 2016), we estimate government expenditure shock using Cholesky and max share identification using real defense expenditure, real GDP, and real tax revenue. Hence we have two measures of government expenditure shocks based on both Cholesky decomposition and max share identification.

The first shock is obtained by using real government expenditure, real GDP, and real tax and is referred to as Blanchard and Perotti shock in Fig. 1. The second shock is obtained using real defense spending, real GDP, and real tax and is referred to as defense expenditure shock in Fig. 1. This gives us a total of four government expenditure shocks.[4]

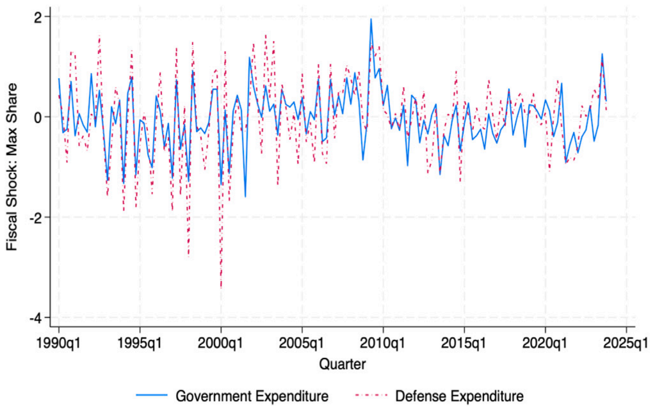
[4] Following Gordon and Krenn (2010), we estimate another government expenditure shock using Cholesky and max share identification using normalized real government expenditure, real GDP, and real tax revenue. We normalize all these three variables using a potential output measure estimated by a fourth-order time trend on real GDP. Results from these shocks are similar and not provided in the paper but are available on request.



(a) Cholesky Decomposition and Max Share Identification



(b) Cholesky Decomposition



(c) Max Share Identification

Fig. 1. (a) gives the government expenditure shock identified using Cholesky decomposition and max share identification with real government expenditure, real GDP, real tax. (b) gives the three shocks identified using Cholesky decomposition. (c) gives the three shocks identified using max share identification.

Table 1
Correlation Among Shocks.

		Cholesky			Max Share
Cholesky	Blanchard Perotti	1.00			
	Defense Expenditure	0.65	1.00		
Max Share	Blanchard Perotti	0.98	0.64	1.00	
	Defense Expenditure	0.65	1.00	0.65	1.00

Fig. 1 (a) suggests that shocks identified using Cholesky decomposition and max share identification are very similar except for the noticeable difference during COVID-19 among these two shocks. The shock identified using defense expenditure is very different in magnitude than the shock identified using real government expenditure. As we can see from Table 1, the correlation among three shocks identified using Cholesky decomposition and max share identification is very high whereas the correlation between the shock identified using real government expenditure and real defense expenditure is relatively low. In the next section, we explain the estimation of responses of variables in the US and emerging economies due to these four shocks.

2.3. Responses of variables in the US and emerging economies due to US government and defense expenditure shocks

We estimate the response of monetary policy rate, real rate (monetary policy rate - consumer inflation), slope of the yield curve (yield on government bond - monetary policy rate) and real effective exchange rate for the US using the local projection regression, based on Cloyne et al. (2023) and Jorda (2005). We estimate the equation given by:

$$Y_{t+h} - Y_{t-1} = \mu^h + f_t \beta^h + \sum_{j=-1}^{j=-4} (x_{t+j} - \bar{x}) \gamma_x^h + e_{t+h} \tag{1}$$

where Y_t is one of the four variables mentioned above. f_t is one of the four US government expenditure shocks identified above. x includes the lag of GDP growth, inflation and Y. β^h is the coefficient of interest which gives the cumulative effect of US government expenditure shock at $t = 0$ on Y at time $t = h$. We estimate a similar regression in a panel framework for emerging economies given by:

$$Y_{i,t+h} - Y_{i,t-1} = \mu_i^h + f_t \beta^h + \sum_{j=-1}^{j=-4} (x_{i,t+j} - \bar{x}_i)\gamma_x^h + e_{i,t+h} \tag{2}$$

where Y_{it} is one of the four variables mentioned above in country i at time t. μ_i^h is the country fixed effects and f_t is one of the four US government expenditure shocks identified above. $x_{i,t}$ include the GDP growth, inflation and lag of Y in country i at time t. β^h is the coefficient of interest which gives the cumulative effect of US government expenditure shock at $t = 0$ on Y at time $t = h$. The response of monetary policy rate, real rate (monetary policy rate-consumer inflation), slope of the yield curve (yield on government bond-monetary policy rate), and real effective exchange rate in emerging economies due to US government expenditure shock can also arise indirectly due to differences in GDP growth and inflation in these economies which may be caused by the US fiscal shocks as well. This is called real channel in this paper. Since we do not control for these indirect effects in the regression (2), β^h captures the sum of the effects due to the real and financial channels. To control for these indirect effects, we include the interaction of the US government expenditure shock with GDP growth and inflation in the above regression model, and the extended model is given in equation (3) below::

$$Y_{i,t+h} - Y_{i,t-1} = \mu_i^h + f_t \beta^h + f_t \left(z_{i,t} - \bar{z}_i\right) \theta_z^h + \left(z_{i,t} - \bar{z}_i\right) \Theta_z^h + \sum_{j=-1}^{j=-4} (x_{i,t+j} - \bar{x}_i)\gamma_x^h + e_{i,t+h} \tag{3}$$

β^h is the coefficient of interest which gives the direct effect of US government expenditure shock at $t = 0$ on Y at time $t = h$. $z_{i,t}$ include the GDP growth and inflation. These direct effects are obtained after teasing out the indirect effect being captured by θ_z^h in equation (3). We compare the β^h from these two regression models (2) and (3) to evaluate the relative role of real and financial channels. This is because the β^h from the regression (2) gives sum of the effects through real and financial channels, whereas β^h from the regression (3) gives the effect due to the financial channel alone.

3. Results

3.1. Spillover to monetary policy rates

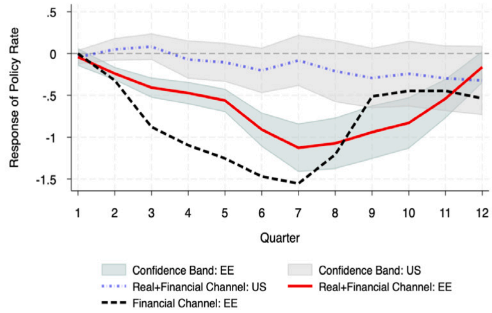
Fig. 2 gives the response of monetary policy rate in the US and emerging economies due to US government expenditure shock obtained using Cholesky decomposition and max share identification. As mentioned before, we obtain two shocks each using Cholesky decomposition and max share identification. The first shock is obtained using real government expenditure, real GDP, and real tax and is very similar to the shock in Blanchard and Perotti (2002). The second shock is obtained using real defense expenditure instead of real government expenditure. All these shocks suggest a negligible effect of the government expenditure shock on the monetary policy rate (Wu-Xia shadow federal funds rate) in the US. As we can see from these figures, the identified US government expenditure shock is very different from the traditional monetary policy shock as these shocks lead to almost no change in the policy rate in the US in the beginning. This difference is important to be mentioned, as the expansionary fiscal shocks are likely to coincide with the expansionary monetary policy shock and one can argue that the spillover of US government expenditure shock analyzed in this paper is effectively the spillover of US monetary policy shock. Hence we argue that US fiscal spillover to emerging economies is distinct from the US monetary policy spillover.

These shocks lead to a decline in the policy rate in the emerging economies.[5] Although these shocks induce qualitatively similar response of monetary policy rate in the emerging economies (red lines) where the policy rate keeps declining for up to two years before recovering but there are some differences, and generates different maximum responses at different points of time. The maximum decline in the policy rate is of more than 1% in the case of government expenditure shock obtained using Cholesky decomposition. Also the responses due to the defense expenditure shocks identified using both Cholesky decomposition and max share identification show slightly more persistent response. Such policy rate decline can be driven by decline in demand experienced by these emerging economies as we show in the sections 3.3 and 3.4.

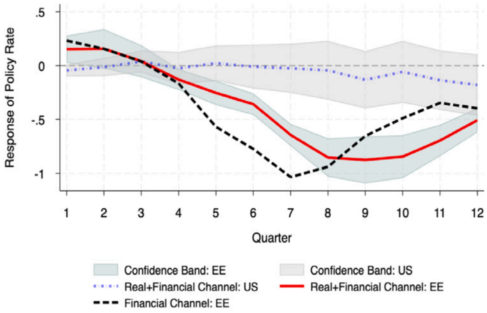
The response of the policy rate in emerging economies due to US government expenditure shock can arise due to differences in GDP growth and inflation or due to the effect of US government expenditure shock on GDP growth and inflation in these economies (real channels) and financial channels. Red lines give the total effect, i.e., the sum of the effects due to the real and financial channels.

We control for the real channel as explained in the previous section and the net effect due to the financial channel is given by dotted black lines. As we can see, the rate declines faster due to financial channels and the maximum decline is more than 1.5%. These results suggest that financial channels are important for spillover of the US government expenditure shock in emerging economies. Fig. B.1 in the appendix gives the response of monetary policy rate from a sample excluding three large emerging economies i.e.

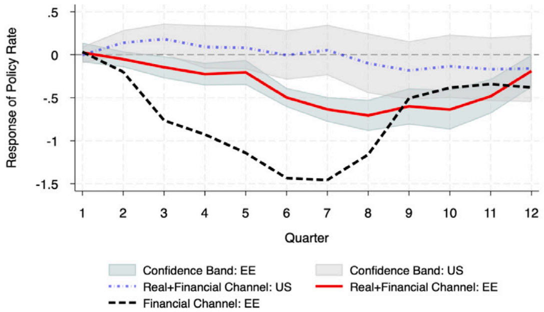
[5] We do not include Turkey in the panel of countries. For a long period, Turkey reduced interest rate to combat inflation which is against the orthodox approach of dealing with inflation: https://edition.cnn.com/2023/05/19/economy/erdogan-turkey-election-inflation-promise/index.html. This has reversed in recent times and Turkey has increased rates to combat inflation: https://www.ft.com/content/70ad468f-1fc7-4cdb-9920-14ff64f3c609. The results are qualitatively similar with a sample including Turkey and are available on request.



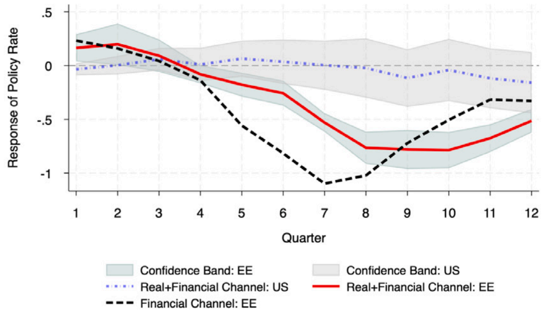
(a) Response of policy rate: Government expenditure shock using Cholesky decomposition



(b) Response of policy rate: Defense expenditure shock using Cholesky decomposition



(c) Response of policy rate: Government expenditure shock Using Max Share identification



(d) Response of policy rate: Defense expenditure shock using max share identification

Fig. 2. Response of the policy rate in emerging economies and US due to US government expenditure shocks
Notes: Dotted blue lines give response β^h of policy rate in the US due to government expenditure shock in the US from $Y_{t+h} - Y_{t-1} = \mu^h + f_t\beta^h + \sum_{j=-1}^{j=-4}(x_{t+j} - \bar{x})\gamma_x^h + e_{t+h}$. Red lines give response β^h of policy rate in emerging economies due to government expenditure shock in the US from $Y_{i,t+h} - Y_{i,t-1} = \mu_i^h + f_t\beta^h + \sum_{j=-1}^{j=-4}(x_{i,t+j} - \bar{x}_i)\gamma_x^h + e_{i,t+h}$. Dotted black lines give response β^h of policy rate in emerging economies due to government expenditure shock in the US from $Y_{i,t+h} - Y_{i,t-1} = \mu_i^h + f_t\beta^h + f_t\left(z_{i,t} - \bar{z}_i\right)\theta_z^h + \left(z_{i,t} - \bar{z}_i\right)\Theta_z^h + \sum_{j=-1}^{j=-4}(x_{i,t+j} - \bar{x}_i)\gamma_x^h + e_{i,t+h}$. x_t and $x_{i,t}$ included GDP growth, inflation, and monetary policy rate. $z_{i,t}$ included GDP growth, and inflation. (For interpretation of the colors in the figure(s), the reader is referred to the web version of this article.)

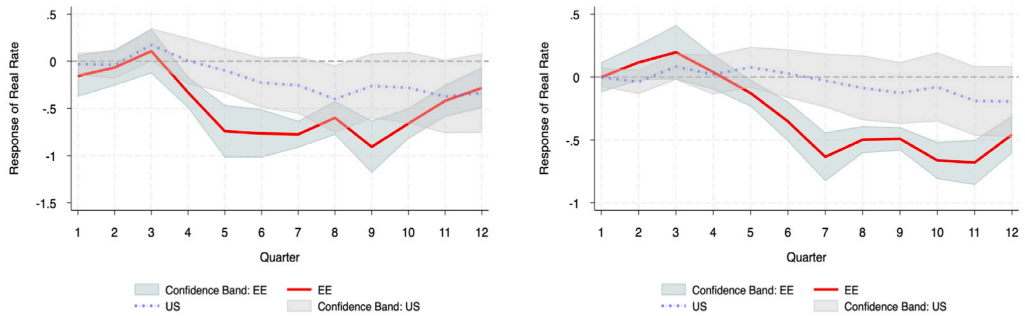
China, India and Russia. These responses are very similar to the responses reported in Fig. 2. We only report the response due to the defense expenditure shock but the response due to the government expenditure shock is also similar.

Fig. 3 gives the response of the real policy rate in the US and emerging economies due to the four US government expenditure shocks obtained using Cholesky decomposition and max share identification. These responses are obtained using the real policy rate (monetary policy rate-consumer inflation) as the dependent variable in the local projection regression. All these shocks suggest a negligible effect of the US government expenditure shock on the real policy rate in the US. These responses are similar to the responses of monetary policy rates in the US. Comparing responses of the monetary policy rate in Fig. 2 and the real monetary policy rate in Fig. 3 also suggests a very negligible spillover of US government expenditure shock on inflation in emerging economies as the response of the policy rate and the real policy rate is very similar.

3.2. Spillover to slope of the yield curve in the emerging economies and the US

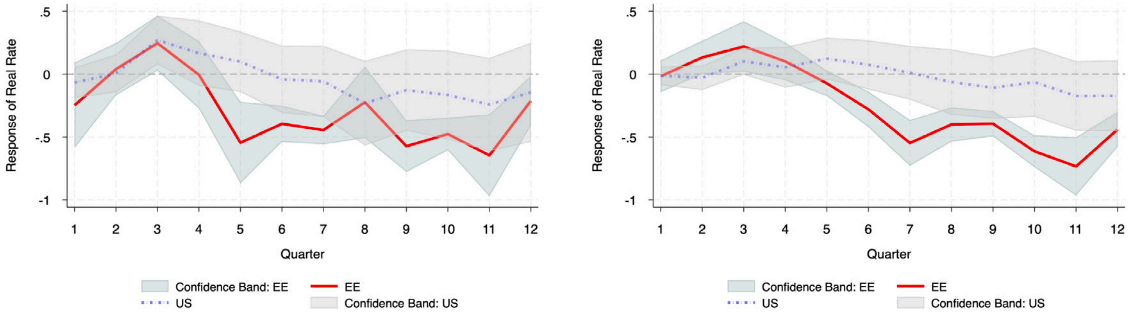
Fig. 4 gives the response of the slope of the yield curve (long-term yield - monetary policy rate) in the US and emerging economies due to the four US government expenditure shocks obtained using Cholesky decomposition and max share identification. These responses are obtained using the interest rate differential (government bond yield-monetary policy rate) as the dependent variable in the local projection regression. These results suggest that US government expenditure shock has very little effect on the slope of the yield curve in the US. Contrary to this, the US government expenditure shock increases the slope of the yield curve in emerging economies. Fig. B.2 in the appendix gives the response of slope of the yield curve from a sample excluding three large emerging economies i.e. China, India and Russia. Fig. B.3 in the appendix gives the response of slope of the yield curve from a sample excluding observations from 2019 onwards. These responses are very similar to the responses reported in Fig. 4.

Based on its effect on the slope of the yield curve, one can argue that this shock would be expansionary, as upward-sloping yield curves suggest economic expansion. Kurmann and Otrok (2013) argue that a future productivity news-led decline in policy rate in the US leads to an increase in the slope of the yield curve and is expansionary. Kumar et al. (2023) argue that the nature of the shock driving the yield curve slope is important and all types of increase in the slope of the yield curve are not expansionary. Morell (2018) makes a similar point and argues that the composition of the shock driving the slope of the yield curve has changed and this has led to diminishing predictive power of the yield curve slope.



(a) Response of real policy rate: Government expenditure shock using Cholesky decomposition

(b) Response of real policy rate: Government expenditure shock using Cholesky decomposition



(c) Response of real policy rate: Government expenditure shock using Max Share identification

(d) Response of real policy rate: Defense expenditure shock using Max Share identification

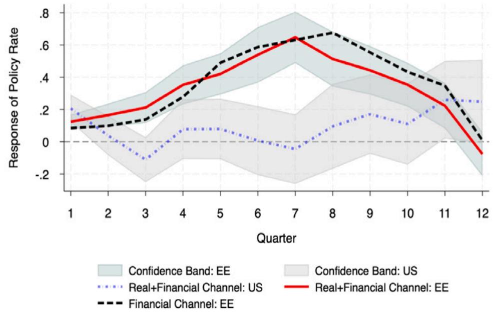
Fig. 3. Response of real monetary policy rate in emerging economies and the US due to the US government expenditure shocks
Notes: Dotted blue lines give response β^h of real policy rate in the US due to government expenditure shock in the US from $Y_{t+h}-Y_{t-1}=\mu^h+f_t\beta^h+\sum_{j=-1}^{j=-4}(x_{t+j}-\bar{x})\gamma_x^h+e_{t+h}$. Red lines give response β^h of real policy rate in emerging economies due to government expenditure shock in the US from $Y_{i,t+h}-Y_{i,t-1}=\mu_i^h+f_t\beta^h+\sum_{j=-1}^{j=-4}(x_{i,t+j}-\bar{x}_i)\gamma_x^h+e_{i,t+h}$. x_t and $x_{i,t}$ include GDP growth, inflation, and real monetary policy rate.

These results seen together with responses of the policy rate in the emerging economies due to the US government expenditure shock suggest that there is very little effect of the shock on long-term rates and there is a policy rate disconnect documented in Kalemli-Ozcan (2019) who also argues that counter-cyclical risk premium in emerging economies may lead to such disconnect between policy rates and government bond yield. We also find that most of these increases in the slope of the yield curve in the medium run are driven by financial channels. Fig. 5 gives the response of the slope of the yield curve where we include an additional control variable i.e. VIX index to control for disruptions or rising uncertainty in global financial markets. Kim et al. (2024) also explores the relationship between bond yield uncertainty and interest rate and find that innovations in bond yield uncertainty increases interest rate. We find that despite controlling for uncertainty in global financial markets, the US government expenditure shock leads to an increase in the slope of the yield curve in emerging economies This is likely because VIX may not be able to capture the risk generated due to output contraction in emerging economies which is the main source of counter-cyclical risk.

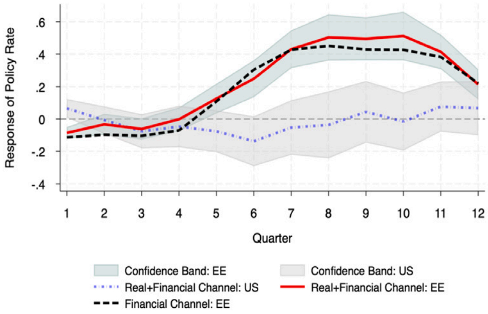
3.3. Spillover to real effective exchange rate in the emerging economies and the US

Fig. 6 gives the response of real effective exchange rates in the US and emerging economies due to the four US government expenditure shocks obtained using Cholesky decomposition and max share identification. These responses are obtained using the log of real effective exchange rate as the dependent variable in the local projection regression. Most of the existing studies suggest that fiscal expansion in the US leads to the depreciation of the real exchange rate for the US (see Kim and Roubini, 2008; Corsetti and Müller, 2006; Monacelli and Perotti, 2010; Ravn et al., 2012; Enders et al., 2011). Results obtained in this paper also suggest that the US government expenditure shock leads to the depreciation of the real effective exchange rate for the US and improves its competitiveness. The effect is persistent and depreciation is accelerated after 2 years. Contrary to this, the US government expenditure shock leads to an appreciation of real effective exchange rates for emerging economies and hurts their competitiveness. The appreciation of real effective exchange rates in emerging economies is also persistent similar to the effect in the US economy. The maximum appreciation of the real effective exchange rate is up to 4% for emerging economies which is mirrored in the maximum depreciation in the US.

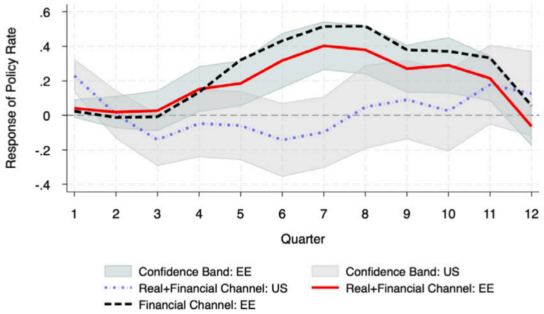
Fig. B.4 in appendix gives the response of the real effective exchange rate from a sample excluding three large emerging economies i.e. China, India and Russia. Fig. B.5 in appendix gives the response of the real effective exchange rate from a regression in which we include lag of real effective exchange rate as an additional control variable in the local projection regressions. Fig. B.6 in the appendix



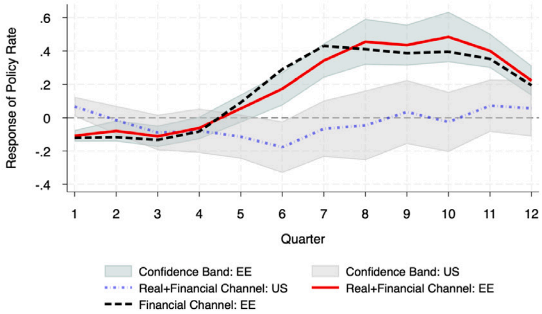
(a) Response of the slope of the yield curve: Government expenditure shock using Cholesky decomposition



(b) Response of the slope of the yield curve: Defense expenditure shock using Cholesky decomposition



(c) Response of the slope of the yield curve: Government expenditure shock Using Max Share identification



(d) Response of the slope of the yield curve: Defense expenditure shock using max share identification

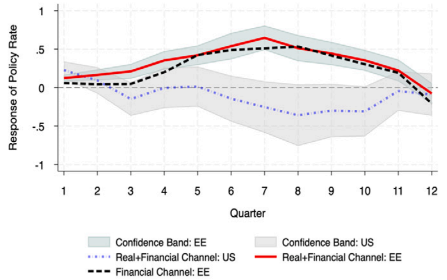
Fig. 4. Response of the slope of the yield curve in emerging economies and US due to US government expenditure shocks
Notes: Dotted blue lines give response β^h of slope of the yield curve in the US due to government expenditure shock in the US from $Y_{t+h} - Y_{t-1} = \mu^h + f_t\beta^h + \sum_{j=-1}^{j=-4}(x_{t+j} - \bar{x})\gamma_x^h + e_{t+h}$. Red lines give response β^h of slope of the yield curve in emerging economies due to government expenditure shock in the US from $Y_{i,t+h} - Y_{i,t-1} = \mu_i^h + f_t\beta^h + \sum_{j=-1}^{j=-4}(x_{i,t+j} - \bar{x}_i)\gamma_x^h + e_{i,t+h}$. Dotted black lines give the response β^h of slope of the yield curve in emerging economies due to government expenditure shock in the US from $Y_{i,t+h} - Y_{i,t-1} = \mu_i^h + f_t\beta^h + f_t\left(z_{i,t} - \bar{z}_i\right)\theta_z^h + \left(z_{i,t} - \bar{z}_i\right)\Theta_z^h + \sum_{j=-1}^{j=-4}(x_{i,t+j} - \bar{x}_i)\gamma_x^h + e_{i,t+h}$. x_t and $x_{i,t}$ include GDP growth, inflation, and slope of the yield curve. $z_{i,t}$ included GDP growth, and inflation.

gives the response of the real effective exchange rate from a sample excluding observations from 2019 onwards. These responses are very similar to the responses reported in Fig. 6.

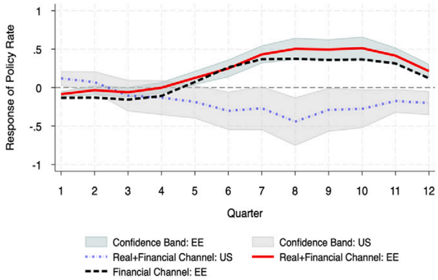
3.4. Spillover to real output

Fig. 7 gives the response of real log GDP in emerging economies due to the four US government expenditure shocks obtained using Cholesky decomposition and max share identification. All these shocks suggest that US government expenditure shock negatively affects growth in emerging economies and the cumulative decline in GDP is between 1 to 1.5%. The maximum (-) response due to the government expenditure shock is obtained after 5 quarters whereas the maximum response due to the defense expenditure shock is obtained after 9 quarters. These results suggest that the real effective exchange rate channel is the dominant channel determining the response of output in emerging economies. This is because if the real interest rate channel was dominating then the output should have increased in the emerging economies. To explore this further, we make country groups based on their exports to GDP ratio, trade to GDP ratio, external debt to GDP ratio and domestic credit to GDP ratio. Exports and trade to GDP ratio help us understand the role of external demand influencing these economies. External debt and domestic credit to GDP ratio help us understand the role of financial dependence and development.

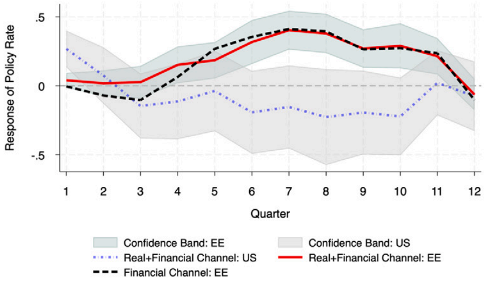
For each of these variables, we create two groups by comparing the mean for these countries with the overall mean for all these countries after 1990. For example, for the trade-to-GDP ratio, we calculate the mean for each country after 1990 and the overall mean of trade-to-GDP ratio for all countries and countries having a mean higher than the overall mean are categorized as high trade-to-GDP ratio and other countries are categorized as low trade-to-GDP ratio. From Fig. 8, we can see that the countries having higher trade and exports to GDP ratio have a more persistent decline in output. This is expected if the external demand is the channel dominating the output effect in emerging economies. Responses presented in Fig. 9 suggest that countries having higher external debt to GDP ratio have a more persistent decline in output compared to the countries with lower external debt to GDP ratio. Responses presented in Fig. 9 also suggest that countries having lower financial development have a more persistent decline in output compared to the countries with lower external debt to GDP ratio.



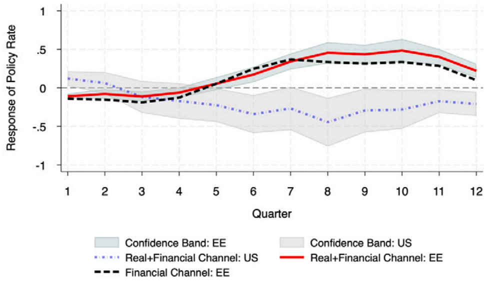
(a) Response of the slope of the yield curve: Government expenditure shock using Cholesky decomposition



(b) Response of the slope of the yield curve: Defense expenditure shock using Cholesky decomposition

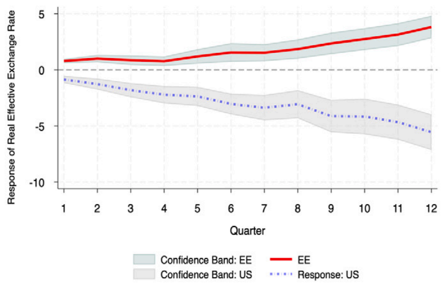


(c) Response of the slope of the yield curve: Government expenditure shock Using Max Share identification

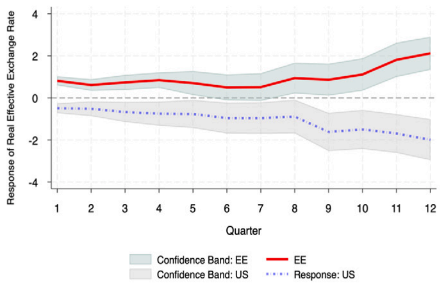


(d) Response of the slope of the yield curve: Defense expenditure shock using max share identification

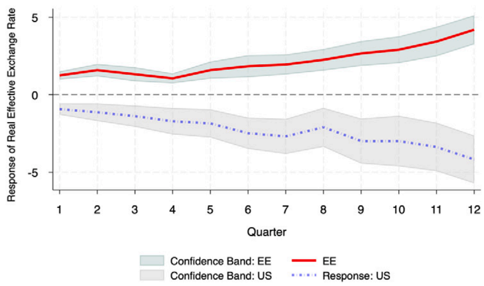
Fig. 5. Response of the slope of the yield curve in emerging economies and the US due to US government expenditure shocks
Notes: Dotted blue lines give response β^h of slope of the yield curve in the US due to government expenditure shock in the US from $Y_{t+h} - Y_{t-1} = \mu^h + f_t\beta^h + \sum_{j=-1}^{j=-4}(x_{t+j} - \bar{x})\gamma_i^h + e_{t+h}$. Red lines give response β^h of slope of the yield curve in emerging economies due to government expenditure shock in the US from $Y_{i,t+h} - Y_{i,t-1} = \mu_i^h + f_t\beta^h + \sum_{j=-1}^{j=-4}(x_{i,t+j} - \bar{x}_i)\gamma_x^h + e_{i,t+h}$. Dotted black lines give response β^h of slope of the yield curve in emerging economies due to government expenditure shock in the US from $Y_{i,t+h} - Y_{i,t-1} = \mu_i^h + f_t\beta^h + f_t\left(z_{i,t} - \bar{z}_i\right)\theta_z^h + \left(z_{i,t} - \bar{z}_i\right)\Theta_z^h + \sum_{j=-1}^{j=-4}(x_{i,t+j} - \bar{x}_i)\gamma_x^h + e_{i,t+h}$. x_t and $x_{i,t}$ included GDP growth, inflation, slope of the yield curve and VIX. $z_{i,t}$ included GDP growth, and inflation.



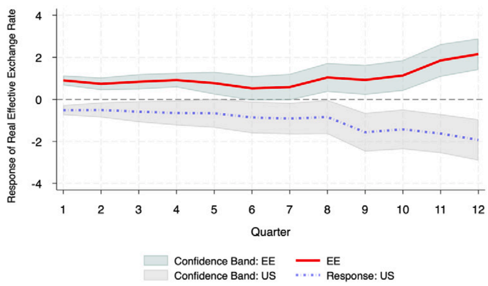
(a) Response of the REER: Government expenditure shock using Cholesky decomposition



(b) Response of the REER: Defense expenditure shock using Cholesky decomposition

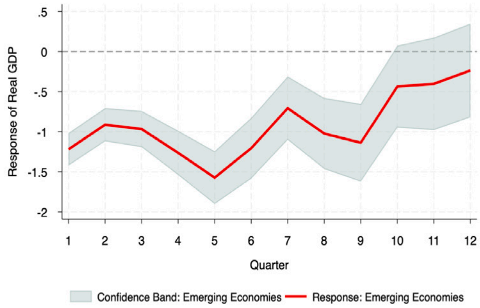


(c) Response of the REER: Government expenditure shock using max share identification

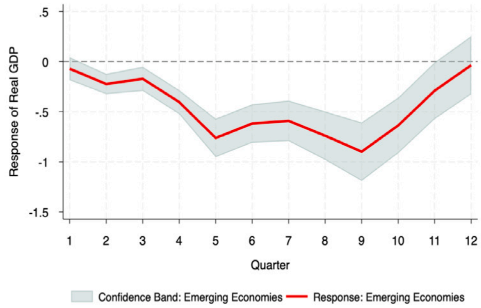


(d) Response of the REER: Defense expenditure shock using max share identification

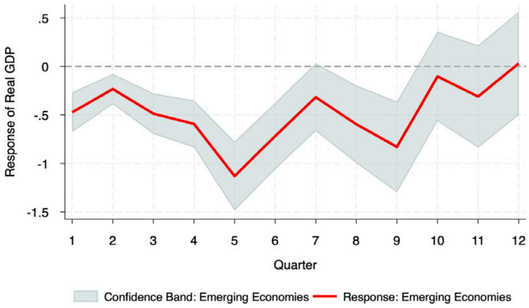
Fig. 6. Response of real effective exchange rate in emerging economies and the US due to the US government expenditure shocks
Notes: Dotted blue lines give response β^h of real effective exchange rate in the US due to government expenditure shock in the US from $Y_{t+h} - Y_{t-1} = \mu^h + f_t\beta^h + \sum_{j=-1}^{j=-4}(x_{t+j} - \bar{x})\gamma_x^h + e_{t+h}$. Red lines give response β^h of real effective exchange rate in emerging economies due to government expenditure shock in the US from $Y_{i,t+h} - Y_{i,t-1} = \mu_i^h + f_t\beta^h + \sum_{j=-1}^{j=-4}(x_{i,t+j} - \bar{x}_i)\gamma_x^h + e_{i,t+h}$. x_t and $x_{i,t}$ included GDP growth, inflation, and monetary policy rate.



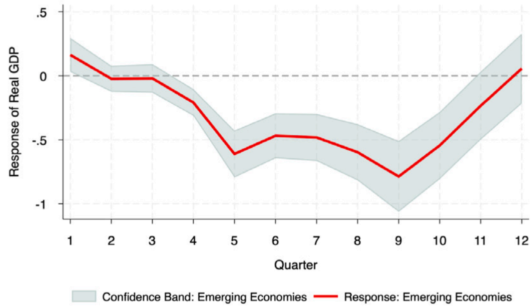
(a) Response of the GDP: Government expenditure shock using Cholesky decomposition



(b) Response of the GDP: Defense expenditure shock using Cholesky decomposition

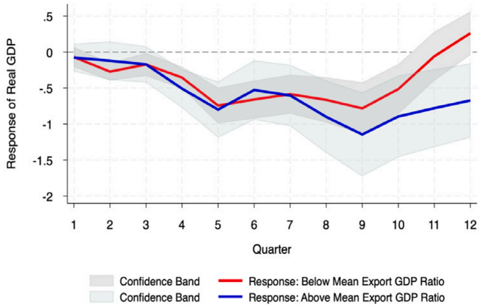


(c) Response of the GDP: Government expenditure shock using max share identification

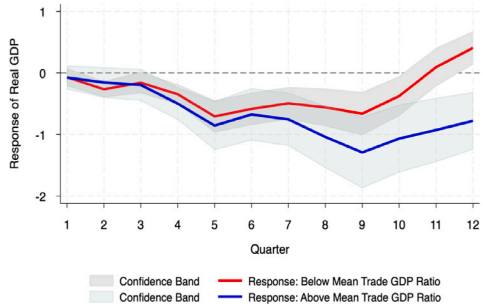


(d) Response of the GDP: Defense expenditure shock using max share identification

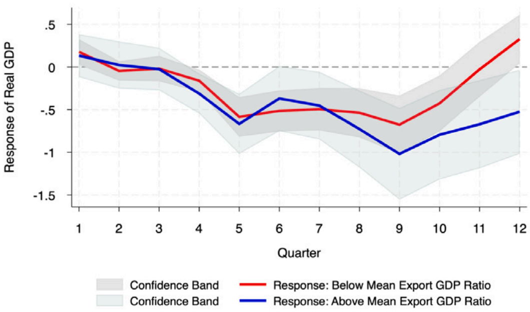
Fig. 7. Response of real GDP in emerging economies due to US government expenditure shock
Notes: Red lines give response β^h of real GDP emerging economies due to expenditure shock in the US from $Y_{i,t+h} - Y_{i,t-1} = \mu_i^h + f_t\beta^h + \sum_{j=-1}^{j=-4} x_{i,t+j}\gamma_x^h + e_{i,t+h}$. $x_{i,t}$ included log real GDP, log consumer price, and monetary policy rate.



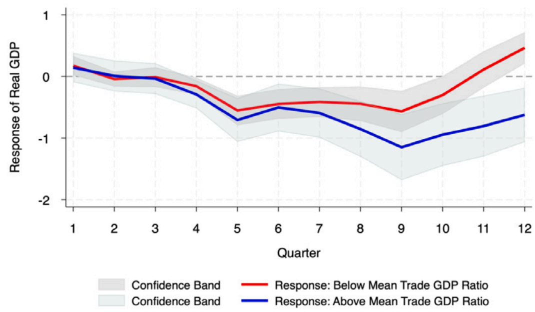
(a) Response of the GDP: Defense expenditure shock using Cholesky decomposition



(b) Response of the GDP: Defense expenditure shock using Cholesky decomposition

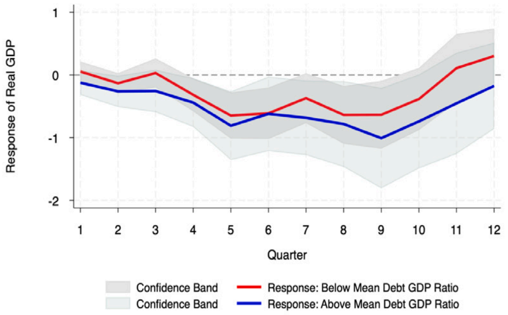


(c) Response of the GDP: Defense expenditure shock using max share identification

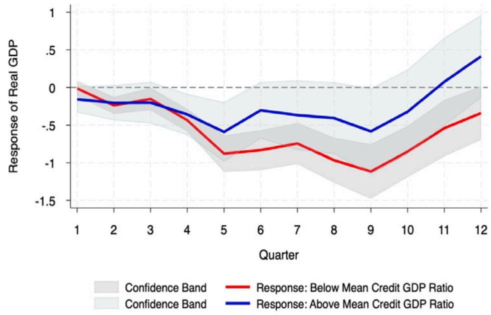


(d) Response of the GDP: Defense expenditure shock using max share identification

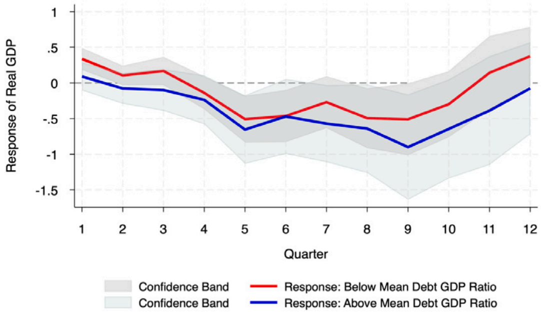
Fig. 8. Response of real GDP in emerging economies due to US government expenditure shock based on exports and trade share
Notes: Red lines give β_1^h response of real GDP emerging economies due to expenditure shock in the US from $Y_{i,t+h} - Y_{i,t-1} = \mu_i^h + \beta_1^h f_t + \beta_2^h f_t \mathrm{Dum}_i + \sum_{j=-1}^{j=-4} x_{i,t+j}\gamma_x^h + e_{i,t+h}$. Blue lines response $\beta_1^h + \beta_2^h$ of real GDP in emerging economies due to expenditure shock in the US from $Y_{i,t+h} - Y_{i,t-1} = \mu_i^h + \beta_1^h f_t + \beta_2^h f_t \mathrm{Dum}_i + \sum_{j=-1}^{j=-4} x_{i,t+j}\gamma_x^h + e_{i,t+h}$. $x_{i,t}$ included log real GDP, log consumer price, and monetary policy rate. $\mathrm{Dum}_i = 1$ for countries having mean export and trade to GDP ratio higher than the overall mean of these variables in the sample. First column is for country grouping based on export to GDP ratio. Second column is for country grouping based on trade to GDP ratio.



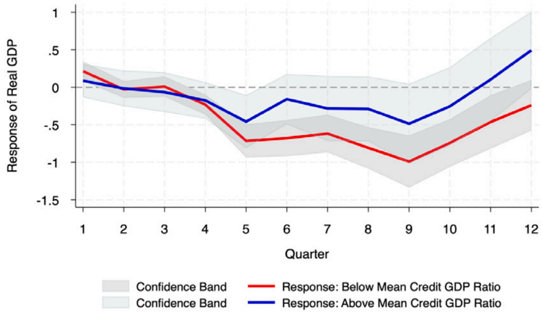
(a) Response of the GDP: Defense expenditure shock using Cholesky decomposition



(b) Response of the GDP: Defense expenditure shock using Cholesky decomposition



(c) Response of the GDP: Defense expenditure shock using max share identification



(d) Response of the GDP: Defense expenditure shock using max share identification

Fig. 9. Response of real GDP in emerging economies due to US government expenditure shock based on debt and financial development
Notes: Red lines give β_1^h response of real GDP emerging economies due to expenditure shock in the US from $Y_{i,t+h} - Y_{i,t-1} = \mu_i^h + \beta_1^h f_t + \beta_2^h f_t \text{Dum}_i + \sum_{j=-1}^{j=-4} x_{i,t+j} \gamma_x^h + e_{i,t+h}$. Blue lines response $\beta_1^h + \beta_2^h$ of real GDP in emerging economies due to expenditure shock in the US from $Y_{i,t+h} - Y_{i,t-1} = \mu_i^h + \beta_1^h f_t + \beta_2^h f_t \text{Dum}_i + \sum_{j=-1}^{j=-4} x_{i,t+j} \gamma_x^h + e_{i,t+h}$. $x_{i,t}$ included log real GDP, log consumer price,and monetary policy rate. $\text{Dum}_i = 1$ for countries having mean external debt and domestic credit to GDP ratio higher than the overall mean of these variables in the sample. First column is for country grouping based on debt to GDP ratio. Second column is for country grouping based on domestic credit to GDP ratio.

Fig. B.7 in appendix gives the response of the real gross domestic product from a sample excluding three large emerging economies i.e. China, India and Russia. Fig. B.8 and B.9 in appendix gives the response of the real gross domestic product from a sample excluding observations from 2019 onwards. These responses are very similar to the responses reported in Figs. 7, 8 and 9.

4. Concluding remarks

Fiscal policy is an important tool for business cycle stabilization both in advanced and emerging economies and has significant spillover due to demand spillover and financial integration in the global economy. In this paper, we estimate the spillover of US fiscal policy shock in emerging economies and show that this is not confounded with the US monetary spillover in emerging economies. This is because the identified US government expenditure shocks have very little effect on the monetary policy rate in the US. Given the zero lower bound on the interest rate in the US, we measure monetary policy rate in the US by Wu-Xia shadow federal funds rate.

We find that - similar to its effect in advanced economies - the US government expenditure shock leads to a lowering of monetary policy rate and real policy rate in the emerging economies. Results suggest a disconnect between long-term rate and policy rate that leads to the steepening of the yield curve in emerging economies due to the shock. This policy rate disconnect has also been argued by De Leo et al. (2022) and Kalemli-Ozcan (2019) in the case of monetary policy spillover. We show that the above-mentioned effects of US government expenditure shock in emerging economies are direct and driven by financial channel and not indirectly driven by the effect of this shock on GDP growth and inflation (real channel).

Similar to the findings in the existing literature, we find that the US government expenditure shock leads to the depreciation of the real effective exchange rate in the US. Contrary to the effect of the shock in the US, we find that this shock causes a prolonged appreciation of real effective exchange rates in emerging economies and hurts their external competitiveness. The US government expenditure shock can increase output in the emerging economies by stimulating domestic demand or decrease output by lowering external demand. Results suggest that the external demand channel dominates and output in the emerging economies declines. As expected, we find that countries having higher openness, i.e., high exports and trade to GDP ratio, experience higher and more persistent decline in output due to the US government expenditure shock. We also find that countries with higher external debt to GDP ratio and lower financial development experience more negative effect on output. These results suggest that the US government expenditure shocks create financial vulnerabilities and reduce external demand for emerging economies.

CRediT authorship contribution statement

Abhishek Kumar: Conceptualization, Data curation, Formal analysis, Methodology, Software, Validation, Visualization, Writing – original draft, Writing – review & editing. **Sushanta Mallick:** Conceptualization, Data curation, Formal analysis, Methodology, Resources, Validation, Visualization, Writing – original draft, Writing – review & editing. **Apra Sinha:** Conceptualization, Data curation, Formal analysis, Methodology, Software, Validation, Visualization, Writing – original draft, Writing – review & editing.

Appendix A. Data

United States of America

Federal Reserve Bank of Saint Louis

- Government Consumption Expenditures and Gross Investment, Billions of Dollars, Quarterly, Seasonally Adjusted Annual Rate (GCE)
- Government consumption expenditures: Federal: National defense, Billions of Dollars, Quarterly, Seasonally Adjusted Annual Rate (A997RC1Q027SBEA)
- Real Broad Effective Exchange Rate for United States (RBUSBIS)
- Real Gross Domestic Product, Billions of Chained 2017 Dollars, Quarterly, Seasonally Adjusted Annual Rate (GDPC1)
- Gross Domestic Product: Implicit Price Deflator, Index 2017 = 100, Quarterly, Seasonally Adjusted (GDPDEF)
- Consumer Price Index for All Urban Consumers: All Items in U.S. City Average, Index 1982-1984 = 100, Quarterly, Seasonally Adjusted (CPIAUCSL)
- Market Yield on U.S. Treasury Securities at 10-Year Constant Maturity, Quoted on an Investment Basis, Percent, Quarterly, Not Seasonally Adjusted DGS10
- CBOE Volatility Index: VIX (VIXCLS)

Bureau of Economic Analysis

- Table 3.2. Federal Government Current Receipts and Expenditures row(1)

Federal Reserve Bank of Atlanta

- Wu-Xia shadow federal funds rate (last business day of the month)

World Bank

- External debt stocks, total (DOD, current US$)
- GDP (current US$)

Table A.1
Gross Domestic Product: Time Period and Sources.

S.No	Country	Start	End	Source
1	Argentina	2004q1	2023q3	https://data.imf.org/
2	Brazil	1996q1	2023q3	https://data.imf.org/
3	Chile	1996q1	2023q3	https://data.imf.org/
4	China, P.R.: Mainland	1992q1	2023q3	https://fred.stlouisfed.org
5	Colombia	2005q1	2023q3	https://data.imf.org/
6	Egypt, Arab Rep. of	2001q3	2023q4	https://mped.gov.eg/
7	Hungary	1995q1	2023q4	https://data.imf.org/
8	India	1996q2	2023q3	https://data.imf.org/
9	Indonesia	2000q1	2023q3	https://data.imf.org/
10	Iran, Islamic Rep. of	1990q1	2023q4	https://www.cbi.ir/
11	Malaysia	2015q1	2023q4	https://open.dosm.gov.my/
12	Mexico	1993q1	2023q4	https://data.imf.org/
13	Philippines	2000q1	2023q3	https://data.imf.org/
14	Poland, Rep. of	1995q1	2023q4	https://data.imf.org/
15	Russian Federation	2003q1	2021q3	https://fred.stlouisfed.org
16	Saudi Arabia	2010q1	2023q4	https://data.imf.org/
17	South Africa	1993q1	2023q3	https://data.imf.org/
18	Thailand	2003q1	2023q4	https://data.imf.org/
19	Turkey, Rep of	1998q1	2023q3	https://data.imf.org/
20	United Arab Emirates	2012q1	2023q4	https://fcsc.gov.ae/

Notes: The real gross domestic product (GDP) is based on expenditure method. For China, the real GDP is obtained using consumer price index as deflator.

Table A.2
Consumer Price Index: Time Period and Sources.

S.No	Country	Start	End	Source
1	Argentina	2017q1	2023q4	https://fred.stlouisfed.org
2	Brazil	1990q1	2023q4	https://data.imf.org/
3	Chile	1990q1	2023q4	https://data.imf.org/
4	China, P.R.: Mainland	1990q1	2023q4	https://data.imf.org/
5	Colombia	1990q1	2023q4	https://data.imf.org/
6	Egypt, Arab Rep. of	1990q1	2023q4	https://data.imf.org/
7	Hungary	1990q1	2023q4	https://data.imf.org/
8	India	1990q1	2023q4	https://data.imf.org/
9	Indonesia	1990q1	2023q4	https://data.imf.org/
10	Iran, Islamic Rep. of	1990q1	2023q4	https://data.imf.org/
11	Malaysia	1990q1	2023q4	https://data.imf.org/
12	Mexico	1990q1	2023q4	https://data.imf.org/
13	Philippines	1990q1	2023q4	https://data.imf.org/
14	Poland, Rep. of	1990q1	2023q4	https://data.imf.org/
15	Russian Federation	1992q1	2022q1	https://data.imf.org/
16	Saudi Arabia	1990q1	2023q4	https://data.imf.org/
17	South Africa	1990q1	2023q4	https://data.imf.org/
18	Thailand	1990q1	2023q4	https://data.imf.org/
19	Turkey, Rep of	1990q1	2023q4	https://data.imf.org/
20	United Arab Emirates	2007q1	2022q4	https://data.imf.org/

Table A.3
Monetary Policy Rate: Time Period and Sources.

S.No	Country	Start	End	Source
1	Argentina	2002q1	2023q4	https://data.imf.org/
2	Brazil	1999q2	2023q4	https://data.imf.org/
3	Chile	1995q3	2023q4	https://data.imf.org/
4	China, P.R.: Mainland	2016q1	2023q4	https://data.imf.org/
5	Colombia	1995q2	2023q4	https://data.imf.org/
6	Egypt, Arab Rep. of	2015q4	2023q4	https://data.imf.org/
7	Hungary	1990q1	2023q4	https://data.imf.org/
8	India	2005q4	2017q2	https://data.imf.org/
9	Indonesia	1990q1	2023q4	https://data.imf.org/
10	Iran, Islamic Rep. of	2021q1	2023q4	https://www.cbi.ir/
11	Malaysia	2002q1	2023q4	https://data.imf.org/
12	Mexico	2002q1	2023q4	https://data.imf.org/
13	Philippines	2002q1	2023q4	https://data.imf.org/
14	Poland, Rep. of	1998q1	2023q4	https://data.imf.org/
15	Russian Federation	2002q1	2023q4	https://data.imf.org/
16	Saudi Arabia	1999q1	2017q4	https://data.imf.org/
17	South Africa	1998q2	2023q4	https://data.imf.org/
18	Thailand	2000q3	2023q4	https://data.imf.org/
19	Turkey, Rep of	1990q1	2023q4	https://data.imf.org/
20	United Arab Emirates	2019q1	2023q4	https://www.centralbank.ae/

Notes: The interest rate for United Arab Emirates is Emirates Interbank Offered Rate (EIBOR). The interest rate for Iran is Interbank Market Rate. For all other countries we use Monetary Policy-Related Interest Rate from IMF.

- Domestic Credit to private sector (% of GDP)
- Trade (% of GDP)
- Exports of goods and services (% of GDP)

Emerging Economies

The IMF World Economic Outlook classifies 39 economies as advanced economies based on income, exports of diversified goods and services, and integration into the global financial system. The remaining countries are classified as “emerging market and developing” economies. The emerging economies are classified based on an index consisting of nominal GDP, population, GDP per capita, share of world trade, and share of world external debt.

Table A.4
Yield on Government Bond: Time Period and Sources.

S.No	Country	Start	End	Source
1	Brazil	2007q1	2023q4	Bloomberg
2	Chile	2004q3	2023q4	https://fred.stlouisfed.org
3	China, P.R.: Mainland	2005q2	2023q4	Bloomberg
4	Colombia	2003q1	2023q4	https://fred.stlouisfed.org
5	Egypt, Arab Rep. of	2005q1	2022q2	Bloomberg
6	Hungary	2001q1	2023q4	https://data.imf.org/
7	India	2005q1	2017q2	https://data.imf.org/
8	Indonesia	2003q3	2023q4	Bloomberg
9	Malaysia	1992q1	2023q3	https://data.imf.org/
10	Mexico	2001q4	2023q3	https://data.imf.org/
11	Philippines	1994q4	2014q2	https://data.imf.org/
12	Poland, Rep. of	2001q1	2023q4	https://data.imf.org/
13	Russian Federation	2005q2	2023q4	https://data.imf.org/
14	South Africa	1990q1	2023q4	https://data.imf.org/
15	Thailand	1999q3	2023q4	https://data.imf.org/
16	Turkey, Rep of	2010q1	2023q4	Bloomberg

Table A.5
Real Effective Exchange Rate: Time Period and Sources.

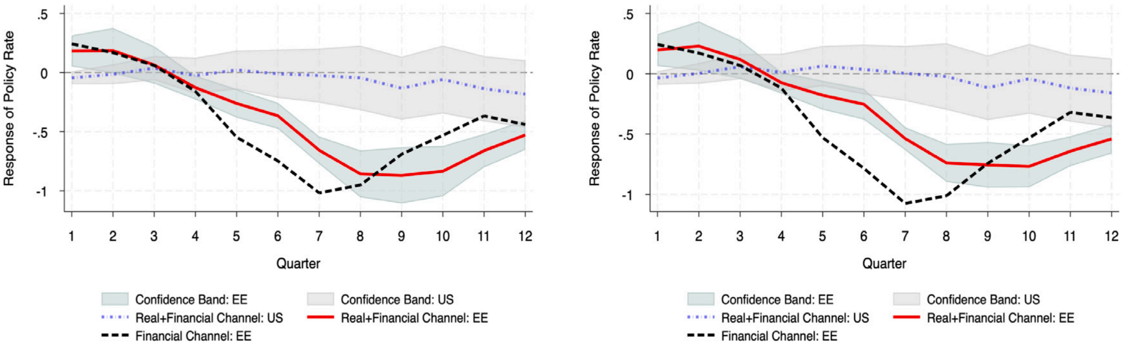
S.No	Country	Start	End	Source
1	Argentina	1994q1	2023q4	https://fred.stlouisfed.org/
2	Brazil	1990q1	2023q4	https://data.imf.org/
3	Chile	1990q1	2023q4	https://data.imf.org/
4	China, P.R.: Mainland	1990q1	2023q4	https://data.imf.org/
5	Colombia	1990q1	2023q4	https://data.imf.org/
6	Hungary	1990q4	2023q4	https://data.imf.org/
7	India	1994q1	2023q4	https://fred.stlouisfed.org/
8	Indonesia	1994q1	2023q4	https://fred.stlouisfed.org/
9	Iran, Islamic Rep. of	1990q1	2023q4	https://data.imf.org/
10	Malaysia	1990q1	2023q4	https://data.imf.org/
11	Mexico	1990q1	2023q4	https://data.imf.org/
12	Philippines	1990q1	2023q4	https://data.imf.org/
13	Poland, Rep. of	1990q4	2023q4	https://data.imf.org/
14	Russian Federation	1994q1	2023q4	https://data.imf.org/
15	Saudi Arabia	1990q1	2023q4	https://data.imf.org/
16	South Africa	1990q1	2023q4	https://data.imf.org/
17	Thailand	1994q1	2023q4	https://fred.stlouisfed.org/
18	Turkey, Rep of	1994q1	2023q4	https://fred.stlouisfed.org/
19	United Arab Emirates	1994q1	2023q4	https://fred.stlouisfed.org/

They identify the following countries in the emerging market group,[6] in alphabetical order: Argentina, Brazil, Chile, China, Colombia, Egypt, Hungary, India, Indonesia, Iran, Malaysia, Mexico, the Philippines, Poland, Russia, Saudi Arabia, South Africa, Thailand, Turkey, and the United Arab Emirates. Two countries were excluded: Nigeria because of its classification as a low-income country (eligible for IMF Poverty Reduction and Growth Trust financing) during the sample period considered (2010-20) and Qatar because of its population of less than 5 million. These 20 emerging market countries account for 34 percent of the world's nominal GDP in US dollars and 46 percent in purchasing-power-parity terms. These countries are also featured in commonly used indices for emerging markets, such as those of J.P. Morgan, Morgan Stanley Capital International, and Bloomberg. Data for these emerging economies have been collected from several sources and is available for different time periods. Tables below give the availability and sources for these variables from emerging economies.

6 https://www.imf.org/external/pubs/ft/fandd/2021/06/the-future-of-emerging-markets-duttagupta-and-pazarbasioglu.htm.

Appendix B. Additional results

B.1. Monetary policy rate

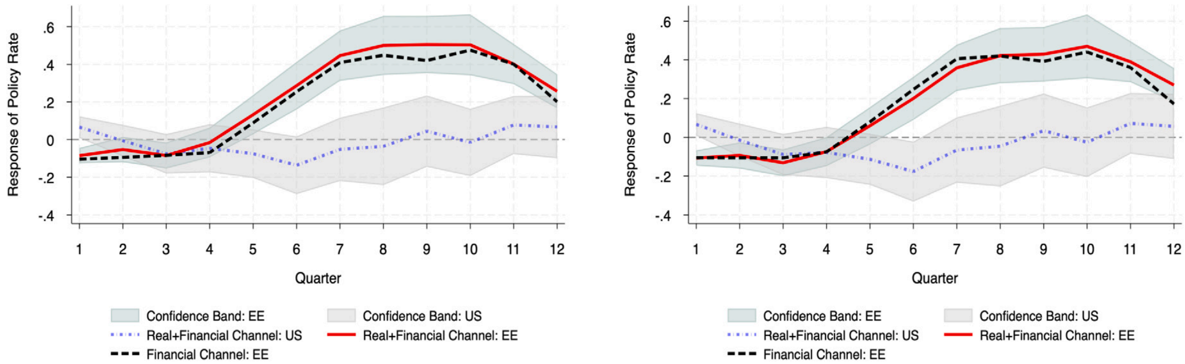


(a) Response due to US government expenditure shock

(b) Response due to US government expenditure shock

Fig. B.1. Response of the policy rate in emerging economies and US due to US government expenditure shocks
Notes: Dotted blue lines give response β^h of policy rate in the US due to government expenditure shock in the US from $Y_{t+h} - Y_{t-1} = \mu^h + f_t\beta^h + \sum_{j=-1}^{j=-4}(x_{t+j} - \bar{x})\gamma_x^h + e_{t+h}$. Red lines give response β^h of policy rate in emerging economies due to government expenditure shock in the US from $Y_{i,t+h} - Y_{i,t-1} = \mu_i^h + f_t\beta^h + \sum_{j=-1}^{j=-4}(x_{i,t+j} - \bar{x}_i)\gamma_x^h + e_{i,t+h}$. Dotted black lines give response β^h of policy rate in emerging economies due to government expenditure shock in the US from $Y_{i,t+h} - Y_{i,t-1} = \mu_i^h + f_t\beta^h + f_t\left(z_{i,t} - \bar{z}_i\right)\theta_z^h + \left(z_{i,t} - \bar{z}_i\right)\Theta_z^h + \sum_{j=-1}^{j=-4}(x_{i,t+j} - \bar{x}_i)\gamma_x^h + e_{i,t+h}$. x_t and $x_{i,t}$ included GDP growth, inflation, and monetary policy rate. $z_{i,t}$ included GDP growth, and inflation. We exclude three large emerging economies China, India and Russia. (For interpretation of the colors in the figure(s), the reader is referred to the web version of this article.)

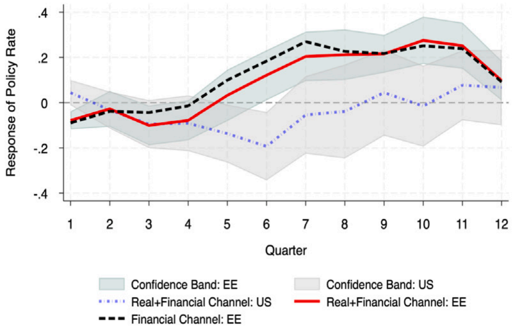
B.2. Slope of the yield curve



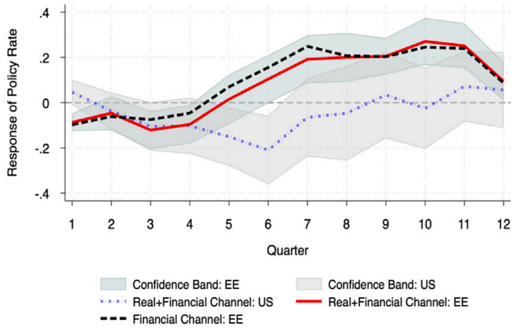
(a) Response of the slope of the yield curve: Defense expenditure shock using Cholesky decomposition

(b) Response of the slope of the yield curve: Defense expenditure shock using max share identification

Fig. B.2. Response of the slope of the yield curve in emerging economies and US due to US government expenditure shocks
Notes: Dotted blue lines give response β^h of slope of the yield curve in the US due to government expenditure shock in the US from $Y_{t+h} - Y_{t-1} = \mu^h + f_t\beta^h + \sum_{j=-1}^{j=-4}(x_{t+j} - \bar{x})\gamma_x^h + e_{t+h}$. Red lines give response β^h of slope of the yield curve in emerging economies due to government expenditure shock in the US from $Y_{i,t+h} - Y_{i,t-1} = \mu_i^h + f_t\beta^h + \sum_{j=-1}^{j=-4}(x_{i,t+j} - \bar{x}_i)\gamma_x^h + e_{i,t+h}$. Dotted black lines give the response β^h of slope of the yield curve in emerging economies due to government expenditure shock in the US from $Y_{i,t+h} - Y_{i,t-1} = \mu_i^h + f_t\beta^h + f_t\left(z_{i,t} - \bar{z}_i\right)\theta_z^h + \left(z_{i,t} - \bar{z}_i\right)\Theta_z^h + \sum_{j=-1}^{j=-4}(x_{i,t+j} - \bar{x}_i)\gamma_x^h + e_{i,t+h}$. x_t and $x_{i,t}$ include GDP growth, inflation, and slope of the yield curve. $z_{i,t}$ included GDP growth, and inflation. We exclude three large emerging economies i.e. China, India and Russia.



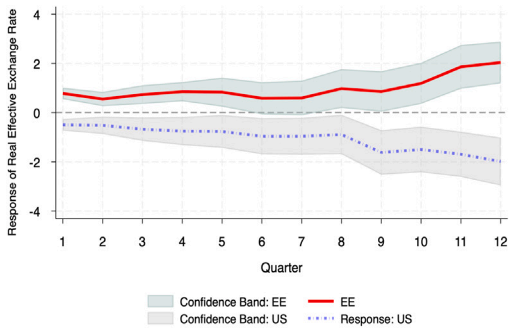
(a) Response of the slope of the yield curve: Defense expenditure shock using Cholesky decomposition



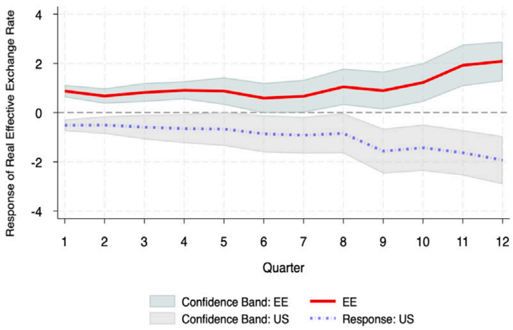
(b) Response of the slope of the yield curve: Defense expenditure shock using max share identification

Fig. B.3. Response of the slope of the yield curve in emerging economies and US due to US government expenditure shocks
Notes: Dotted blue lines give response β^h of slope of the yield curve in the US due to government expenditure shock in the US from $Y_{t+h} - Y_{t-1} = \mu^h + f_t\beta^h + \sum_{j=-1}^{j=-4}(x_{t+j} - \bar{x})\gamma_x^h + e_{t+h}$. Red lines give response β^h of slope of the yield curve in emerging economies due to government expenditure shock in the US from $Y_{i,t+h} - Y_{i,t-1} = \mu_i^h + f_t\beta^h + \sum_{j=-1}^{j=-4}(x_{i,t+j} - \bar{x}_i)\gamma_x^h + e_{i,t+h}$. Dotted black lines give the response β^h of slope of the yield curve in emerging economies due to government expenditure shock in the US from $Y_{i,t+h} - Y_{i,t-1} = \mu_i^h + f_t\beta^h + f_t\left(z_{i,t} - \bar{z}_i\right)\theta_z^h + \left(z_{i,t} - \bar{z}_i\right)\Theta_z^h + \sum_{j=-1}^{j=-4}(x_{i,t+j} - \bar{x}_i)\gamma_x^h + e_{i,t+h}$. x_t and $x_{i,t}$ include GDP growth, inflation, and slope of the yield curve. $z_{i,t}$ included GDP growth, and inflation. We exclude sample from 2020 onwards.

B.3. Real effective exchange rate

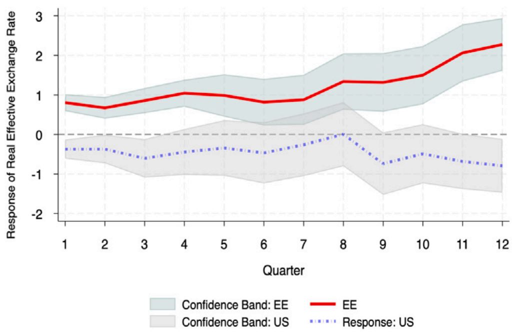


(a) Response of the REER: Defense expenditure shock using Cholesky decomposition

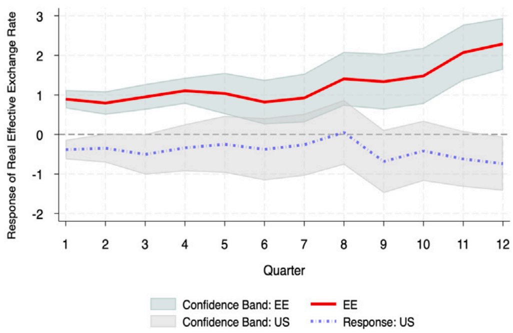


(b) Response of the REER: Defense expenditure shock using max share identification

Fig. B.4. Response of real effective exchange rate in emerging economies and the US due to the US government expenditure shocks
Notes: Dotted blue lines give response β^h of real effective exchange rate in the US due to government expenditure shock in the US from $Y_{t+h} - Y_{t-1} = \mu^h + f_t\beta^h + \sum_{j=-1}^{j=-4}(x_{t+j} - \bar{x})\gamma_x^h + e_{t+h}$. Red lines give response β^h of real effective exchange rate in emerging economies due to government expenditure shock in the US from $Y_{i,t+h} - Y_{i,t-1} = \mu_i^h + f_t\beta^h + \sum_{j=-1}^{j=-4}(x_{i,t+j} - \bar{x}_i)\gamma_x^h + e_{i,t+h}$. x_t and $x_{i,t}$ included GDP growth, inflation, and monetary policy rate. We exclude three large emerging economies i.e. China, India and Russia.

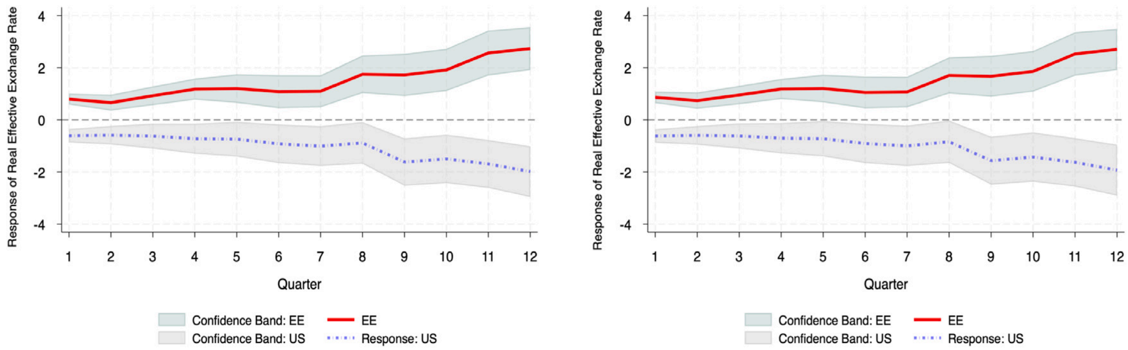


(a) Response of the REER: Defense expenditure shock using Cholesky decomposition



(b) Response of the REER: Defense expenditure shock using max share identification

Fig. B.5. Response of real effective exchange rate in emerging economies and the US due to the US government expenditure shocks
Notes: Dotted blue lines give response β^h of real effective exchange rate in the US due to government expenditure shock in the US from $Y_{t+h} - Y_{t-1} = \mu^h + f_t\beta^h + \sum_{j=-1}^{j=-4}(x_{t+j} - \bar{x})\gamma_x^h + e_{t+h}$. Red lines give response β^h of real effective exchange rate in emerging economies due to government expenditure shock in the US from $Y_{i,t+h} - Y_{i,t-1} = \mu_i^h + f_t\beta^h + \sum_{j=-1}^{j=-4}(x_{i,t+j} - \bar{x}_i)\gamma_x^h + e_{i,t+h}$. x_t and $x_{i,t}$ included GDP growth, inflation, monetary policy rate and real effective exchange rate.

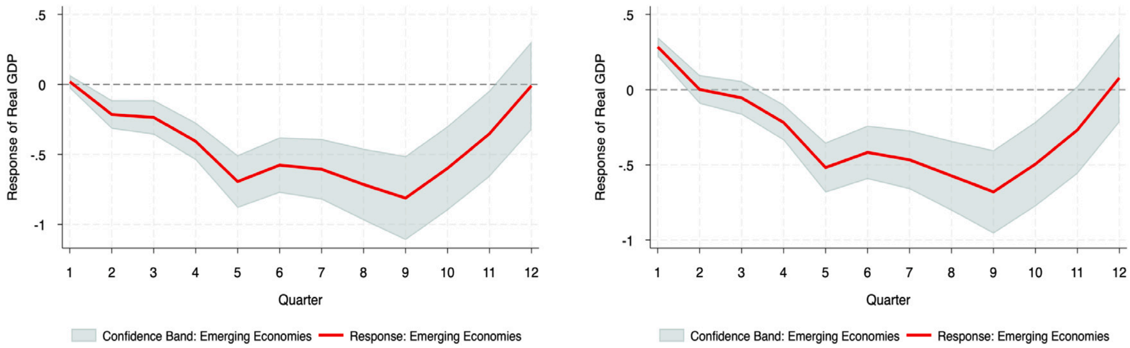


(a) Response of the REER: Defense expenditure shock using Cholesky decomposition

(b) Response of the REER: Defense expenditure shock using max share identification

Fig. B.6. Response of real effective exchange rate in emerging economies and the US due to the US government expenditure shocks
Notes: Dotted blue lines give response β^h of real effective exchange rate in the US due to government expenditure shock in the US from $Y_{t+h} - Y_{t-1} = \mu^h + f_t\beta^h + \sum_{j=-1}^{j=-4}(x_{t+j} - \bar{x})\gamma_x^h + e_{t+h}$. Red lines give response β^h of real effective exchange rate in emerging economies due to government expenditure shock in the US from $Y_{i,t+h} - Y_{i,t-1} = \mu_i^h + f_t\beta^h + \sum_{j=-1}^{j=-4}(x_{i,t+j} - \bar{x}_i)\gamma_x^h + e_{i,t+h}$. x_t and $x_{i,t}$ included GDP growth, inflation, and monetary policy rate. We exclude sample from 2020 onwards.

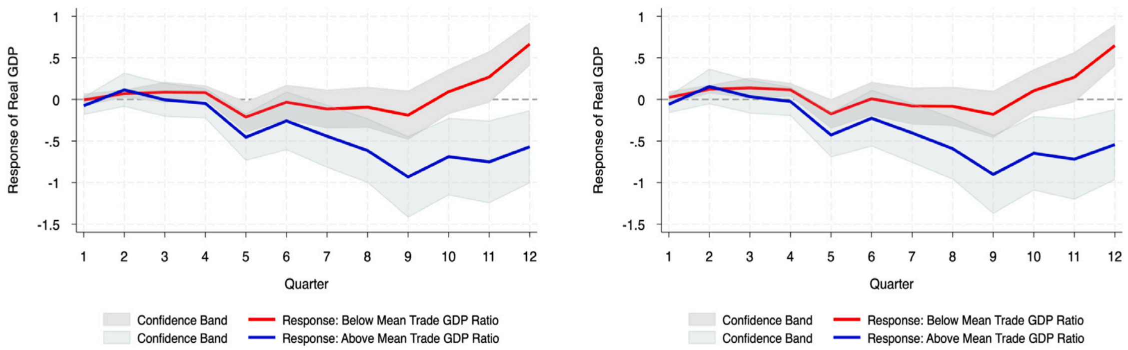
B.4. Gross domestic product



(a) Response of the GDP: Defense expenditure shock using Cholesky decomposition

(b) Response due to US government expenditure shock

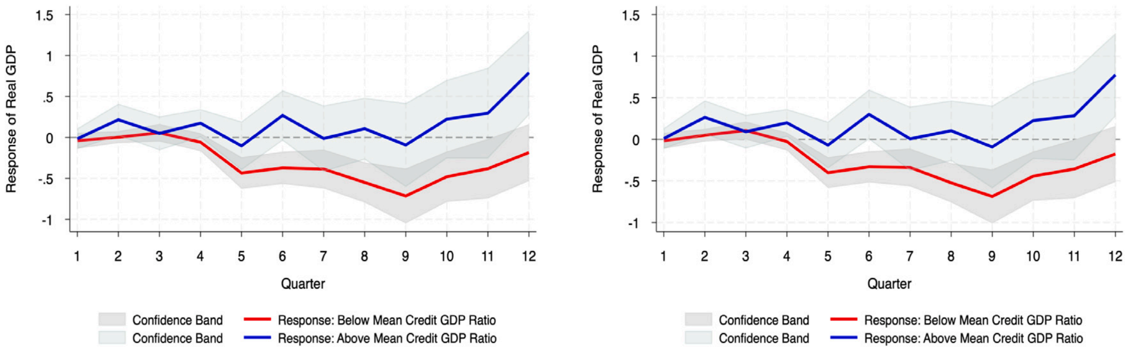
Fig. B.7. Response of real GDP in emerging economies due to US government expenditure shock
Notes: Red lines give response β^h of real GDP emerging economies due to expenditure shock in the US from $Y_{i,t+h} - Y_{i,t-1} = \mu_i^h + f_t\beta^h + \sum_{j=-1}^{j=-4} x_{i,t+j}\gamma_x^h + e_{i,t+h}$. $x_{i,t}$ included log real GDP, log consumer price, and monetary policy rate. (a) is with defense expenditure shock identified using Cholesky decomposition and (b) is for defense expenditure shock identified using max share identification. We exclude three large emerging economies i.e. China, India and Russia.



(a) Response of the GDP: Defense expenditure shock using Cholesky decomposition

(b) Response of the GDP: Defense expenditure shock using max share identification

Fig. B.8. Response of real GDP in emerging economies due to US government expenditure shock based on trade share
Notes: Red lines give β_1^h response of real GDP emerging economies due to expenditure shock in the US from $Y_{i,t+h} - Y_{i,t-1} = \mu_i^h + \beta_1^h f_t + \beta_2^h f_t \text{Dum}_i + \sum_{j=-1}^{j=-4} x_{i,t+j}\gamma_x^h + e_{i,t+h}$. Blue lines response $\beta_1^h + \beta_2^h$ of real GDP in emerging economies due to expenditure shock in the US from $Y_{i,t+h} - Y_{i,t-1} = \mu_i^h + \beta_1^h f_t + \beta_2^h f_t \text{Dum}_i + \sum_{j=-1}^{j=-4} x_{i,t+j}\gamma_x^h + e_{i,t+h}$. $x_{i,t}$ included log real GDP, log consumer price, and monetary policy rate. $\text{Dum}_i = 1$ for countries having mean trade to GDP ratio higher than the overall mean of this variables in the sample. We exclude sample from 2020 onwards.



(a) Response of the GDP: Defense expenditure shock using Cholesky decomposition

(b) Response of the GDP: Defense expenditure shock using max share identification

Fig. B.9. Response of real GDP in emerging economies due to US government expenditure shock based on financial development
Notes: Red lines give β_1^h response of real GDP emerging economies due to expenditure shock in the US from $Y_{i,t+h} - Y_{i,t-1} = \mu_i^h + \beta_1^h f_t + \beta_2^h f_t \mathrm{Dum}_i + \sum_{j=-1}^{j=-4} x_{i,t+j}\gamma_x^h + e_{i,t+h}$. Blue lines response $\beta_1^h + \beta_2^h$ of real GDP in emerging economies due to expenditure shock in the US from $Y_{i,t+h} - Y_{i,t-1} = \mu_i^h + \beta_1^h f_t + \beta_2^h f_t \mathrm{Dum}_i + \sum_{j=-1}^{j=-4} x_{i,t+j}\gamma_x^h + e_{i,t+h}$. $x_{i,t}$ included log real GDP, log consumer price, and monetary policy rate. $\mathrm{Dum}_i = 1$ for countries having mean credit to GDP ratio higher than the overall mean of this variables in the sample. We exclude sample from 2020 onwards.

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