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Monetary Policy Autonomy and International Monetary Spillovers

Ishak Demir

Lincoln International Business School, University of Lincoln,
Brayford Pool, Lincoln, LN6 7TS
Tel: +44 (0)1522 882 000

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Ishak Demir†

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Abstract

While Federal Reserve continues to normalize its monetary policy on the back of a strengthening U.S. economy, the possibility of mimicking U.S. policy actions and so the debate of monetary autonomy has been particularly heated in the most of developing countries, even in advanced economies. We analyse the role played by country-specific characteristics in domestic monetary policy autonomy to set short-term interest rates in the face of spillovers from of U.S. monetary policy as global external shocks. First, we extricate the non-systematic (non-autonomous) component of domestic interest rates which is related to business cycle synchronisation across countries. Then we employ an interacted panel VAR model, which allows impulse response functions to vary by country characteristics for a broad sample of countries. We find strong empirical evidence for the role of exchange rate flexibility, capital account openness in line with trilemma, but also a significant role for other country characteristics, such as dollarisation in the financial system, the presence of a global bank, use of macroprudential policies, and the credibility of fiscal and monetary policy.

*Keywords:*monetary policy autonomy, international spillovers, global financial cycle, cross-country difference, trilemma, country-specific characteristics

JEL Classification: C38, E43, E52, E58, F42, G12

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†Lincoln International Business School, University of Lincoln, Brayford Pool, Lincoln, LN6 7TS, United Kingdom. E-mail: idemir@lincoln.ac.uk

Contents

1 Introduction

As the U.S. economic outlook has strengthened in the last three years, the Federal Reserve is preparing to raise policy rates for the first time in almost a decade. Monetary authorities in the developing countries have been considering the possibility of mimicking U.S. policy actions. Monetary authorities are expected to set their interest rate to achieve their objectives of domestic output and price stability. However, global financial shocks may limit the ability of central banks to fulfill domestic objectives. For instance, we find significant spillovers from U.S. monetary policy to advanced and emerging market economies, in particular on interest rates[1]. This can be interpreted as monetary policy in these countries being constrained to some extent by foreign developments.

As the U.S. exit from quantitative easing, the debate about monetary autonomy has been most heated in developing countries. However, it also concerns advanced economies. The issue of monetary autonomy is one of the fundamental issues in the open macroeconomic and policy literature. The literature has postulated conventional "policy trilemma or impossible trinity" which states that it impossible to jointly pursue three objectives: *i*) free international capital mobility, *ii*) fixed exchange rate and *iii*) monetary autonomy[2]. Policymakers can maintain only two of the three objectives mutually and they must decide which one to give up. Thus, countries with fully open capital markets and tightly fixed exchange rates forego all monetary autonomy.

On the other side, Rey (2015) argues that the global financial cycle[3] transforms the trilemma into a "dilemma": monetary autonomy is possible if and only if the capital account is controlled directly or indirectly. She finds that U.S. monetary policy -as an important determinant of the global financial cycle- determines domestic financial conditions regardless of exchange rate regime and emerging market economies can loose monetary autonomy unless they impose capital controls.

In this study, we attempt to shed light on the ability of open economies to implement autonomous monetary policy by addressing the following questions: *i*) Can monetary authorities in small open economies maintain control of their monetary stance in the face of spillovers from a large open economy like the U.S. or a tightening of global financial conditions that is not warranted by their domestic cycle?, and *ii*) What policies can help monetary authorities regain more autonomy vis-à-vis global financial shocks like tightening in U.S. monetary policy?

[1] See IMF (2013), Chen et al. (2014), Aizenman et al. (2016), Demir (2019)

[2] See Obstfeld and Taylor (2004) for theoretical details.

[3] The global financial cycle can be defined as the widespread co-movement in capital flows, asset prices and credit growth across countries.

In this highly integrated global financial world domestic financial conditions become synchronised with the conditions of international financial markets. For instance, countries with strong trade and financial linkages to the United States, such as Canada and Mexico, will tend to have an economic cycle that is highly synchronised with the U.S. cycle. These synchronised economic cycle may reflect commonality of monetary policy stance in such countries with United States. We first must distinguish between *synchronisation* and *spillovers* from the U.S. to domestic interest rates based on the methodology proposed in Caceres et al. (2016). While *synchronisation* corresponds to the correlation between foreign and domestic rates, *spillovers* are defined as movements in domestic short-term interest rates that do not correspond to central banks seeking to achieve the objectives of domestic output and price stability, and that can be attributed to changes in U.S. rates. We associate the interest rate spillovers with impaired monetary autonomy. Monetary autonomy can be defined as the insulation of monetary policy decisions made by an domestic authority from short-term influences of the global financial shocks such as U.S. monetary shocks. In other words, it implies setting policy interest rates according to developments in domestic economy, where financial conditions abroad constrains policy decisions. It is expected that degree of monetary autonomy is low where spillovers are high. We then investigate how determinants (country-specific characteristics) of monetary autonomy affect the degree of monetary autonomy in a small open economy.

We use an interacted panel VAR approach, as in Towbin and Weber (2013), for 30 countries since the early 2000s. The interaction of variables with the country-specific characteristics allows the model parameters to deterministically vary across time and countries. Therefore we can evaluate the model coefficients at specific values of country-specific characteristics. We then compare impulse responses evaluated at high and low level of country characteristics to test how country characteristics affect the degree of monetary autonomy to external shocks. We find that, consistently with the classical monetary trilemma in open economies, exchange rate flexibility plays the key role in ensuring that the central bank can gear monetary policy to a greater degree towards stabilising the domestic economy. In turn, opening the capital account increases the degree of spillover for a country with a flexible exchange rate regime. The exchange rate regimes and capital openness alone do not insulate economies from foreign monetary developments. Furthermore, stronger policy frameworks, an active use of reserve requirements, and lower financial dollarisation are also associated with greater autonomy.

Monetary autonomy has been studied by Obstfeld (2015), Obstfeld et al. (2005) and many others. This empirical study differs from the prior literature in three ways. First, we eliminate the synchronised component in domestic interest rates and focus on pure spillovers.

Second, most of these studies mainly only focus on exchange rate regime and capital openness, whereas we cover different fundamentals such as financial dollarisation, macroprudential policy and CDS. Third, they estimate their models and calculate impulse response functions across two groups of countries that are classified according to the level of fundamentals and they assume model impulse responses are homogenous within group but heterogeneous across groups. In contrast, we do not group countries but allow fundamentals in the model as interaction terms to have deterministically varying coefficients across time and countries. Thus, the model parameters vary by level of fundamentals so impulse response functions can be directly analysed for different levels of fundamentals.

The structure of this chapter proceeds as follows: Section 2 presents the empirical methodology and data used in the analysis. Section 3 presents impulse response analysis for U.S. monetary policy shock and explores which policies may help improve the degree of monetary policy autonomy in small open economies for different levels of country characteristics. It also shows how results are robust for different measures of monetary policy and the pre-zero lower bound (ZLB) period. Section 4 concludes and discusses policy implications.

2 Empirical methodology:

2.1 Model and estimation:

We estimate a recursive Interacted-Panel VAR (IPVAR) model as described in Towbin and Weber (2013). The framework can be considered as a generalised panel VAR regression in which each right hand side variable can vary deterministically with structural country-specific characteristics[4]. The model is given in the following representation:

$$\begin{bmatrix} 1 & 0 & 0 \\ \alpha_0^{21} & 1 & 0 \\ \alpha_{0,it}^{31} & \alpha_{0,it}^{32} & 1 \end{bmatrix} \begin{bmatrix} VIX_{i,t} \\ \Delta i_{i,t}^{FFR} \\ \hat{u}_{i,t}^{s} \end{bmatrix} = \Gamma' X_{it} + \sum_{j=1}^{2} \begin{bmatrix} \alpha_j^{11} & \alpha_j^{12} & 0 \\ \alpha_j^{21} & \alpha_j^{22} & 0 \\ \alpha_{j,it}^{31} & \alpha_{j,it}^{32} & \alpha_{j,it}^{33} \end{bmatrix} \begin{bmatrix} VIX_{i,t-j} \\ \Delta i_{i,t-j}^{FFR} \\ \hat{u}_{i,t-j}^{s} \end{bmatrix} + \varepsilon_{i,t} \quad (1)$$

where $\varepsilon_{i,t} \sim N(0, \Sigma_{i.t})$.

with time index $t = 1...T$, $i = 1...N$ denotes countries. External variables include $VIX_{i,t}$ which is a global risk sentiments or global uncertainty proxied by the VIX Index as well as $\Delta i_{i,t}^{FFR}$ which is changes in U.S. federal funds rate; and domestic variables include $\hat{u}_{i,t}^{s}$

[4]In distinction from the standard VAR models, IPVAR adds the cross-sectional of data set and, thus it allows to exploit the heterogeneous information in cross-country which is the one of the aim of this study. It also increases the sample size and degree of freedom to reduce the risk over-fitting and to eliminate idiosyncratic effects (Gavin and Theodorou (2005))

which is the unexplained component of domestic interest rates that can be interpreted as deviations from the historical policy reaction function that characterises the central bank's efforts to achieve its domestic output and inflation stabilisation objective[5][6]. $X_{i.t}$ is a matrix of the vector of controls that includes country-specific intercepts and levels of country-specific characteristics; and $\varepsilon_{i,t}$ is a vector of residuals that are assumed to be uncorrelated across countries and normally distributed with a covariance matrix $\Sigma_{i,t}$. $\alpha_{j,it}$ are deterministically varying coefficients as by time and with given country-specific characteristics[7].

We identify external shocks with a small open economy assumption in the traditional international macroeconomics literature: the external variables (VIX and i^{FFR}) can affect domestic variables ($\hat{u}^s$) but the external variables do not depend on domestic variables ($\alpha_j^{13} = \alpha_j^{23} = 0$ for all j), implying exogeneity. Furthermore, we assume that the external variables are contemporaneously unaffected by domestic conditions ($\alpha_0^{12} = \alpha_0^{13} = \alpha_0^{23} = 0$). This partial identification scheme is sufficient to identify shocks to the interested external variable, i^{FFR}.

In order to investigate how responses vary with country-specific characteristics, we allow for interactions terms in the model. More precisely, the coefficients in equation system (1) are given by:

$$\alpha_{j,it}^{kl} = \gamma_j^{kl} + \beta_j^{kl} F_{i,t} \tag{2}$$

where $F_{i,t}$ is a vector of country-specific characteristics that vary across countries and across time. Therefore slope coefficients,$\alpha_{j,it}^{kl}$ are varying across cross-sections, and over time. However, if country-specific characteristics are the same, the slope coefficient will be homogeneous as in the standard panel VAR models. Allowing interaction terms in our model suggests that domestic interest rates are modeled not only as a function of their own lags, the contemporaneous and lagged U.S. rate, and VIX, but also of interactions between these terms with country-specific characteristics. However, we restrict the dynamics of external

[5]These unexplained interest rate movements could reflect other objectives of the central bank beyond preserving price stability, including financial stability concerns, and thus could well be welfare-enhancing. Nonetheless, they entail changes in domestic monetary conditions beyond what can be attributed to the central bank's usual response to inflation and output developments. See appendix for details and estimation of $\hat{u}_{i.t}^s$ using multi-stage VAR proposed in Caceres et al. (2016)

[6]We enter $VIX_{i,t}$ in the model as an external variable to capture unobserved global financial shocks that might affect global interest rate, and thus domestic and U.S. interest rates simultaneously. For instance, changes in global risk tolerance may simultaneously move the domestic and U.S. rates in the same direction, so omitting this variable raises a biased estimate problem since there is a positive correlation between residual and domestic rate.

[7]In this model, coefficient-variation is parameterised as a function of structural country-specific elements, in contrast to other studies in the literature using single country VARs that allow model coefficients to vary stochastically (see, for example, Primiceri (2005) and many others).

variables to be independent of country characteristics ($\alpha^{kl}_{j,it} = \gamma^{kl}_{j}$ for all l while $k = \{1, 2\}$). In other words, they are only a function of their own lags and the lags of each other.

Although single coefficients $\alpha^{kl}_{j,it}$ cannot be interpreted as in VAR models, we can evaluate the coefficients at specific values of country-specific characteristics and then compute impulse responses. Evaluations are taken at a lower value (defined as the 10th percentile of values realised in the sample) and a higher values (defined as the 90th percentile of values realised in the sample) for continuous variables; at three (floating) and one (fix) for the exchange rate regime.

One important feature of our model is that it includes the country fixed effects, $X_{i.t}$, to control for unobserved heterogeneity among countries. However, estimating the model with country fixed effects only allows for heterogeneous intercepts but imposes homogeneous slope (Pesaran and Smith (1995)). They suggest to use the mean group estimator to address this problem for estimation country-by-country. Since we investigate the sources of cross-country dynamic heterogeneity, this approach is not suitable for us. We are allowing slope coefficients to differ with country-specific characteristics that enter as the interaction terms in the model. The use of interaction term should therefore alleviate the slope heterogeneity bias.

Since the error terms $\varepsilon_{i,t}$ are uncorrelated across equations by construction the interacted Panel VAR can be estimated using OLS with allowing country fixed effects. We can estimate system (1) equation by equation without loss in efficiency. Estimating the recursive form of the model provides a simple way to parameterise the covariance matrix of the reduced form residual and, therefore, the variation in the contemporaneous relationship of the endogenous variables as a function of country and time-varying structural characteristics. Employing the equivalent OLS procedure to the reduced form would keep the off-diagonal elements of the covariance matrix constant. The recursive model may correspond to the structural identification scheme.[8]

We use bootstrapped standard errors, which are more accurate than analytical standard errors that rely on first order asymptotic, since the impulse response functions are a nonlinear function of the OLS estimates. The bootstrapping procedure's steps are as follows: (i) estimate model (1) by OLS, (ii) draw randomly residuals from normal distribution $N(0, \hat{\Sigma})$, where $\hat{\Sigma}$ is estimated covariance matrix, (iii) simulate recursively dependent variables, $\hat{Y}_{i,t}$ using drawn residual, previous observation of dependent variables and estimates of $\hat{\alpha}^{kl}_{j,it}$ and values of iteration terms at time t, (iv) repeat step (ii) and (iii) for $t = 1...T$ and $i = 1...N$,

[8] In principle, the reduced form estimates will depend on the ordering of the variables in the recursive VAR, as Primiceri (2005) discusses. Estimating the model with several orderings and assessing sensitivity could address this problem. Note that this is not the case in our model since the recursive ordering corresponds to the structural ordering.

(v) use the obtained artificial sample and interaction terms to re-estimate the model coefficients, (vi) compute impulse response functions, and (vii) step (ii) to (v) are repeated 1000 times. We compute 90% confidence interval from the simulated estimates.

We use monthly data from a sample of 30 advanced and emerging market economies (see Table 1 for a list of the countries included in the IPVAR model). We estimate the model using monthly data from January 2000 to October 2015, evaluate the coefficients in equation (2) at different values for the country characteristics and then compute impulse response functions.

2.2 Data:

The data consist of monthly observations from 2000:01 to 2015:10 on a set of 30 emerging and advanced countries, at monthly frequency[9]. The series can be grouped into three categories: short-term interest rates; expectations about economic activity and inflation; and country-specific characteristics.

As short-term interest rate, we choose the federal funds rate for the U.S and interest rates on short-term government bonds (with maturity of about three months), rather than monetary policy or money market rates for domestic countries. The following two considerations drive this decision. First, policy rates are often discontinuous for long time series since the choice of policy instrument changes over time. For example, Chile changed its policy rate from a real rate to a nominal rate in August 2001. Second, money market rates are available but usually more homogeneous across countries. Variation in them may be unrelated to monetary policy; for instance, unexpected liquidity shortages can lead to large spikes in nominal interest rates despite unchanged monetary policy.

Ideally, the central bank's internal forecasts are preferable for use as expectations since they are more informative about the policy decisions made. However, these are not publicly available for a few countries and with a significant delay. In this study, we use 12-months-ahead forecasts of inflation and output growth, as reported by Consensus Economics[10].

We employ eight different country-specific characteristics suggested by the literature[11]. We use exchange rate regimes that correspond to the coarse classification adopted by Ilzetzki et al. (2017). The financial openness index is from Aizenman et al. (2010). We construct an index of central bank credibility based on forecast disagreement and sovereign CDS spreads to capture perceived fiscal risks in domestic countries. For a measure of macroprudential

[9]The countries in the sample are listed in the Table 1 in the Appendix

[10]Actual data can be used but forward-looking indicators allow researchers to control for domestic conditions at monthly frequency rather than quarterly.

[11]See Appendix 5.2 for further details on country characteristics.

policies, we use the index constructed by Cordella et al. (2014) that is based on the frequency with which reserve requirements are adjusted. The financial dollarisation index proposed in Yeyati (2006) is also used. It is based on the share of bank deposits denominated in foreign currency. We use a metric that captures the role of global banks in the provision of the domestic credit market. Lastly, we use the share of sovereign debt held by foreigners data constructed by Ebeke and Kyobe (2015).

Our primary data sources are generic bond estimates provided by Bloomberg and the series for treasury bills and government bond yields provided by the IMF's International Financial Statistics. While sources vary by country, instrument and time period, we supplement these primary sources with data from the IMF's monetary surveys, Haver Analytics, Global Financial Data, and national authorities[12].

3 Results:

The monetary policy autonomy of small open economies has been discussed in the literature.

3.1 The trilemma's pillars: exchange rate flexibility and capital openness:

We first estimate the model with only two fundamentals in $F_{i,t}$ capturing the exchange rate regime and the degree of financial openness, the two pillars underlying the traditional monetary trilemma. Figure 1 shows the cumulative response of domestic rates over two years to 100 basis points cumulative increase in U.S. federal funds rate using different exchange rate regimes and different level of capital openness.

We expected that a country that maintains a fixed exchange rate regime to raise interest rates in response to contractionary policy shocks, to avoid interest rate differential by definition. On the other hand, a country that has a floating exchange rate regime could absorb part of the effect of shocks on the domestic interest rate by allowing their local currency to depreciate against the base currency.

We find that, indeed, the predictions of the trilemma remain valid. Figure 1, panel A, shows monetary policy spillovers under different exchange rate regimes, while conditioning on high financial openness. Maintaining a flexible exchange rate sharply decreases the degree of spillovers from the U.S. to domestic interest rates. The cumulative spillover response after a 12-month period declines from almost 35 basis points under a fixed exchange rate to about 13 basis points under a floating exchange rate and disappears under a fully flexible regime

[12]See Appendix for further details of data construction and country-level data sources.

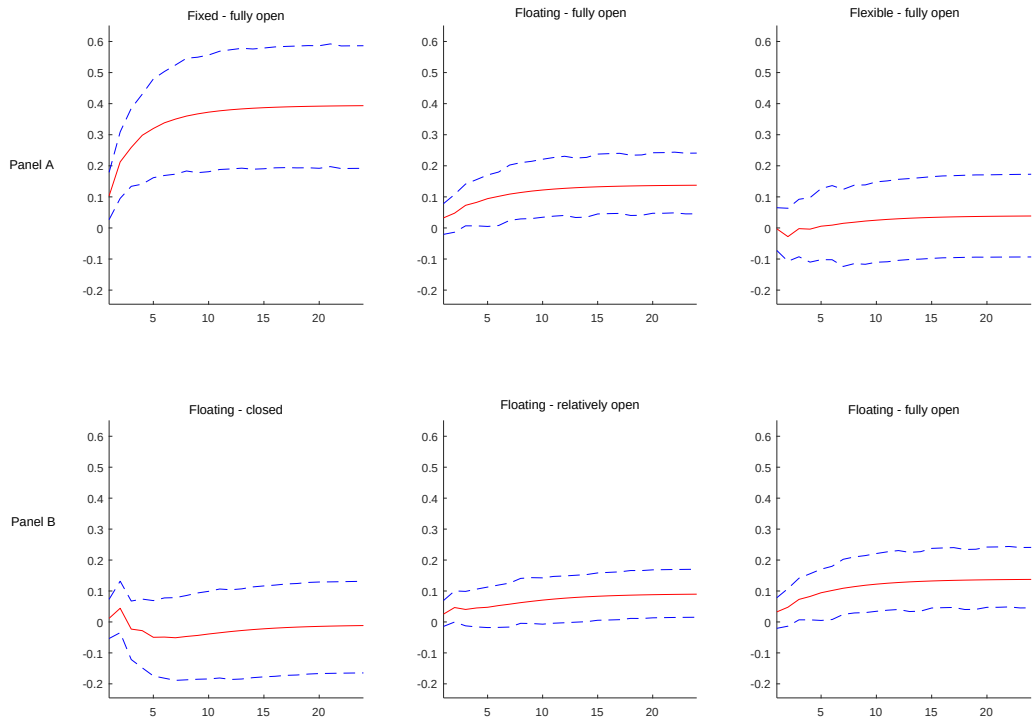

Figure 1: Testing the trilemma's hypothesis

Note: The charts show the cumulative monetary policy spillover (as defined in the text) to a 100-basis cumulative increase in the U.S. federal funds rate. Panel A shows monetary policy spillovers (basis points) under different exchange rate regimes, conditional on having high financial openness.Panel B shows monetary policy spillovers (basis points) under different degrees of financial openness, conditional having a floating exchange rate regime. The solid line reports the median response, conditional on the fundamental values. The dotted line show a 90 percent confidence interval, calculated based on standard bootstrapping.

(the response is 3 basis points but it is insignificant at the 90 per cent confidence level). The differences between the three impulse response functions are statistically significant. These findings are therefore in line with the classical argument of *trilemma* and consistent with studies that show validation of the trilemma by Obstfeld (2015) and Klein and Shambaugh (2015).

Allowing exchange rates to float can be helpful to absorb some global financial shocks but might not provide full insulation against disturbances from abroad. In turn, opening the capital account increases the degree of monetary spillovers to domestic countries. Figure 1, panel B, shows monetary policy spillovers for different degrees of capital openness while conditioned on having a floating exchange rate regime. The cumulative spillover response

declines from 13 to 6 basis points when the degree of financial openness moves from the ninth decile in our sample (corresponding to fully open) to the median, and to -7 (but indistinguishable from zero) when it moves to the first decile.

We find that the traditional policy trilemma is valid, and floating exchange rate regime and controls on capital flows allow monetary policy autonomy. However, it is not a full tradeoff between the trilemma pillars: free international capital mobility, fixed exchange rate and monetary autonomy. More exchange rate flexibility and imposing more prohibitions on international capital flows allow a greater degree of monetary autonomy against the development in monetary conditions in abroad.

3.2 Looking beyond the trilemma: do other factors matter?

In this section, we extend the model to account for a third fundamental in $F_{i,t}$ and explore how the monetary policy spillover response varies by the third fundamental while conditioned on a floating exchange rate regime and high financial openness. Figure 2 shows the cumulative response of spillovers over two years to 100 basis points cumulative increase in U.S. federal funds rate, changing the third fundamental's value from the first to ninth decile.

Financial dollarisation: The financial dollarisation might affect the monetary autonomy and transmission mechanism in domestic countries. It reduces the ability of balance sheets to absorb large exchange rate swings driven by external financial shocks. When residents and banks hold substantial volumes of assets and liabilities in foreign currency, central banks exert less control on the domestic interest rate and the exchange rate becomes an important issue in conducting monetary policy Fischer et al. (2013). Consequently, central banks in countries with a higher degree of financial dollarization may be more concerned about letting the exchange rate react to rising U.S. rates. We explore this by using an updated version of the financial dollarisation index proposed in Yeyati (2006), which is proxied by the share of bank deposits denominated in foreign currency. Our estimates in Figure 2 suggest that reducing financial dollarisation from 40 per cent—the level observed in Israel over our estimation sample—to the first decile level in our sample (about 2 per cent), decreases the extent of spillovers by almost 7 basis points in response to a U.S. monetary tightening. While this difference may seem small, it should be noted that it corresponds to a rather limited reduction in the degree of dollarisation, from 40 percent to 2 per cent. Some countries in our sample have a much larger degree of dollarisation (e.g., is about 92 per cent in Bolivia and 80 percent in Peru in the early 2000s).

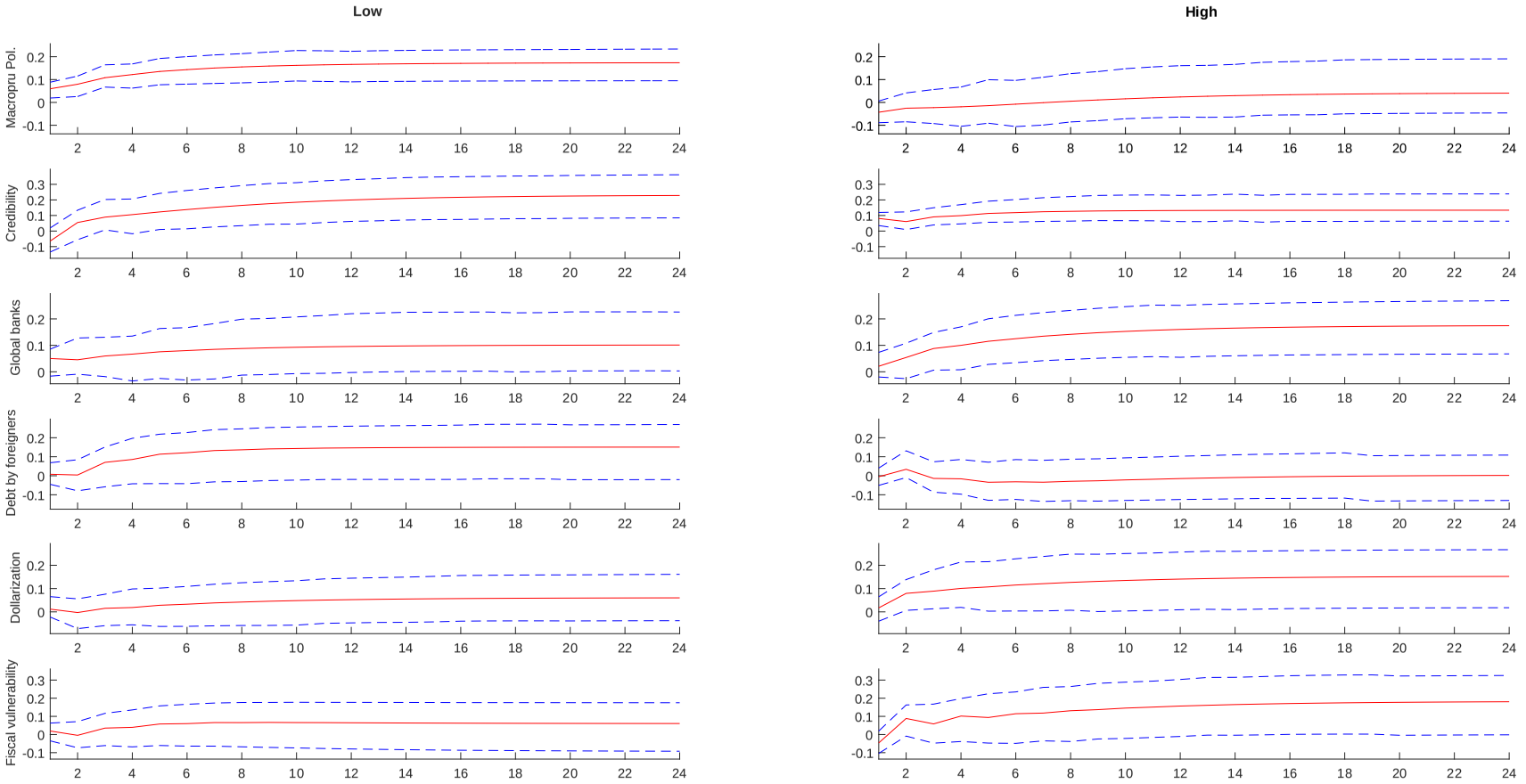

Figure 2: Beyond the trilemma's hypothesis

Note: The charts show the cumulative monetary policy spillover (as defined in the text) to a 100-basis cumulative increase in the U.S. federal funds rate. It shows monetary policy spillovers (basis points) for first, and ninth decile of the distribution each fundamental. The solid line reports the estimated response, conditional on the fundamental values. The dotted line show a 90 percent confidence interval, calculated based on standard bootstrapping.

Reserve requirement activity: Monetary policy in major advanced economies and related international financial conditions has possible adverse effects on financial stability in other countries through their impacts on global asset prices and capital flows. The use of macroprudential policies has been often posited as a strengthening tool in the face of these external financial shocks that can threaten macroeconomic stability since the onset of the global financial crisis. Central banks may use macroprudential policies in contexts where adjusting policy rates to offset the effect of global financial conditions on capital flows is at odds with the output and price stability objectives. An interesting question then is whether the active use of macroprudential policies has helped countries to reduce negative spillovers and attain greater monetary autonomy.

The challenge is finding measures of macroprudential policies that capture not only their use or lack of use, but also the intensity with which those policies are implemented. Here we use the index constructed by Cordella et al. (2014) that is based on the frequency with which reserve requirements are adjusted[13]. We find that, indeed, movingfrom the first to the ninth decile in terms of the intensity with which reserve requirements are used is associated with a smaller monetary spillover in about 14 basis points.

Presence of global banks in financial system: The structure of the domestic financial system and, in particular, the presence of global banks may affect the way monetary policy responds to changes in global financial conditions. A large share of foreign banks in a domestic financial system amplifies the effects of monetary shocks in advanced economies, notably U.S., on local liquidity conditions. Wu et al. (2011) find evidence that, as the level of foreign bank penetration increases, loan supply becomes less responsive to domestic monetary policy conditions and foreign banks adjust loan and deposit growth rates less than domestic banks in the face of domestic shocks. Goldberg (2013) finds some evidence that the presence of global banks may affect monetary autonomy, although the effects are heterogeneous—probably reflecting different business models of global banks—and relatively minor compared to those of the exchange rate regime. Here we use an analogous metric that captures the role of global banks in the provision of domestic credit and find that a stronger presence of global banks (that is, moving from the first to the ninth decile of its distribution in our sample is associated with a slightly larger spillover (but only about 6 basis points).

Central Bank Credibility Index: We first explore how the strength of the monetary frameworks may affect the extent of monetary policy spillovers from abroad. Following a rise in U.S. rates, a less credible central bank may need to deliver a larger interest rate movement to convince agents that the exchange rate depreciation following an opening interest rate

[13]The direction of reserve requirement change and the used prudential instrument matter, but this index does not cover all of this information.

differential will not lead to significant second round effects in inflation. To explore this, we construct an index of central bank credibility based on forecast disagreement (see Appendix 5.2 for details). We find that, conditional on the exchange rate regime and the degree of financial openness, moving the proxies for the strength of the monetary and fiscal frameworks from the first to the ninth decile of their distribution in our sample, in each case, to a decrease in spillovers of close to 8 basis points (see Figure 2).

Credit default swap (CDS) spreads: We also explore how the strength of the fiscal frameworks may affect the extent of monetary policy spillovers. Countries with larger perceived fiscal vulnerabilities and default risk may be more susceptible to capital outflows after an increase in U.S. rates, prompting a larger increase in domestic rates. We use sovereign CDS spreads to capture perceived fiscal and credit risks. We find that, conditional on the floating exchange rate regime and the degree of financial openness, moving the proxy for the strength of the fiscal frameworks from the first to the ninth decile of the distribution in our sample leads to a decrease in spillovers of close to 11 basis points (see Figure 2). The result for CDS spreads is consistent with the findings in Bowman et al. (2015) regarding the response of long-term domestic interest rates to unconventional monetary shocks in the United States.

Foreign ownership of public debt: The share of sovereign debt in domestic currency that is held by foreigners has been increasing substantially over the last few years, especially in emerging market economies. In this context, portfolio rebalancing by international investors following a rise in U.S. rates can be potentially more harmful in terms of capital outflows. Central banks may then need to raise policy rates in an attempt to attenuate outflow pressures, irrespective of domestic macro conditions. With this in mind, we assessed whether monetary spillovers vary depending on the share of sovereign debt held by foreigners, using the data constructed by Ebeke and Kyobe (2015). Surprisingly, we found the opposite but insignificant effect in this sample.

3.3 Robustness analysis:

A potential problem with our estimates is that U.S. policy rates have remained unchanged at the zero lower bound since end-2008. However, most central banks elsewhere exhibited large positive interest rates, which enabled them to increase or decrease their domestic policy rates whilst the Fed Fund rates remained constant. Given that policy rates in the United States have been at the zero lower bound since end-2008, we conducted the same exercise and re-estimated the model with data up to June 2009. The results, in terms of the role played by the exchange rate and the degree of financial openness, remain broadly unchanged

(see Figure 3)[14].

As an alternative to U.S. policy rate, we re-estimate our model with exogenously identified narrative monetary policy shock for U.S. measured by Romer and Romer (2004)[15]. Our results are qualitatively consistent as can be seen in the Figure 4.

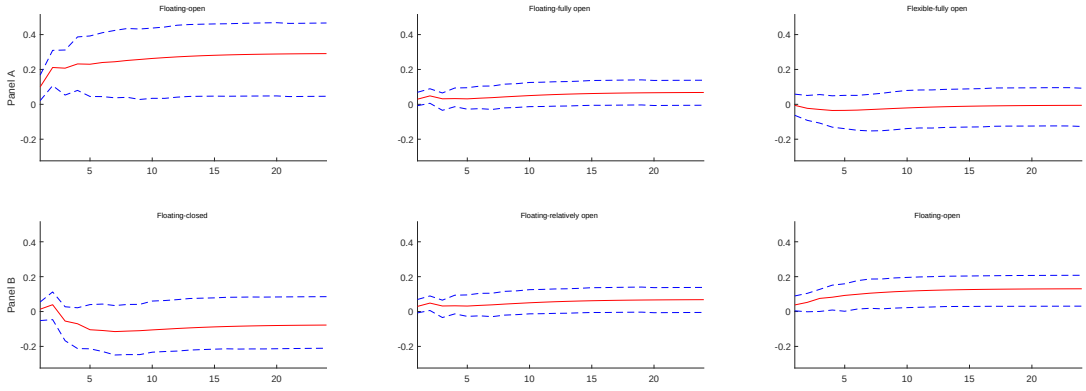

Figure 3: Testing the trilemma's hypothesis before ZLB

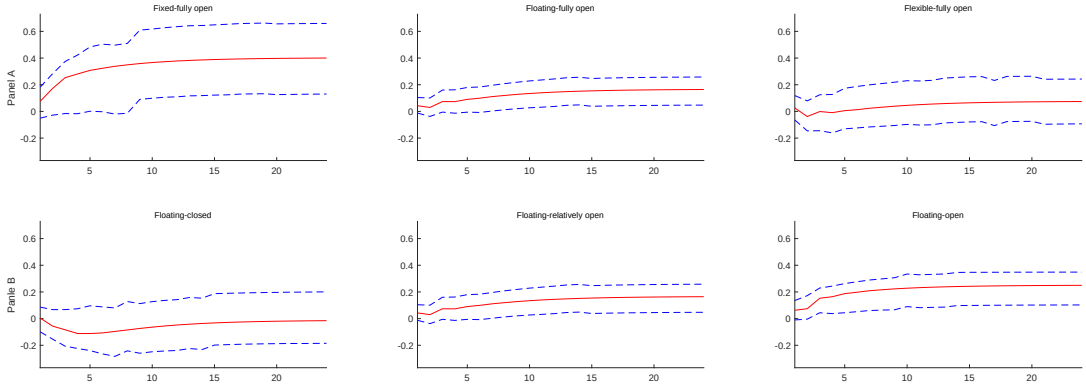

Figure 4: Testing the trilemma's hypothesis for Romer and Romer shocks

4 Conclusion and policy implications:

We empirically assess the autonomy of monetary policy in small open economies against to shocks to U.S. monetary policy using an Interacted Panel VAR by allowing the response to

[14]The results for other factors are can be seen in the Appendix

[15]The identified monetary policy shocks for United States in the previous chapter could be used, but they are on quarterly basis

vary with country-specific characteristics for a large sample of countries. First, we remove *synchronisation* between domestic and U.S. interest rates that corresponds to the correlation due to common global factors like uncertainty to focus on pure *spillovers* of U.S. monetary policy. It is expected that *spillovers* are low where monetary autonomy is high. We then investigate the role of country-specific characteristics that change by time and across country, in terms of the degree of monetary autonomy in a small open economy.

We provide empirical evidence that the magnitude of the spillovers from U.S. monetary policy also appears to depend on the economic policy framework that is in place and other country-specific characteristics. Our results confirm that exchange rate flexibility plays an important role in ensuring greater monetary autonomy, even when the capital account is unrestricted. Countries with more flexible exchange rates will be better prepared to cope with the challenges posed by the developments in global external shocks. Our results also suggest that, for a given policy choice along the capital account openness and exchange rate flexibility dimensions, improving the credibility of policy frameworks, reducing the extent of financial dollarisation, and using macroprudential reserve requirements may help achieve a higher degree of monetary autonomy. Some of these other dimensions may be very relevant for some particular countries, however they seem to play a more modest role compared to the exchange rate regime.

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5 Appendix

5.1 Estimation of unexplained domestic interest rate movements

Synchronization or spillovers in short-term interest rates?

Short-term interest rates from both advanced and emerging market economies tend to exhibit a positive correlation with the global interest rate[16] in most countries (an average correlation of about 0.83). However, this synchronicity of interest rates may simply reflect a high degree of co-movement in business cycles across countries. In other words these fluctuations tend to mimic the variations in synchronization of business cycles across countries. All countries in our sample exhibit a positive correlation of real GDP growth with the corresponding global component of real GDP.

In particular, we are interested in "*pure monetary policy spillovers from U.S. interest rates*" that can be defined as movements in domestic short-term interest rates that do not correspond to the central bank seeking to achieve the objectives of domestic output and price stability, and that can be attributed to changes in U.S. rates. To eliminate interest rate fluctuations tend to mimic the variations in synchronization of business cycles across countries, we follow the multi-stage VAR procedure proposed in Caceres et al. (2016). This approach is consistent with estimating a Taylor-type rule for the dynamic relationship between domestic interest rates and domestic macro conditions.

We estimate the following country-specific VAR model for individual domestic country:

$$\begin{bmatrix} X_t^s \\ \Delta i_t^s \end{bmatrix} = \Phi_0 + \sum_{j=1}^{2} \Phi_j \begin{bmatrix} X_{t-j}^s \\ \Delta i_{t-j}^s \end{bmatrix} + \begin{bmatrix} \epsilon_t^{X^s} \\ \epsilon_t^{i^s} \end{bmatrix}$$

where i^s is the nominal domestic short-term interest rate in the small economy and X^s is a vector including changes in domestic macroeconomic conditions (expectations of output and inflation) in the small economy. We then take the residual from the above equation (which essentially purges the interest rate from the effects of the lags of X^s) and regress it on the other residuals (vector $\hat{\epsilon}^{X^s}$):

$$\hat{\epsilon}_t^{i^s} = \phi_0 + \phi_1 \hat{\epsilon}_t^{X^s} + u_t^{i^s}$$

$u_t^{i^s}$ is the unexplained components can be interpreted as deviations from the historical policy reaction function that characterizes the central bank's efforts to achieve its domestic output and inflation stabilization objective.

[16] In order to calculate global component of short-term interest rate(real GDP growth), we use a principal component analysis of short-term interest rates (real GDP growth) for countries in our sample.

5.2 Data and Sources

Exchange rate regimes: The classification is from is from Ilzetzki et al. (2017) and updated version is available on Carmen Reinhart's website. They use parallel market data and assesses the conditional probability an exchange rate will move outside a certain range over a five year window. See Ilzetzki et al. (2017) for greater details.

Capital account openness: It is a de jure index of capital account openness from Aizenman et al. (2010). The index is based on information regarding restrictions in the International Monetary Fund's Annual Report on Exchange Arrangements and Exchange Restrictions. Specifically, it is the first standardized principal component of the variables that indicate restrictions on current account transactions, on capital account transactions, and the requirement of the surrender of export proceeds. See Aizenman et al. (2010) for more details.

Central Bank Credibility Index: Forecast disagreement has commonly been used as a proxy of inflation uncertainty, which reflects both the predictability and credibility of the central bank, as well as the variability of supply and demand shocks affecting the economy. Inflation forecast disagreement is moreover closely related to de jure measure of central bank independence in G7 economies. In this study, we then use the degree of anchoring of inflation expectations to construct an index for central bank credibility. More precisely, the central bank credibility index $CBC_{i,t}$ for country i at time t is constructed as an ordinal ranking of the inverse disagreement among forecasters (measured as the 4-year moving average of the standard deviation of inflation forecasts reported by Consensus Economics, $MA48(\sigma_{i,t})$);

$$CBC_{i,t} = \frac{1}{N}\left[\frac{1}{MA48(\sigma_{i,t})}\right]$$

Financial dollarization: It is proposed by Yeyati (2006) and is based on the share of bank deposits denominated in foreign currency.

Reserve requirement activity: It is constructed by Cordella et al. (2014) that is based on frequency of active use of reserve requirements as a macroprudential tool for financial stability concerns. The main idea behind their operational definition is following: if the average duration between the changes in reserve requirements for a country is shorter than the average duration of the business cycle in the same country, it will be classified as having an active reserve requirement. Otherwise, it has a passive reserve requirement.

Presence of global banks in financial system: It an analogous metric to Goldberg (2013) that captures the role of global banks in the provision of domestic credit. It is computed as share of foreign bank claims on local residents from the BIS Consolidated Banking Statistics relative to total domestic credit from IFS database.

Foreign ownership of public debt: It is constructed by Ebeke and Kyobe (2015) and is based on share of sovereign debt hold by foreigners. See Ebeke and Kyobe (2015) for more details.

Table 1: Sample of countries

Advanced		*Emerging*		
AUS	JPN	ARG	IND	THA
CAN	KOR	BOL	MEX	TUR
CHE	LVA	BRA	MYS	ZAF
CZE	NOR	CHL	NGA	
DNK	NZL	COL	PER	
GBR	SGP	CRI	PHL	
ISR	SWE	IDN	POL	

Country classification in this table is based on IMF's income group classification.

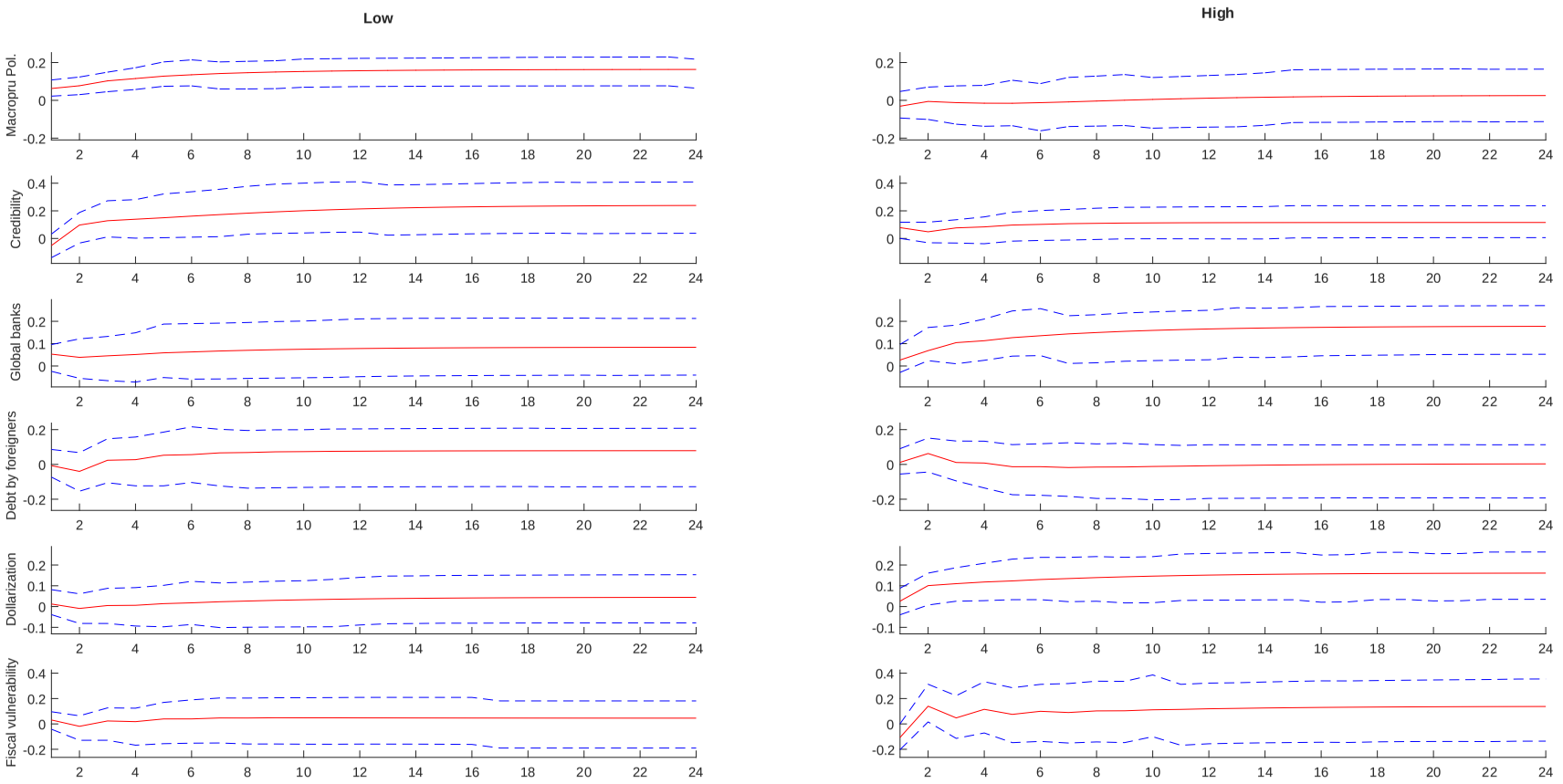

Figure 5: Beyond the trilemma's hypothesis before ZLB

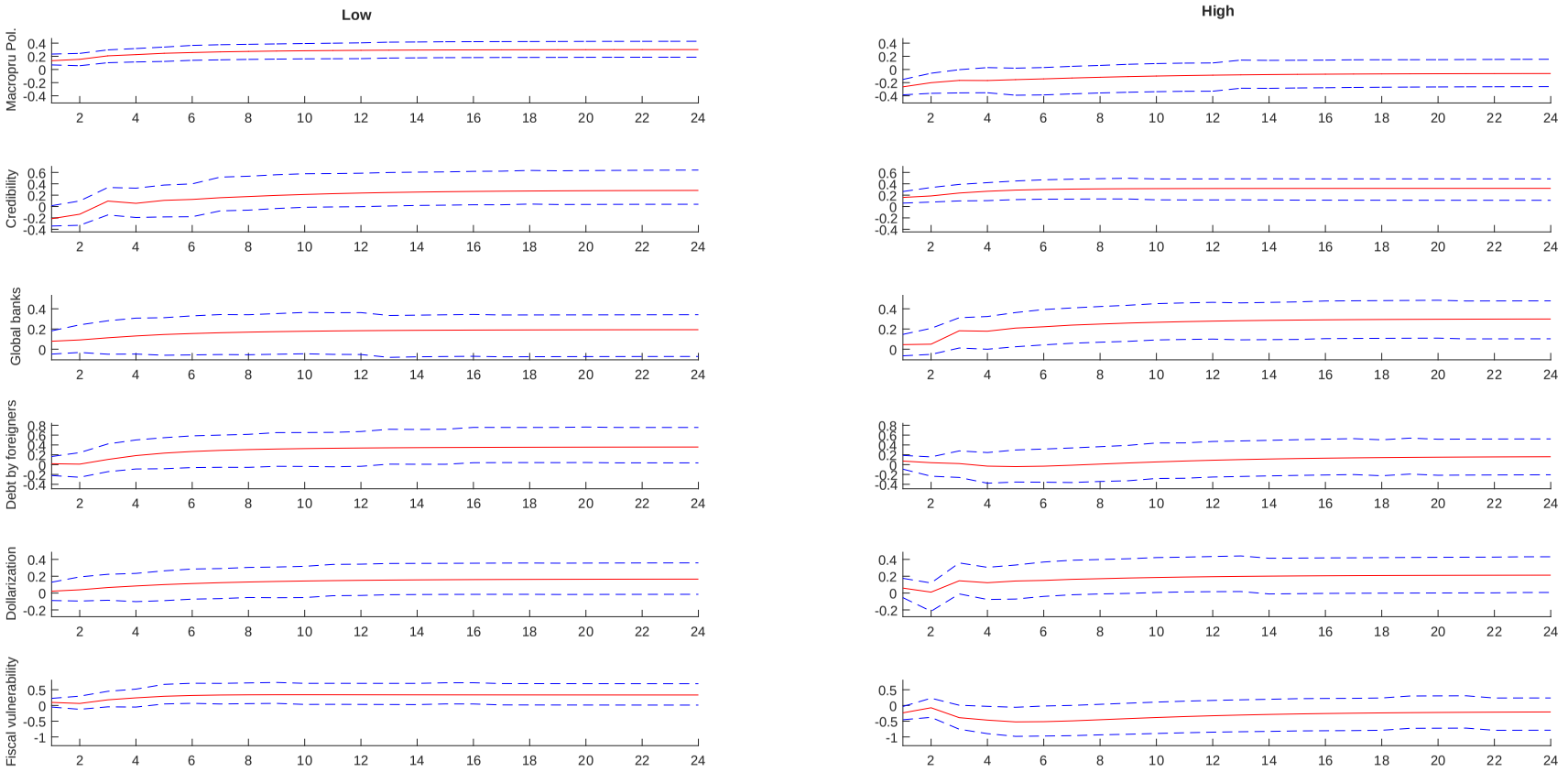

Figure 6: Beyond the trilemma's hypothesis for Romer and Romer shocks