Monetary Policy News in the US: Effects on Emerging Market Capital Flows*

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Abstract

We examine the impact of US monetary policy news on portfolio flows to emerging markets using a Bayesian Vectorautoregression that accounts for expectations of future monetary policy. We define the US "monetary policy news shock" as one that increases monetary policy expectations while leaving the policy rate unchanged. Results suggest that the impact of this shock on portfolio flows as a share of GDP is economically small on aggregate but varies considerably across countries. Countries we identify as being the most affected, also experienced larger volumes of capital in- and outflows before and after the 2013 taper tantrum episode, respectively. Also, macroeconomic performance and external vulnerabilities may matter. However, financial openness and the exchange rate regime, do not seem to be associated with differences in effects on capital flows over our sample period.

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1 Introduction

The conduct of monetary policy in advanced economies has undergone significant changes since the global financial crisis of 2007-08, with several central banks relying increasingly on unconventional monetary policy tools in addition to the traditional approach of using short-term interest rates to stabilize the economy. Notably, with interest rates at their (zero) lower bound, unconventional monetary policies (UMPs) – communication about the future evolution of interest rates as well as large scale asset purchases (LSAPs)– have been the only way for the Federal Reserve (Fed) to affect market expectations and to provide policy accommodation in the US until a few years ago. As these policy interventions are unwound, the focus among investors and policymakers has turned to the challenges that monetary policy normalization in advanced economies could pose for global financial markets. And, central to any discussion about the cross-border spillovers of monetary policy are capital flows to emerging market economies (EMEs).

One prominent example of how Fed communication can result in large swings in global financial markets is the so-called "taper tantrum" episode of May 2013 – then-Chairman Ben Bernanke's 22 May congressional testimony hinting that the Fed would start scaling back its LSAPs.[1] Financial market participants revised their expectations as to when the Fed would begin normalizing monetary policy. These changes in policy rate expectations likely led to reductions in market participants' tolerance for risk and a reassessment of the returns from investing in EMEs, and resulted in a sharp withdrawal of private capital flows.

As the "taper tantrum" episode illustrates, a pressing question for emerging-market policymakers is how capital flows respond to news about future US monetary policy. Addressing this question is important as the past few decades have been witness to several episodes of abrupt reversals in capital flows to EMEs, followed in most cases by economic and financial crises.[2] In a world of highly integrated capital and goods markets, US monetary policy news is bound to have some influence on capital flows to EMEs. In

[1]For further details on former Chairman Bernanke's testimony before the Joint Economic Committee of the US Congress on 22 May 2013, see `http://www.federalreserve.gov/newsevents/testimony/bernanke20130522a.htm`.

[2]See, for example, Forbes and Warnock (2012) and Reinhart and Reinhart (2008) for a detailed discussion on large capital flow movements and economic crises.

this paper, we provide an empirical estimate of these spillover effects.

To do so, we include expectations of the future path of the federal funds rate as well as a common factor of capital flows in a standard monetary policy vector autoregressive (VAR) model. We, then, identify US monetary policy news by a combination of zero and sign restrictions. Market participants receive new information (news) about the future path of the policy rate from the Fed well before these changes in the rate actually occur and, therefore, adjust their expectations about monetary policy accordingly. These news shocks, such as those related to Fed communication about the future evolution of interest rates (forward guidance) but also possibly about LSAPs, shift markets' expectations about future policy actions while leaving the policy rate per se unchanged. Thus, one could interpret these shocks as future or anticipated monetary policy shocks as they are observed before they materialize (in the sense of Beaudry and Portier, 2006).

The idea that US monetary policy is partly anticipated is not new and has gained ground with the first release of a Federal Open Market Committee (FOMC) statement in 1994.[3] Following the financial crises of 2007-08, monetary policy news shocks (such as forward guidance) were of particular relevance as the policy rate was constrained at the zero lower bound (ZLB).

Finally, accounting for monetary policy expectations is of particular importance since, in the case of anticipation, VAR models with insufficient information (that is, without agent's expectations) fail to capture the true dynamics of the time series (see, e.g., Hansen and Sargent, 1991 and Lippi and Reichlin, 1994).[4]

Our paper contributes to three main strands of the literature. First, a few recent studies have used an event study approach to analyze the impact of Fed announcements (such as FOMC statements) on emerging market exchange rates, interest rates, and asset

[3]For example, Gürkaynak et al. (2005) and Campbell et al. (2012) have demonstrated that monetary policy news (from FOMC statements) affect expectations about future monetary policy decisions. At the same time, Poole (2005) shows that since February 1994, policy decisions taken at regularly scheduled FOMC meetings, whether or not they have involved a federal funds target change, have generated relatively little surprise in the federal funds futures market. Such current decisions have been well anticipated by market participants. Moreover, Coibion and Gorodnichenko (2012) find an increase in the ability of financial markets and professional forecasters to predict subsequent interest rate changes after 1994. Similarly, Swanson (2006) documents improved predictability of US monetary policy by both professional forecasters and Fed funds futures after communications reforms (including the introduction of FOMC statements in 1994).

[4]Fiscal foresight and news shocks are prominent examples, see Yang, 2005 and Leeper et al., 2013.

prices (for example, Aizenman et al. 2016, Eichengreen and Gupta 2015, and Mishra et al. 2014).[5] In contrast to these papers, we focus on the impact on capital flows since they are the channel through which asset prices and exchange rates are ultimately affected. In addition, we use a VAR approach which informs us about the persistence of the effects on capital flows as opposed to just the instantaneous effect of a policy surprise, as is the case with an event study approach.

Second, our paper also makes an important contribution to the literature assessing spillover effects of US monetary policy to emerging markets. The notion that (expansionary) US monetary policy plays a role in driving capital flows to EMEs goes back to the seminal paper by Calvo et al. (1993). Since then, a large volume of papers has examined the role of Fed's monetary policy in explaining movements in emerging markets' real activities and financial markets (see Canova, 2005, Mackowiak, 2007, Iacoviello and Navarro, 2018, and Dedola et al. (2017) among many others). The novel contribution of our paper lies in being among the first to incorporate expectations of future US monetary policy and, thus, allowing for monetary policy anticipation. We explicitly identify the effects of monetary policy news on emerging-market capital flows, an aspect that has largely gone unexplored.

Third, a strand of literature has isolated US monetary policy surprises by using market-based measures to calculate the unanticipated part of the the Fed's policy action. The dominant approach in this literature, pioneered by Kuttner (2001), has been to measure monetary policy surprises as the change in expectations of the federal funds rate on the day of a Fed policy change or announcement itself (Barakchian and Crowe 2013; Gertler and Karadi 2015; Gürkaynak 2005 and Hamilton 2008, among others). The focus of this literature has mainly been on the federal funds futures and Eurodollar futures contracts at very short horizons. While we also use the federal funds futures and Eurodollar futures contracts as measures of future monetary policy expectations, our approach differs in two ways. First, in contrast to using the futures contracts at short horizons, we use the 36-month horizon contracts in our benchmark model. This is needed since as much as half of our sample covers the ZLB period where the short-term expectations of

[5] Recent studies focusing on the impact of UMPs by the Fed at the ZLB on capital flows using different methodologies include Ahmed and Zlate (2014), Fratzscher et al. (2016), Lim et al. (2014), and Moore et al. (2013).

the federal funds rate are essentially flat (Figure 1).

The second point of departure is the manner in which we identify monetary policy shocks. The approach taken by recent contributions by Barakchian and Crowe (2013) and Gertler and Karadi (2015) involves two steps: first, monetary policy shocks are identified as changes in the expected federal funds rate on the day of a Fed policy change or announcement itself; and then these shocks are incorporated into a classic monetary policy VAR.[6] In contrast, in our baseline model we follow a more direct approach by identifying the monetary policy shock within a VAR using a combination of zero and sign restrictions. Specifically, since we are interested in the effects of news about future monetary policy decisions, we define a US monetary policy news shock as a shock that increases the expectations of the future federal funds rate, while leaving the policy rate per se unchanged.

Our baseline results indicate that the effect of a US monetary policy news shock on aggregate portfolio flows to EMEs is economically small.[7] We find that a monetary policy news shock that increases the expected federal funds rate by 50 basis points (bps), indicating a future monetary policy tightening, results in aggregate portfolio flows declining by about 0.2% of GDP on impact. After a year, the cumulative decline in aggregate capital flows amounts to 0.5% of GDP. However, the effects vary considerably across countries in terms of magnitude with Hungary, South Africa, and Malaysia being potentially affected most.

Further, using the "taper tantrum" episode as an illustrative example, our results show that the countries identified as being the most affected are also the ones that received greater financial flows prior to 2013 and saw greater capital outflows over May to August 2013. These results indicate that investors are likely to be better able to rebalance their portfolio allocations when recipient countries have large, liquid financial markets (Eichengreen and Gupta, 2015). The estimated effects on capital flows are also found to be related to macroeconomic fundamentals such as real GDP growth, external

[6]Gertler and Karadi (2015) identify the effects of monetary shocks on credit costs by employing the monetary policy surprises as external instruments in a set of VARs which include output, inflation and various interest rates. Barakchian and Crowe (2013) extract the first common factor from monetary surprises based on federal funds futures at various maturities (current month and up to 5-month ahead). The factor is then used in a VAR containing output and inflation, which is identified using a Cholesky decomposition with the factor ordered last.

[7]Throughout the paper we use the terms capital flows and portfolio flows interchangeably.

debt/GDP, reserves/GDP, and the fiscal balance/GDP. However, financial openness and the exchange rate regime do not seem to be key determinants of cross-country differences in spillovers effects on capital flows. While the estimated effects on portfolio flows are seemingly small, they can still be of relevance, as the experience from the taper tantrum episode has shown that changes in capital flows of a similar magnitude were associated with significant financial turmoil in EMEs.

We also examine the robustness of our baseline results to our shock identification strategy by constructing the monetary policy news shock similar to Barakchian and Crowe (2013) and then incorporating this measure in the Bayesian VAR system. Our main results turn out to be quite robust to using this alternative approach which lends credibility to our direct method of using monetary policy expectations per se in the VAR.

The remainder of the paper is organized as follows. Section 2 motivates why expectations about future US monetary policy matter for capital flows to EMEs by looking at past Fed tightening cycles. Section 3 outlines the empirical methodology, and section 4 provides a description of the data. Section 5 reports the estimation results, and section 6 discusses the key findings.

2 Capital flows and Fed monetary policy expectations: Lessons from the past

The Fed tightening cycles of previous decades provide some interesting insights into the response of emerging-market capital flows to changes in US monetary policy expectations. The evidence from the 1994-95 and 2004-06 tightening episodes is mixed, however. After the 1990-91 recession, the Fed first increased rates in February 1994. This was largely unanticipated by markets. Over the next twelve months, the Fed raised its policy rate from 3% to 6%. Expectations of the federal funds rate, as measured by the 12-quarters ahead Eurodollar futures, increased by about 200 bps over the same period (Figure 2).[8] This, in turn, had significant spillovers on global financial markets. Portfolio flows to EMEs declined sharply after 1994.

[8]Yields on 10-year Treasury bonds rose by around 150 bps (not shown).

In contrast, in the 2000s the Fed gradually increased the policy rate from 1% to 5.25% over 2004-06 by following a pre-announced schedule. The increase in the 12-quarters ahead Eurodollar rates and the 10-yr Treasury bill rates was small over this period, and had a limited initial impact on global financial markets compared with the 1994-95 episode. Portfolio inflows to EMEs continued to be strong almost until the end of the Fed's tightening cycle (Figure 2).

One of the key lessons learned from these episodes is the importance of communication in influencing expectations of short-term interest rates and the subsequent impact of monetary tightening on markets (IMF 2013). The experience from these tightening cycles also reinforces the argument of Hamilton (2008) that the primary news for market participants is not what the Fed just did but instead is the new information about what the Fed is going to do in the future. As noted earlier, the role of private-sector expectations about future monetary policy actions was also reflected in the significant financial market volatility that followed the May and June 2013 tapering announcements by the Fed. Thus, these episodes clearly illustrate the importance of accounting for expectations in studying the impact of US monetary policy on portfolio flows to EMEs. The key contribution of our paper lies in incorporating these expectations of future monetary policy and thus filling an important gap in the literature on the linkages between US monetary policy changes and capital flows to EMEs.

3 Empirical framework

To quantify the impact of US monetary policy news on net portfolio flows to EMEs, we employ the following empirical strategy. First, we extract a common factor from net portfolio flows to EMEs in our sample. Second, we estimate a simple Bayesian VAR model containing US variables and the estimated capital flow factor. We then identify a monetary policy news shock in this VAR framework and assess its effects on portfolio flows to EMEs. Finally, we also examine the impact on capital flows to EMEs using an alternative way to identify the monetary policy news shock, which is based on monetary policy surprises (i.e., changes in monetary policy expectations on Fed announcement days).

3.1 Empirical model

Let $\mathbf{W}_t$ denote a vector of N standardized capital flow series that have the following factor model representation:

$$\begin{aligned} \mathbf{W}_t &= \boldsymbol{\chi}_t + \boldsymbol{\xi}_t \\ &= \boldsymbol{\lambda}'\mathbf{F}_t + \boldsymbol{\xi}_t, \end{aligned} \tag{1}$$

where $\boldsymbol{\chi}_t$ is the common component of $\mathbf{W}_t$, which captures the co-movement among the underlying capital flow series, while $\boldsymbol{\xi}_t$ is the idiosyncratic component, which can be interpreted as shocks affecting only individual portfolio flow series. $\mathbf{F}_t$ is a $r \times 1$ vector of common or static factors, and $\boldsymbol{\lambda}$ is an $r \times N$ matrix of factor loadings. The factors, their loadings and the idiosyncratic errors are not observable, and have to be estimated from the data in practice. We use the method of principal components to extract the first common factor of $\mathbf{W}_t$. We set the number of factors to one, since it is sufficient to explain most of the variation in our sample of portfolio flow series.[9]

Our baseline VAR model takes the following form:

$$\mathbf{y}_t = \boldsymbol{\alpha} + \mathbf{A}(\mathbf{L})\mathbf{y}_{t-1} + \mathbf{u}_t, \tag{2}$$

where $\mathbf{y}_t$ is a vector of endogenous variables, $\boldsymbol{\alpha}$ a vector of constants, $\mathbf{A}(\mathbf{L})$ a matrix polynomial in the lag operator $\mathbf{L}$, and $\mathbf{u}_t$ a vector of reduced-form residuals, such that $\mathbf{u}_t \sim N(\mathbf{0}, \boldsymbol{\Omega})$. The reduced-form residuals can be related to the underlying structural shocks such that $\mathbf{u}_t = \mathbf{B}_0\boldsymbol{\epsilon}_t$, where $\mathbf{B}_0$ denotes the contemporaneous impact matrix, with $\boldsymbol{\epsilon} \sim N(\mathbf{0}, \mathbf{I})$, and $\boldsymbol{\Omega} = \mathbf{B}_0\mathbf{B}_0'$. We leave $\mathbf{A}(\mathbf{L})$ unrestricted.[10]

The vector of endogenous variables, $\mathbf{y}_t$, comprises six variables: the federal funds rate, federal funds rate expectations, US inflation, US industrial production growth, the level of the implied US stock market volatility index (or VIX), and the common factor of portfolio flows. The choice of these variables is motivated as follows.

[9] The first common factor explains about 71% of the variation in the portfolio flow series, on average. See section 5.1 for details.

[10] One could also prevent movements in the capital flow factor from influencing US variables by imposing a zero restriction on the corresponding coefficients of $\mathbf{A}(\mathbf{L})$. Imposing this restriction, however, does not alter our main findings.

The starting point for our model is a standard US monetary policy VAR that includes US CPI inflation, the growth rate of US industrial production, and the federal funds rate (see, for example, Bernanke et al. 2005 and Sims 1992). As discussed earlier and motivated in Section 2, to assess the effects of monetary policy news, we augment the VAR with a measure of future monetary policy expectations. To select an appropriate proxy for policy rate expectations, we draw upon the growing literature focusing on the identification of monetary policy shocks using financial market data. Our main measure of monetary policy expectations is based on the federal funds futures and the Eurodollar futures contracts at the 36-month horizon.[11] The argument for using federal funds futures contracts to identify monetary policy shocks goes back to Rudebusch (1998) and Kuttner (2001). More recent papers in this vein are Gertler and Karadi (2015), Gürkaynak (2005), Hamilton (2008), among others. However, we differ from these studies in using expectations at a long-run horizon since expectations at shorter horizons (up to one year) are basically flat at the zero lower bound (see Figure 1). Finally, we also use the 12-month-ahead as well as 24-month ahead futures to examine the sensitivity of our results to alternate horizons.

Further, we also include the implied stock market volatility in the United States as proxied by the VIX.[12] The VIX is widely used in the literature as the key indicator of risk aversion and a general proxy for financial turmoil, economic risk, and uncertainty. The literature has also found the VIX to be a significant determinant of capital flows to EMEs (for example, Ahmed and Zlate 2014; Forbes and Warnock 2012; and Lim et al. 2014).

Lastly, we include the portfolio flow factor in the VAR model, which is our key variable of interest. This allows us to calculate the effects of policy news on portfolio flows to individual countries in our sample, as well as on aggregate flows.[13] It is important to note that in this paper our focus is on assessing the impact of Fed monetary policy news on capital flows to EMEs, rather than on explaining possible determinants of capital

[11] Section 4.2 describes this measure in detail.

[12] Indices of implied stock market volatility are forward-looking measures of stock index volatility computed based on option prices. These indices measure market expectations of stock market volatility in the next 30 days.

[13] We also estimated separate VAR models for individual countries by including the capital flow series for the respective country in each model. However, results for the aggregate and individual-country level effects on capital flows remain similar.

flows. Therefore, we exclude potential "pull" factors or country-specific macroeconomic variables from the VAR model, since this allows us to isolate the effects of US monetary policy news without contaminating them with possible feedback from "pull" factors.

We include one lag in the VAR due to the relatively short sample size. However, our main results hold with alternative lag lengths. We estimate equation (2) using standard Bayesian methods (i.e., Gibbs sampler) described in Koop and Korobilis (2010). Further details about the estimation procedure are provided in Appendix A. The VAR is estimated over the period January 2004 to May 2017.

3.2 Identification of a US monetary policy news shock

In our baseline VAR model, we define the monetary policy news shock as a shock that increases the expected federal funds rate while leaving the policy rate unchanged. Since it is a shock to the expectation of future federal funds rate, one could interpret this shock as a "future" monetary policy shock. That is, agents expect an increase in the fed funds rate by the Federal Reserve in the future. The shock is identified by imposing a combination of sign restrictions and a single zero restriction on the contemporaneous impact matrix $\mathbf{B}_0$ underlying equation (2).

Table 1 summarizes the restrictions on the responses of the federal funds rate, federal funds futures, inflation, and economic activity measured by industrial production growth. The responses of the VIX and the capital flow factor are left unconstrained. The zero restriction is imposed on impact, while the sign restrictions are imposed on impact and for five months.[14]

Specifically, we assume that a monetary policy news shock, that increases federal funds rate expectations (indicating a future monetary policy tightening) and leaves the federal funds rate unchanged, decreases industrial production and prices. Therefore, a future monetary policy tightening by the central bank has contractionary effects on the economy. This view is supported by theoretical models (see, e.g., Eggertsson and Woodford, 2003, Laséen and Svensson, 2011, Milani and Treadwell, 2012).

Moreover, employing the above restrictions allows us to distinguish monetary policy

[14] Results are robust to imposing restrictions for shorter horizons.

news shocks from Fed information shocks. In case of informationally constrained agents (in the sense that the Federal Reserve has superior information), news about future monetary policy tightening can signal either the anticipated monetary policy action or stronger than anticipated economic fundamentals (see, e.g., Nakamura and Steinsson, 2018 and Melosi, 2017, among others). The latter is the so-called information shock that implies positive responses of economic activity and prices. Therefore, similar in spirit to Andrade and Ferroni (2018) and Jarocinski and Karadi (2019), the imposed sign restrictions on industrial production and prices guarantee that our monetary policy news shock does not mix with the Fed information shock.

Finally, impulse-response functions that satisfy the sign and zero restrictions are calculated using the procedure proposed by Baumeister and Benati (2013). They combine the method suggested by Rubio-Ramirez et al. (2010) for imposing sign restrictions with the imposition of a single zero restriction via a deterministic rotation matrix. At each draw of the Gibbs sampler, the impact matrix $\mathbf{B}_0$ is calculated and kept if the corresponding impulse responses satisfy the sign and zero restrictions.

We test the robustness of our results to the choice of identifying restrictions and model specification. In particular, we use policy rate expectations at the 12-month- and 24-month-ahead horizons and we also consider an alternative measure of the monetary policy news shock based on high-frequency identification, as described in the following section.

3.3 An alternative identification of the monetary policy news shock

One potential critique of using the federal funds rate expectations directly in the VAR at monthly frequency is that other news shocks, distinct from monetary policy news, such as news about total factor productivity, could influence federal funds rate expectations. This would imply that our identified monetary policy news shock could potentially be confounding other types of news shocks as well. We address this concern by replacing the federal funds rate expectations with a market-based measure of interest rate expectations obtained from high-frequency data. This measure is based on federal funds rate futures surprises calculated as the change in the expectations of the federal funds rate on the day of a Fed announcement. It reflects the monetary policy news contained in the announcement and is unlikely to be influenced by other macroeconomic news. Following the important early contribution by Kuttner (2001), measuring the surprise components of US monetary policy announcements by using futures contracts has become popular in the recent academic literature (Barakchian and Crowe 2013; Gertler and Karadi 2015; Gürkaynak 2005; Hamilton 2008, etc.).

In terms of notation, let t denote time, i.e., month. Let f_{t+j} be the settlement price on the FOMC day in month t for interest rate futures (either the federal funds or the Eurodollar futures) expiring in month $t + j$. $f_{t+j,-1}$ is the corresponding settlement price for the day prior to the FOMC meeting. The unexpected movement in the target federal funds rate anticipated for month $t + j$ is denoted by $E_t i_{t+j}$ which can be expressed as:[15]

$$E_t i_{t+j} = f_{t+j} - f_{t+j,-1} \tag{3}$$

Table 2 lists the monetary policy announcement days we consider.

As mentioned, we use the federal funds futures and Eurodollar futures contracts with a 36-month maturity since expectations of the federal funds rate based on contracts with shorter maturity are essentially flat at the ZLB. Section 4.2 describes the futures data in detail. Finally, we incorporate this constructed monetary policy surprise series in the baseline VAR (Equation 2) and exclude the federal funds futures contracts series.[16] In the spirit of Barakchian and Crowe (2013), this series is included in the VAR in cumulative terms.[17] We use the taper tantrum episode as an illustrative example and consider a shock of 25 bps to the cumulated surprise measure based on the change in this series from April to June 2013. The identifying restrictions on the responses of the other variables are the same as those in the baseline VAR (see Table 1).

[15]Since we do not focus on the surprise in the futures rate for the current month, we do not scale the surprises based on the number of days in the month and the timing of the FOMC meeting in that particular month. In doing so, we follow Gertler and Karadi (2015) and Barakchian and Crowe (2013).

[16]Thus the number of variables in the resulting VAR is still 6.

[17]Barakchian and Crowe (2013) and Romer and Romer (2004) argue for including the surprise measure in cumulative terms as it is the level and not the change in policy that is relevant.

4 Data

4.1 Capital flows

We use data on net portfolio flows from the Emerging Portfolio Fund Research (EPFR) Global database. The database contains weekly portfolio investment (net) flows by more than 14,000 (mutual and ETF) equity funds and more than 7,000 (mutual and ETF) bond funds. We use EPFR data since it is available at higher frequencies than the balance of payments data, allowing us to examine movements in portfolio flows at a monthly frequency. While the database represents up to 20% of the market capitalization in equity and in bonds for most countries, it closely matches portfolio flows in the balance of payments data (as shown in, e.g., Fratzscher, 2012 and Jotikasthira et al., 2012) and is being increasingly used in academic research on capital flows (Forbes et al., 2016 and Lo Duca, 2012, among many others). In addition, the EPFR data are used widely in the financial industry as a timely, high-frequency indicator of movements in portfolio flows.

Our sample covers the following 23 emerging markets: Argentina, Brazil, Bulgaria, Chile, China, Colombia, Czech Republic, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Peru, the Philippines, Poland, Romania, Russia, South Africa, Thailand, Turkey, Ukraine and Venezuela. We use monthly data over the period January 2004 to May 2017.

4.2 US variables

We use the federal funds futures contracts as a measure of expectations of the future federal funds rate. The federal funds futures contract price represents the market opinion of the average daily federal funds effective rate, as calculated and reported by the Federal Reserve Bank of New York, for a given calendar month. Federal funds futures have long been regarded as an effective means of tracking market expectations of Fed monetary policy actions.[18]

As mentioned, in our baseline specification, we use the federal funds future contracts at the 36-month horizon as a measure of expectations about future short-term interest

[18] Futures for the federal funds rate started trading in the late 1980s but only up to a 6-month ahead horizon. Meaningful trading volumes of up to the 24-month ahead futures contracts only began in 2004, while those for the 36-month ahead futures are available since 2011.

rates. We chose to use expectations of future monetary policy at a long-term horizon since this avoids problems with the ZLB; i.e., expectations of the federal funds rate are essentially flat at short-term horizons (Figure 1). Since up to 36-month ahead futures only exist from January 2011 onward, we use the Eurodollar futures contracts for the period prior to this. The correlation between the two series is 0.99 over the period January 2011 to May 2017. Below we briefly describe how the two series are combined.

While the federal funds futures contracts extend up to the first 36 calendar months in the future, the Eurodollar futures contracts mature during the months of March, June, September, and December, extending outward 10 years into the future. Thus, in order to combine the two series we use the federal funds futures contracts expiring in March, June, September, and December. In other words, for the first month of any given quarter we use the fed funds futures contracts at the 36-month horizon; for the second month of the quarter, we use the 35-month ahead futures contracts, and; for the third month of a quarter, we use the 34-month ahead futures contracts. Finally, the data on federal funds and Eurodollar futures contracts are obtained from Bloomberg. Daily futures rates are transformed into monthly frequency by taking the average over the month. For robustness, we also present results based on federal funds futures at the 12-month and 24-month horizon.

US inflation is measured as the first difference of the log of the consumer price index and US industrial production growth is measured as the first difference of the log of US industrial production. These data, along with the effective federal funds rate and the VIX are taken from Haver Analytics. The latter data is transformed to monthly frequency by taking the monthly average.

5 Results

5.1 Common factor of capital flows to EMEs

We first examine the extent to which capital flows to emerging markets co-move.[19] Figure 3 plots the estimated first principal component for the capital flow series. The common

[19] Recent literature has also documented co-movement of capital flows (for example, Förster et al. 2014; Fratzscher 2012).

component tracks aggregate net capital flows very well. Moreover, the common component explains about 71% of the variation in country-specific flows, on average, which lends credibility to our approach of including the common factor into the VAR model to obtain the impact of monetary policy news shocks on individual countries (see Table 3). It also suggests that common (i.e., global) factors have played a much larger role than idiosyncratic factors in shaping fund flows into emerging-market bonds and equities in recent years. In some cases, however, country-specific factors matter more. For example, the common factor explains less than 40% of the variation for India, Thailand and Bulgaria .

5.2 The effect of a US monetary policy news shock

As discussed in the previous section, we identify a US monetary policy news shock as a shock that increases the expected federal funds rate while leaving the policy rate unchanged. We consider a shock of 50 bps, which is in line with the increase in the federal funds futures following former Chairman Bernanke's testimony on 22 May 2013.[20] Figure 4 shows the impulse-response functions for this shock. The shock leaves the federal funds rate unchanged on impact as imposed by the zero restriction. Monetary policy expectations –as measured by the federal funds futures– increase, and this effect is significant for about 10 months. The monetary policy news shock decreases US inflation and industrial production growth by about 0.4% and 0.9% on impact, respectively. Both inflation and industrial production growth return to their pre-shock levels after about 15 months. Stock market volatility, as measured by the VIX, increases for about 20 months following the shock, although the response is not significant on impact.

Turning to the response of portfolio flows, which is the focus of this paper, we find that the monetary policy news shock decreases the portfolio flow factor significantly. Capital flows return to their pre-shock level after 9-10 months following the shock. By combining equations (1) and (2), we obtain the effects on portfolio flows to individual countries and then sum these effects across countries to obtain the response of aggregate

[20]The federal funds future contract at the 36-month horizon increased by 52 bps from April to June 2013. A 50 bps shock represents a relatively small-sized shock equivalent to 0.3 times the standard deviation of the series.

capital flows. In order to assess the economic size of the effects on aggregate as well as country-specific flows, we scale these responses by the level (nominal) of 2016 GDP for the respective countries. Table 4 reports the results. We find that the shock corresponding to an increase in futures of 50 bps decreases aggregate capital flows to GDP by 0.15% on impact (see column 2, last row of Table 4). After three months, the cumulative decline in aggregate capital flows amounts to 0.35% of GDP. One year after the shock, aggregate capital flows decrease by 0.5% of GDP on a cumulative basis.

Table 4 also shows the effects on capital flows to individual countries following the monetary policy news shock of 50 bps. The impact effects (column "h=0") vary considerably across countries in terms of magnitude. South Africa, Hungary and Malaysia are found to be affected most, with impact effects ranging from about -0.6% of GDP to about -0.4% of GDP. However, the corresponding effects on Bulgaria, China, Venezuela and Romania are relatively small, ranging from roughly -0.1% to -0.03% of GDP. The three-month cumulative effects on capital flows range from -0.1% of GDP (Bulgaria) to -1.4% (South Africa). After one year, the cumulative decline in capital flows is as high as nearly 2% of GDP in the case of South Africa and 1.7% of GDP in the case of Hungary, while the corresponding figures for Bulgaria, Venezuela and Romania are quite small (between -0.3% and -0.1% of GDP).

Lastly, as the EPFR data base contains portfolio investment by equity and bond funds, we can decompose portfolio flows into bond and equity flows and examine the effects of monetary policy news shocks on these flows. In order to do so, we estimate two separate baseline VARs as specified in equation (2): one including the common factor extracted from equity flows as an endogenous variable and the other with the common factor of bond flows. Equity flows are slightly more volatile compared to bond flows in our sample, with the common factor explaining only 55%, on average, of the variation in flows compared to an average of 62% for bond flows. Looking at the impulse-response functions for a 50 bps monetary policy news shock, the bond flows factor shows a bigger drop on impact compared to the equity flows factor in response to the shock (see Figure 5). The response of bond flows also appears slightly more persistent. However, since the magnitude of equity flows is larger than that of bond flows in our sample, the cumulative 3-month response of aggregate bond flows as a share of GDP is actually smaller (-0.11%)

than that of equity flows (-0.17%) (see Table 4). These results are qualitatively similar with those in Fratzscher et al. (2016) and Lim et al. (2014). The latter paper concludes that bond flows appear to be affected via the portfolio balance channel while equity flows are not which, in turn, yields a bigger response in bond flows.

5.3 Country characteristics and the effects of US monetary policy news

To shed some light on the possible explanations for the differences in the magnitudes of the effects across countries, we investigate the association between the estimated effects and country characteristics. In particular, we consider the behavior of capital flows during the 2013 taper tantrum episode, the role of financial openness and the exchange rate regime, as well as economic fundamentals such as GDP growth, reserves, external debt, fiscal balance, and sovereign credit default swap (CDS) spreads. We use the sample average of country characteristics to assess their relation to 3-month cumulative effects on capital flows.[21] Table 5 present the sample averages of the country characteristics we consider.

First, we study the consistency of our estimated effects with the observed behaviour in capital markets during the taper tantrum episode in May 2013. In particular, we examine the correlation of the estimated country-specific effects with capital inflows prior to 2013 and the outflows following the taper tantrum. Figure 6 shows a scatterplot between the 3-month cumulative effects on capital flows and financial inflows from 2010-12 as a share of GDP. As can be seen, the countries we identify as being potentially most affected are the ones that received greater financial inflows prior to 2013. These results are consistent with recent findings in Eichengreen and Gupta (2015). We also run a simple regression of the estimated effects on the financial inflows from 2010-12 and find the coefficient for financial flows to be statistically significant, with an adjusted R-squared of 0.2.

Further, we analyze the relation between the estimated effect on capital flows and the capital outflows experienced over end-May to August 2013 following former Chairman Bernanke's testimony (see Figure 7). Again, there seems to be a strong association be-

[21] This is in line with the approach in, e.g., Miniane and Rogers (2007) and Dedola et al. (2017) in which point impulse response estimates are directly regressed on average characteristics over the sample.

tween the countries that are identified by the model as being most affected and the ones that saw greater outflows over May to August 2013. Running a regression of the estimated effects on the capital outflows over end-May to August 2013 confirms a statistically significant relation between these variables with an adjusted R-squared of 0.8.

Therefore, countries that seem to be more affected by a monetary policy news shocks are those that attract greater volumes of capital flows (at least for the period prior to the taper tantrum). This raises the obvious question whether the degree of capital openness potentially could explain the observed cross-country differences in effects. More financially open and interconnected economies may experience a larger impact of changes in global risk appetite and, hence, US monetary policy news. We use the widely applied financial openness measure of Chinn and Ito (2006, 2008).[22] The Chinn-Ito index is normalized between zero and one and higher values of the index indicate that a country is more open to cross-border capital transactions. Figure 8 plots the 3-month cumulative effects on capital flows against the sample average of this index. We do not observe any apparent relationship between cross-country effects and financial openness. While this seems to be a surprising result at first, it is in line with former findings in the literature studying spillovers of conventional monetary policy shocks. For example, Miniane and Rogers (2007) show that countries with less open capital accounts do not exhibit smaller responses in exchange rates and interest rates following US monetary shocks.

Further, countries that peg their currency to the United States could experience stronger spillovers. We use the standard Shambaugh (2004) classification since it contains information on the base country which allows us to determine whether countries pegged their currency to the United States at each point time over our sample.[23] There are only seven countries (Argentina, China, Malaysia, Philippines, Thailand, Ukraine and Venezuela) that pegged their currency to the US Dollar at some point in time over our sample (see Table 5). Countries such as Hungary and South Africa, whose capital flows seem to be affected most by monetary policy news shocks, did not peg their currency to the United States. However, countries such as China or Venezuela that pegged their

[22] We obtain the index from `http://web.pdx.edu/~ito/trilemma_indexes.htm`.

[23] The data for the Shambaugh (2004) classification is obtained from `https://www2.gwu.edu/~iiep/about/faculty/jshambaugh/data.cfm` and ends in 2014. Therefore, we use the sample average of the Dollar peg over the period 2004-2014.

currency to the US Dollar for most of our sample seem to experience relatively small effects on capital flows (see Figure 9).[24]

Further, the scatterplot shows a slight negative but insignificant relationship between effects on capital flows and the dollar peg. Therefore, we do not find any evidence for the standard exchange rate channel, i.e., countries with more flexible exchange rates experiencing less spillover effects. Nevertheless, given that our sample covers as much as half of the ZLB period and focuses on monetary policy news, our results seem to support the findings of Eichengreen and Gupta (2015): the countries least able to limit the impact on their real exchange rates during US quantitative easing were the same ones to experience large and sometimes uncomfortable real exchange rate reversals (and larger capital outflows) during the tapering episode.

We also investigate whether country-specific macroeconomic fundamentals can be related to the estimated effects on capital flows since capital could be more likely to flow to less risky or less vulnerable emerging market countries ("flight-to-quality"). Figure 10 shows the relation between estimated cross-country effects on capital flows and average real GDP growth. We find a negative and significant relation suggesting that countries with higher average GDP growth tend to experience smaller negative effects on capital flows. Further, Figure 11 shows the relation between cross-country effects on capital flows and average CDS spreads.[25] Countries with lower average CDS spreads over the sample tend to experience more capital outflows following a monetary policy news shock (although the relation is not significant).

Turning to indicators of external sustainability, Figure 12 shows a scatterplot between the estimated effects on capital flows and the external debt to GDP ratios averaged over the sample. Countries with higher external debt to GDP ratios are the ones with higher estimated impacts on capital flows (although not significantly). Similarly, the stock of reserves relative to nominal GDP also appears to be associated with the effect on capital flows (Figure 13). While this seems to suggest that capital flows of countries with lower reserves seem to be affected more after a monetary policy news shock, the relation is not

[24]Note that, at the same time, China and Venezuela have essentially closed capital accounts which reduces the volatility of capital flows to China and Venezuela, respectively.

[25]Note that we excluded CDS spreads of Argentina, Ukraine and Venezuela as their CDS spreads only start in 2012 and average about 1000 basis points.

statistically significant. Finally, we find evidence for a (marginally significant) relation between the fiscal balance and cross-country effects on capital flows (see Figure 14). Emerging markets with larger fiscal deficits are the ones with higher estimated effects on capital flows.

Overall, we find that the countries we identify as being the most affected, also experienced larger volumes of capital in- and outflows before and after the taper tantrum episode, respectively. Further, we find evidence that macroeconomic performance and external vulnerabilities may matter. However, common candidates to explain cross-country differences in spillover effects, i.e., financial openness and the exchange rate regime, do not seem to be associated with differences in effects on capital flows over our sample period.

5.4 Robustness

We assess the robustness of our VAR results to alternative horizons of the federal funds futures and the alternative shock identification based on federal funds future surprises described in Section 3.3.[26]

First, Figure 15 shows the impulse responses for the robustness exercise in which we re-estimate the baseline VAR with the federal funds futures contracts at the 24-month and 12-month ahead horizons. As can be seen, the response of US inflation, industrial production, VIX and the capital flow factor are robust to using the futures contracts at these horizons.

Moreover, Figure 16 shows the impulse responses for a shock of 25 bps to the cumulated surprise series. As before, the federal funds rate is unchanged on impact, in line with the zero restriction. The response of the federal funds futures surprise series is qualitatively very similar to that of the federal funds futures in our baseline VAR. The shock decreases US inflation and industrial production growth by about 0.7% and 1.3% on impact, respectively, with both variables responding slightly more than in the baseline VAR. Both inflation and industrial production growth return to their pre-shock levels

[26] In an unreported exercise, we also use a survey-based measure of federal funds rate expectations (at the five-quarters-ahead horizon) coming from the Blue Chip Financial Forecasts. VAR results based on survey-based rather than market-based expectations remain similar.

after about 15 months. The response of the VIX is once again not significant on impact but qualitatively consistent with that in the baseline VAR. Finally, the response of the capital flow factor is consistent with that in the baseline VAR, although it is not significant on impact. Since our results are quite robust with those obtained in the baseline VAR, constructing monetary policy surprises around Fed announcement dates seems not to bring any additional insights. Thus, including expectations about monetary policy directly in the VAR is appealing as a straightforward and direct way of assessing the effects of US monetary policy news shocks.

6 Conclusion

This paper uses a Bayesian VAR model to examine the potential effects of a US monetary policy news shock on portfolio flows to major EMEs. In our benchmark model, we define the US monetary policy news shock as a shock that increases expectations of the federal funds rate while leaving the policy rate per se unchanged. Results show that the effect of a US monetary policy news shock on aggregate portfolio flows as a share of GDP is economically small, amounting to 0.5% of GDP after a year. However, the effects vary considerably across countries with Hungary, South Africa, and Malaysia being potentially affected the most. There is a strong association between the countries that are identified by our analysis as being the most affected and the ones that received greater financial flows prior to 2013 and saw greater capital outflows over May to August 2013 following the Bernanke testimony. We also find evidence of a significant relationship between the estimated country-specific effects and macroeconomic fundamentals such as real GDP growth and the fiscal balance. However, financial openness and the exchange rate regime do not seem to be key determinants of cross-country differences in spillovers effects on capital flows. Our baseline results are robust to alternative shock identification strategies and model specification.

The main policy implication of our findings is that the effects of US monetary policy news shocks are likely to be asymmetric across countries. It is reasonable to expect episodes of volatility in global financial markets, especially capital flow reversals in EMEs, as the Fed continues to proceed on a gradual path of monetary policy normalization.

Higher bond yields will trigger portfolio rebalancing, the effects of which could well be amplified in the presence of market imperfections. Thus, the effects of US monetary policy news on EMEs will depend on the extent of their vulnerabilities. It is important to keep in mind that our analysis has abstracted from such country-specific or "pull" factors in order to isolate the impact of US monetary policy changes. Potential interactions between the Fed's monetary policy and country-specific macroeconomic factors could exacerbate the impact of US monetary policy news on capital flows.

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Table 1: *Identification restrictions for the baseline VAR*

Variable	Restriction	
Federal funds rate	0	$(h = 0)$
Federal funds futures	+	$(h = 0, ..., 5)$
Inflation	-	$(h = 0, ..., 5)$
IP growth	-	$(h = 0, ..., 5)$
VIX	?	
Capital flow factor	?	

Notes: IP denotes industrial production. "?" means that the variable is left unconstrained. h denotes the horizon (in months) of imposed restrictions

Table 2: *Dates of U.S. monetary policy announcements*

Year	Day	Description
2004	1/28, 3/16, 5/4, 6/30, 8/10, 9/21, 11/10,12/14	FOMC Meetings
2005	2/02, 3/22, 5/03, 6/30,8/09,9/20,11/01, 12/13	FOMC Meetings
2006	01/31, 03/28, 05/10, 06/29, 08/08, 09/20,10/25, 12/12	FOMC Meetings
2007	1/31, 3/21, 5/09,6/28,8/07,8/17, 9/18, 10/31, 12/11	FOMC Meetings
2008	1/22, 1/30, 3/18, 4/30,6/25, 08/05, 09/16	FOMC Meetings
	10/08	FOMC Meetings
	10/29	FOMC Meetings
	11/25	Fed announces purchases of MBS and Agency bonds
	12/01	Bernanke states Treasuries may be purchased
	12/16	FOMC Meeting
2009	28/01, 3/18, 4/29, 6/24, 8/12, 9/23, 11/4, 12/16	FOMC Meetings
2010	27/01, 3/16, 4/28, 6/23, 8/10	FOMC Meetings
	8/27	Bernanke Speech at Jackson Hole
	9/21	FOMC Meeting
	10/15	Bernanke Speech at Boston Fed
	11/03, 12/14	FOMC Meetings
2011	1/26, 3/15, 4/27, 6/22, 8/9	FOMC Meetings
	8/26	Bernanke Speech at Jackson Hole
	9/21, 11/2, 12/13	FOMC Meetings
2012	01/25,3/13, 4/25, 6/20,8/1	FOMC Meetings
	8/31	Bernanke Speech at Jackson Hole
	9/13, 10/24, 12/12	FOMC Meetings
2013	1/30, 3/20, 5/1	FOMC Meetings
	5/22	Bernanke Testimony
	6/19, 7/31, 9/18, 10/30, 12/18	FOMC Meetings
2014	1/29, 3/12, 4/30, 6/18, 7/30, 9/17, 10/29, 12/17	FOMC Meeting
2015	1/28, 3/18, 4/29, 6/17, 7/29, 9/17, 10/28, 12/16	FOMC Meeting
2016	1/27, 3/16, 4/27, 6/15, 7/27, 9/12, 11/2, 12/14	FOMC Meeting
2017	2/1, 3/15, 5/3	FOMC Meeting

Table 3: ***Variation in capital flows explained by the common component (in percent)***

Argentina	67	Mexico	89
Brazil	74	Peru	92
Bulgaria	39	Philippines	89
Chile	81	Poland	88
China	44	Romania	60
Colombia	66	Russia	70
Czech Republic	46	South Africa	90
Hungary	85	Thailand	37
India	27	Turkey	93
Indonesia	90	Ukraine	85
Korea	58	Venezuela	73
Malaysia	90		
Average	71		

Table 4: ***Effects of a monetary policy news shock on individual countries' capital flows (percent of 2016 GDP)***

	Effect					Cumulative Effect		
	h=0	h=1	h=2	h=5	h=11	3-month	6-month	12-month
Argentina	-0.08	-0.07	-0.04	-0.01	0.00	-0.19	-0.24	-0.27
Brazil	-0.29	-0.24	-0.16	-0.04	-0.01	-0.69	-0.90	-0.99
Bulgaria	-0.03	-0.03	-0.02	0.00	0.00	-0.08	-0.10	-0.11
Chile	-0.21	-0.17	-0.11	-0.03	-0.01	-0.49	-0.64	-0.71
China	-0.06	-0.05	-0.03	-0.01	0.00	-0.14	-0.18	-0.20
Colombia	-0.24	-0.20	-0.13	-0.04	-0.01	-0.58	-0.75	-0.83
Czech Republic	-0.09	-0.08	-0.05	-0.01	0.00	-0.22	-0.28	-0.31
Hungary	-0.50	-0.42	-0.27	-0.07	-0.01	-1.19	-1.55	-1.72
India	-0.12	-0.10	-0.07	-0.02	0.00	-0.29	-0.37	-0.42
Indonesia	-0.19	-0.16	-0.11	-0.03	-0.01	-0.46	-0.60	-0.66
Korea	-0.21	-0.17	-0.11	-0.03	-0.01	-0.49	-0.64	-0.71
Malaysia	-0.39	-0.33	-0.21	-0.06	-0.01	-0.93	-1.20	-1.33
Mexico	-0.27	-0.22	-0.14	-0.04	-0.01	-0.63	-0.82	-0.91
Peru	-0.31	-0.26	-0.17	-0.05	-0.01	-0.73	-0.95	-1.05
Philippines	-0.23	-0.19	-0.13	-0.03	-0.01	-0.55	-0.71	-0.79
Poland	-0.24	-0.20	-0.13	-0.04	-0.01	-0.57	-0.74	-0.82
Romania	-0.09	-0.08	-0.05	-0.01	0.00	-0.22	-0.29	-0.32
Russia	-0.24	-0.20	-0.13	-0.04	-0.01	-0.57	-0.74	-0.82
South Africa	-0.58	-0.49	-0.32	-0.09	-0.02	-1.39	-1.80	-1.99
Thailand	-0.24	-0.20	-0.13	-0.03	-0.01	-0.56	-0.73	-0.81
Turkey	-0.18	-0.15	-0.10	-0.03	-0.01	-0.42	-0.55	-0.61
Ukraine	-0.29	-0.24	-0.16	-0.04	-0.01	-0.68	-0.88	-0.98
Venezuela	-0.09	-0.07	-0.05	-0.01	0.00	-0.21	-0.27	-0.29
Aggregate	-0.15	-0.12	-0.08	-0.02	0.00	-0.35	-0.45	-0.50
Agg. bond flows	-0.04	-0.04	-0.03	-0.01	0.00	-0.11	-0.17	-0.20
Agg. equity flows	-0.09	-0.06	-0.03	0.00	0.00	-0.17	-0.19	-0.20

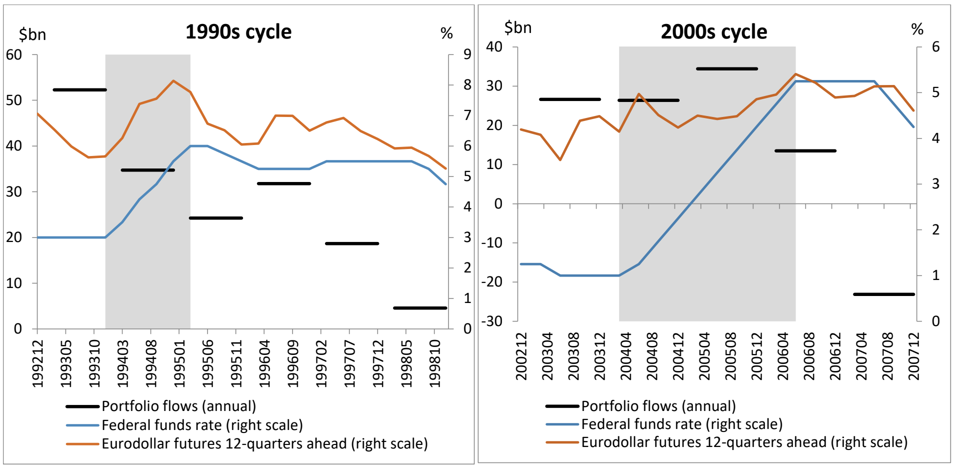
Table 5: ***Average Country Characteristics Over the Sample***

	Inflows 2010-2012 (%GDP)	Outflows May-Sept 2013 (%GDP)	Financial Openness	Dollar Peg	Real GDP Growth (%)	Sovereign CDS Spreads (bps)	External Debt (%GDP)	Reserves/ Nominal GDP (%)	Budget Balance (%GDP)
Argentina	3.10	-0.14	0.19	0.18	3.71	1046.78	43.02	0.39	-0.88
Brazil	9.50	-1.76	0.42	0.00	2.53	198.72	15.67	0.52	-3.36
Bulgaria	0.27	-0.01	0.89	0.00	3.34	167.96	82.10	1.41	0.00
Chile	15.30	-1.31	0.83	0.00	3.92	75.07	44.49	0.56	1.27
China	1.21	-0.35	0.17	0.73	9.47	72.75	13.64	1.45	5.71
Colombia	8.60	-0.43	0.44	0.00	4.35	184.60	25.99	0.45	-2.82
Czech Republic	7.20	-0.23	1.00	0.00	2.75	73.45	52.62	0.98	-2.05
Hungary	6.46	-2.09	1.00	0.00	1.66	203.90	110.38	1.03	-3.93
India	6.60	-0.47	0.17	0.00	7.61	167.30	20.16	0.72	-4.59
Indonesia	5.80	-0.95	0.57	0.00	5.65	207.29	31.89	0.46	-1.39
Korea	8.90	-0.42	0.60	0.00	3.63	81.66	28.60	0.99	0.83
Malaysia	20.60	-2.17	0.36	0.18	5.05	93.51	61.52	1.68	-4.02
Mexico	15.10	-1.27	0.70	0.00	2.44	121.84	25.34	0.44	-1.56
Peru	6.20	-1.76	1.00	0.00	5.57	131.14	32.87	1.06	0.00
Philippines	10.90	-1.40	0.36	0.09	5.63	196.76	35.96	0.99	-1.97
Poland	16.00	-1.14	0.49	0.00	3.87	92.19	59.95	0.71	-2.20
Romania	5.62	-0.65	0.97	0.00	3.61	185.37	56.69	0.71	-3.46
Russia	5.10	-1.56	0.55	0.00	3.00	200.87	31.48	1.01	0.92
South Africa	12.20	-2.16	0.17	0.00	2.79	160.79	30.45	0.12	-2.59
Thailand	17.20	-1.84	0.24	0.09	3.68	98.53	34.13	1.52	-1.36
Turkey	18.60	-1.05	0.36	0.00	5.72	233.91	39.85	0.46	-1.80
Ukraine	18.30	-1.95	0.06	0.64	-0.13	858.54	76.68	0.68	-2.73
Venezuela	7.50	-0.60	0.10	1.00	3.31	1000.05	28.44	N/A	-3.63

Figure 1: ***Market expectations of the federal funds rate at different horizons (monthly data)***

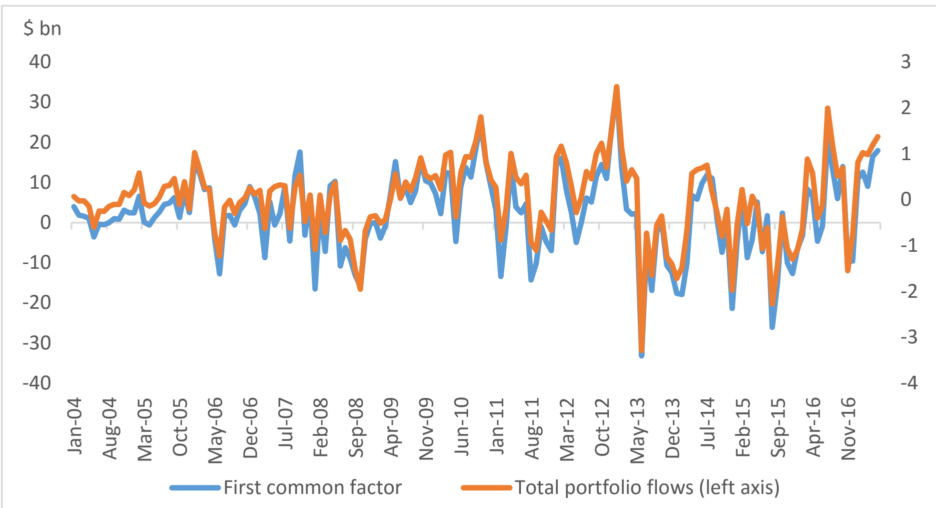
Notes: The figure shows the federal funds future contracts at the 6-month-, 12-month-, 24-month-ahead horizons. Expectations of the federal funds rate at the 36-month-ahead horizon are obtained by combining the data on the federal funds futures contracts and the Eurodollar futures, as described in section 4.2.

Figure 2: *Portfolio flows to EMEs during previous Fed tightening cycles*



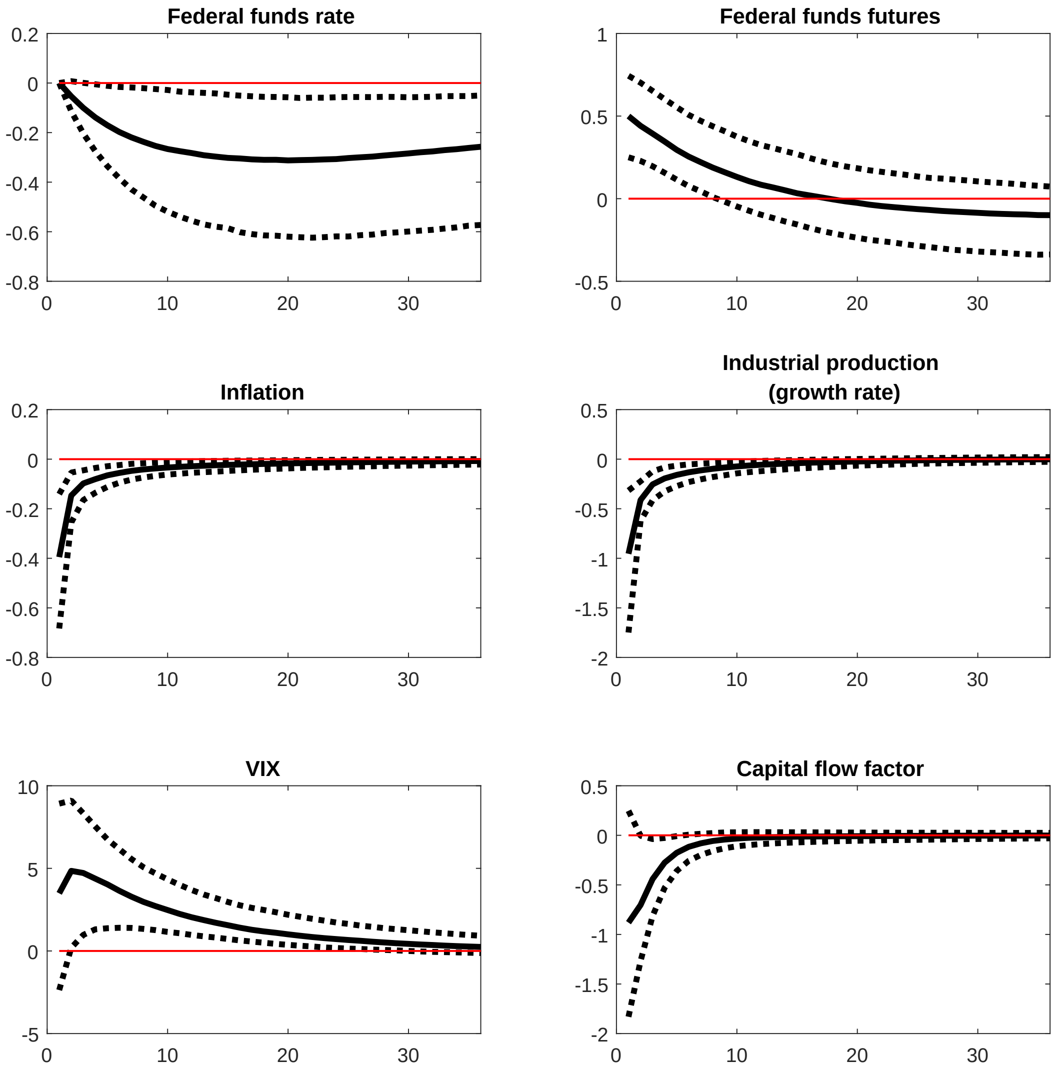
Notes: The federal funds rate and the 12-quarter-ahead Eurodollar futures are shown at quarterly frequency. The capital flows data are taken from the IIF and are only available at annual frequency for the time period shown in the graph. Portfolio flows represent the sum of flows to all the EMEs in our sample. The gray shaded areas represent the period over which the Federal Reserve raised the federal funds rate.

Figure 3: *Common factor of portfolio flows and aggregate portfolio flows*



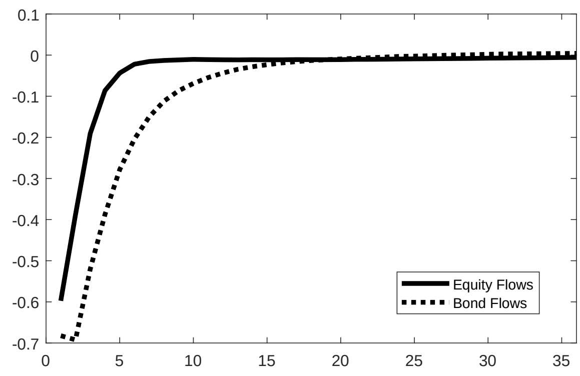
Note: The common factor is the first principal component calculated from our panel of net portfolio flows.

Figure 4: *Impulse responses to a monetary policy news shock identified by sign restrictions*



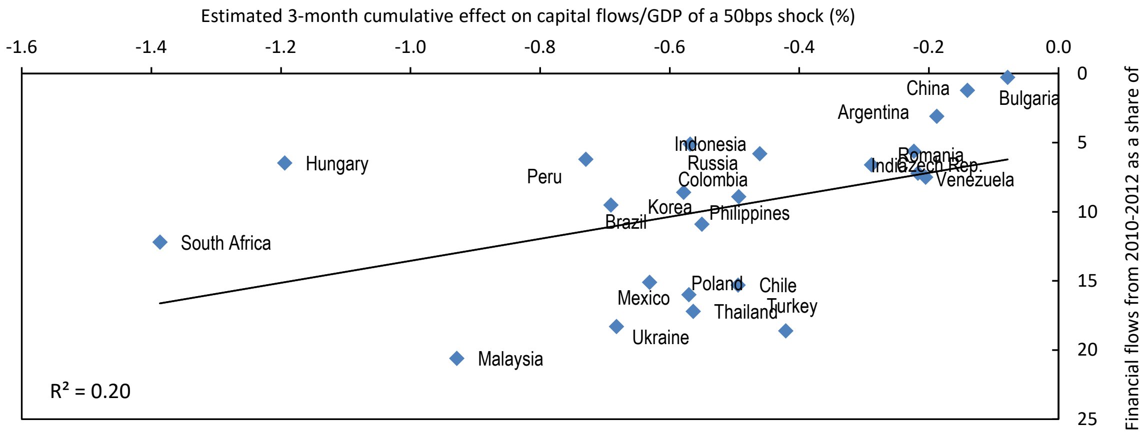
Note: Median (solid line) responses together with 68 percent credible set (dashed lines)

Figure 5: ***Impulse responses of Bond and Equity Flows***



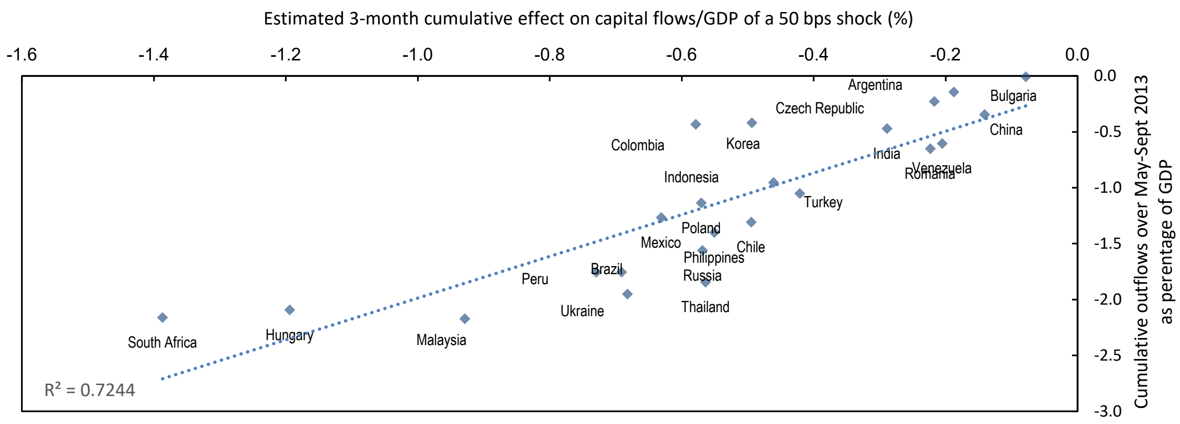
Note: Median responses of bond flows (dashed line) and equity flows (solid line).

Figure 6: ***Estimated effect on capital flows/GDP vs. financial flows from 2010-12***



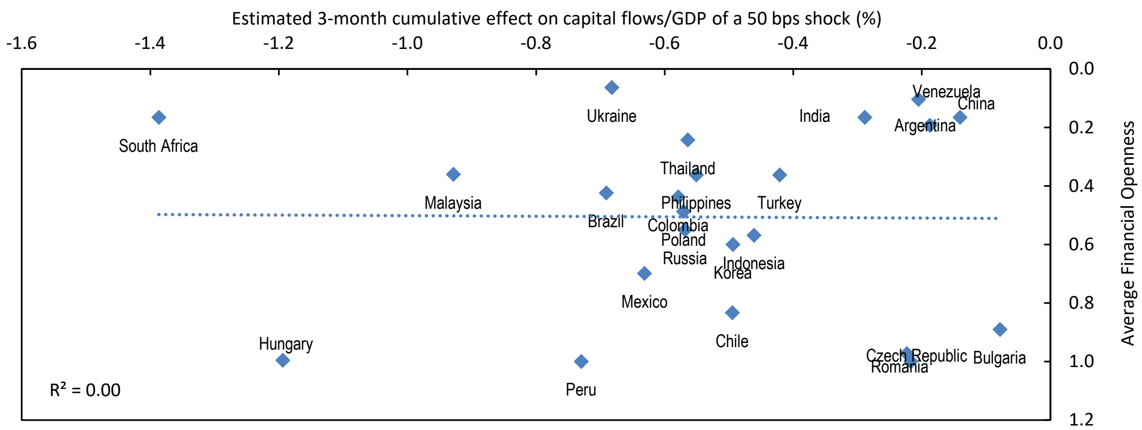
Notes: Financial flows refers to total portfolio inflows. The X-axis shows the estimated 3-month cumulative effect of a 50 bps monetary policy news shock on the respective countries, as shown in Table 4.

Figure 7: ***Estimated effect on capital flows/GDP vs. capital outflows over end-May to August 2013***



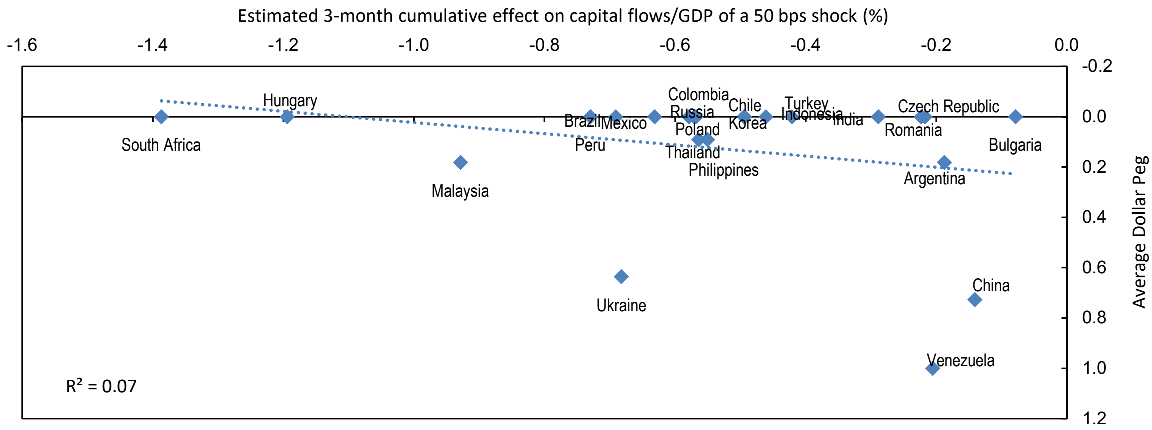
Notes: The X-axis shows the estimated 3-month cumulative effect of a 50 bps monetary policy news shock on the respective countries, as shown in Table 4.

Figure 8: ***Estimated effect on capital flows/GDP vs. Financial Openness***



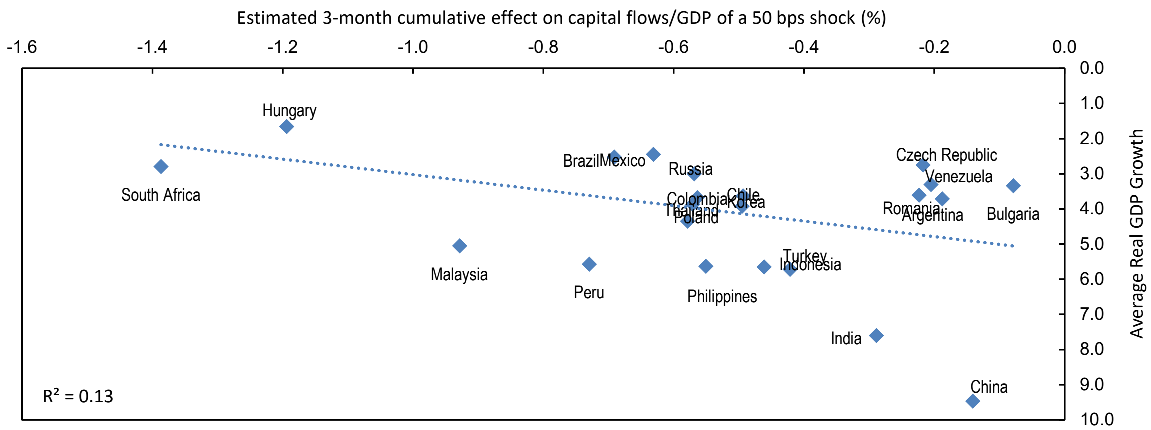
Notes: The X-axis shows the estimated 3-month cumulative effect of a 50 bps monetary policy news shock on the respective countries, as shown in Table 4. Financial openness is the Chinn and Ito (2006, 2008) capital openness index averaged over the sample.

Figure 9: ***Estimated effect on capital flows/GDP vs. U.S. Dollar Peg***



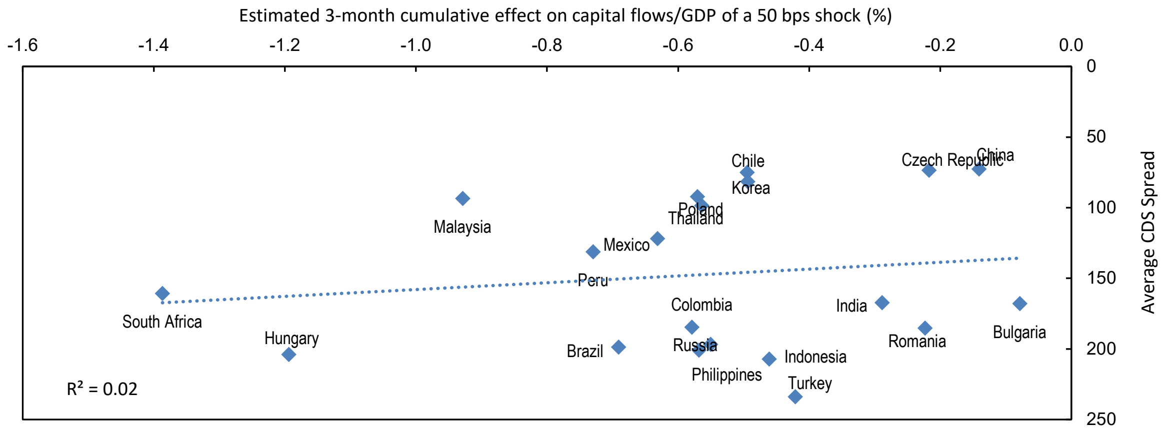
Notes: The X-axis shows the estimated 3-month cumulative effect of a 50 bps monetary policy news shock on the respective countries, as shown in Table 4. U.S. dollar peg is based on Shambaugh (2004) and averaged over the sample.

Figure 10: ***Estimated effect on capital flows/GDP vs. Real GDP Growth***



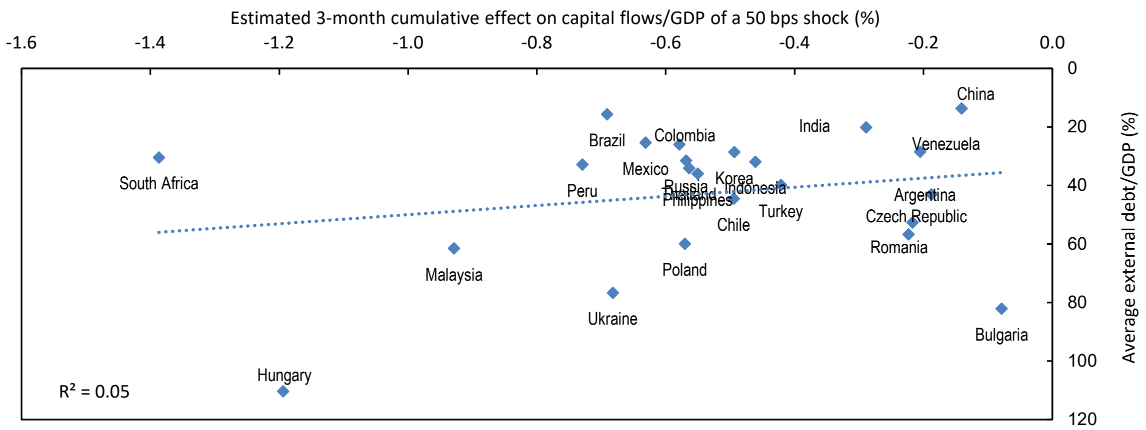
Notes: The X-axis shows the estimated 3-month cumulative effect of a 50 bps monetary policy news shock on the respective countries, as shown in Table 4. Real GDP growth is averaged over the sample.

Figure 11: ***Estimated effect on capital flows/GDP vs. CDS Spreads***



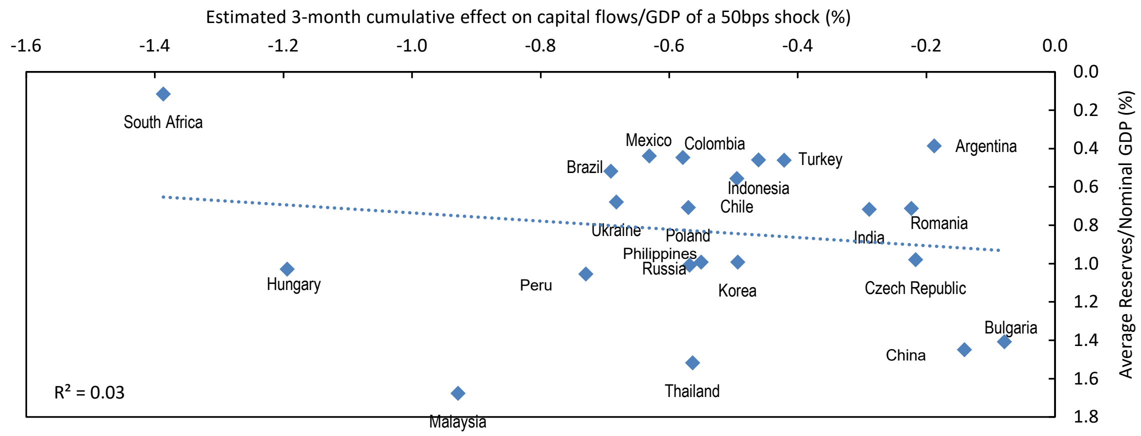
Notes: The X-axis shows the estimated 3-month cumulative effect of a 50 bps monetary policy news shock on the respective countries, as shown in Table 4. Sovereign CDS spreads are averaged over the sample.

Figure 12: ***Estimated effect on capital flows/GDP vs. average external debt/GDP***



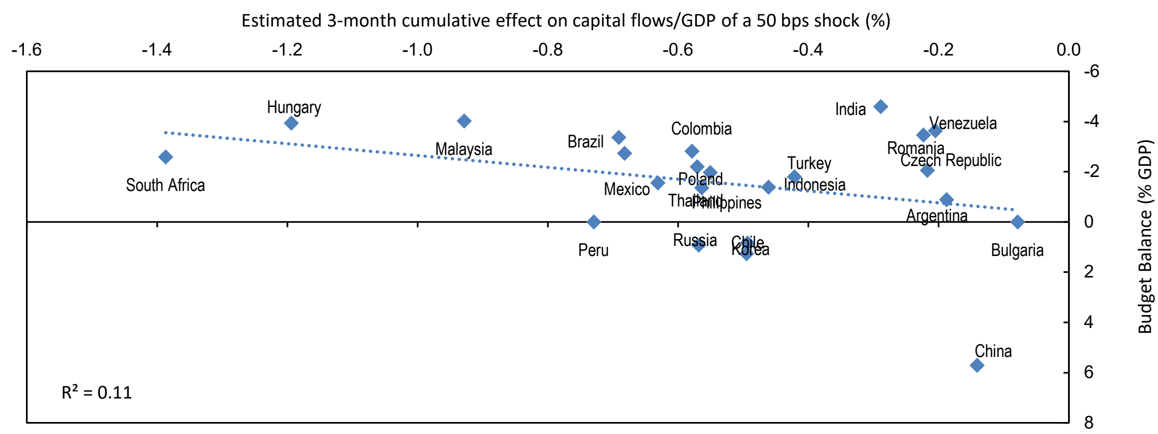
Notes: The X-axis shows the estimated 3-month cumulative effect of a 50 bps monetary policy news shock on the respective countries, as shown in Table 4. Country-specific external debt to GDP ratios are averaged over the sample.

Figure 13: *Estimated effect on capital flows/GDP vs. average reserves/GDP*



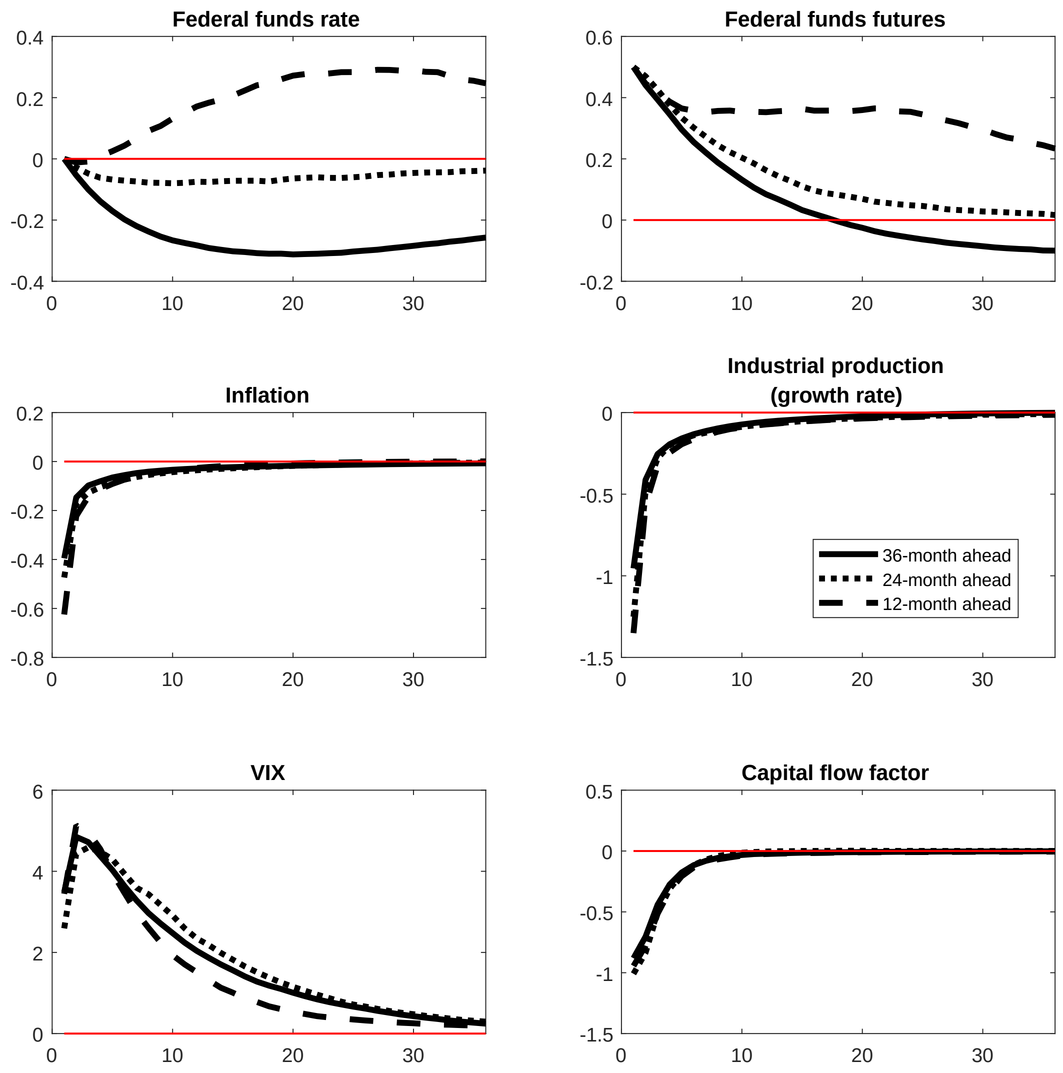
Notes: The X-axis shows the estimated 3-month cumulative effect of a 50 bps monetary policy news shock on the respective countries, as shown in Table 4. Country-specific reserves to GDP ratios are averaged over the sample.

Figure 14: *Estimated effect on capital flows/GDP vs. Budget Balance*



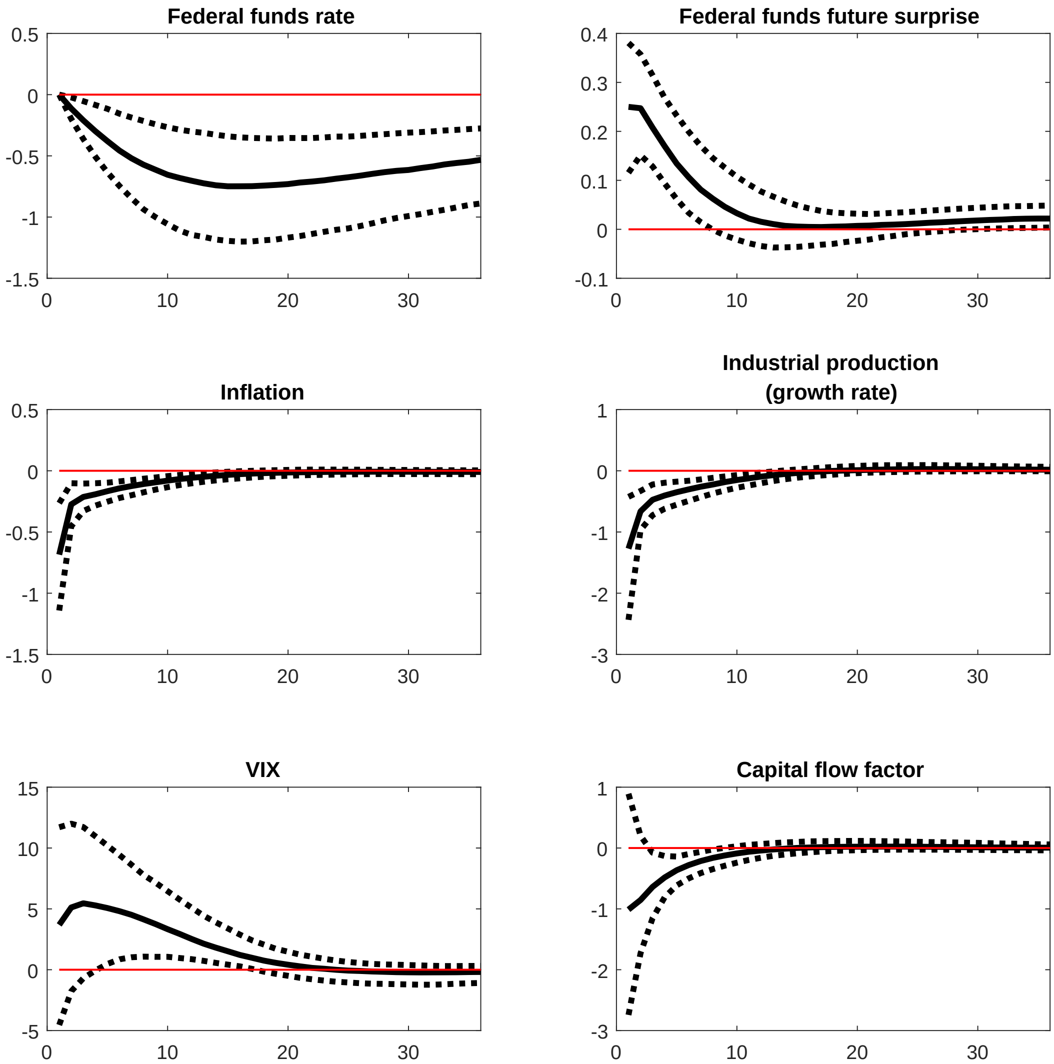
Notes: The X-axis shows the estimated 3-month cumulative effect of a 50 bps monetary policy news shock on the respective countries, as shown in Table 4. Country-specific budget balances (as % of GDP) are averaged over the sample.

Figure 15: *Impulse responses to monetary policy news shocks at alternative expectation horizons*



Note: Median (solid line) responses together with 68 percent credible set (dashed lines).

Figure 16: *Impulse responses for alternative monetary policy news shock using federal funds future surprises*



Note: Median (solid line) responses together with 68 percent credible set (dashed lines).

A Bayesian estimation details

Let us define $\mathbf{x}_t = \left(\mathbf{1}, \mathbf{y}'_{t-1}, ..., \mathbf{y}'_{t-p}\right)$ and the $T \times (7p+1)$ matrix $\mathbf{X} = (\mathbf{x}_1, ..., \mathbf{x}_T)$. If $A = (\alpha, A_1, ..., A_p)'$, we can define $\mathbf{a} = vec(\mathbf{A})$, which is a vector stacking all the VAR coefficients and their intercepts. Finally, let $\mathbf{Y}$ and $\mathbf{U}$ be matrices stacking $\mathbf{y}_t$ and $\mathbf{u}_t$ over time, respectively. Then, we can rewrite equation (2) as follows:

$$\mathbf{Y} = \mathbf{X}\mathbf{A} + \mathbf{U}. \tag{4}$$

We estimate equation (4) via Bayesian methods, treating the VAR model's parameters $\mathbf{A}$ and $\mathbf{\Omega}$ as random variables. Estimation by a Gibbs sampler implies alternately sampling these parameters from their respective conditional posterior distributions. We assume an independent Normal-Wishart prior and, thus, the conditional posterior distribution of the coefficients is given by $\mathbf{a}|\mathbf{y}, \mathbf{\Omega} \sim N(\overline{\mathbf{a}}, \overline{\boldsymbol{V}})$, where $\mathbf{a} = vec(\mathbf{A})$, $\mathbf{y} = vec(\mathbf{Y})$, $\mathbf{Z} = \mathbf{I} \otimes \mathbf{X}$, $\mathbf{\Sigma} = \mathbf{\Omega}^{-1} \otimes \mathbf{I}$, $\overline{\mathbf{V}} = (\underline{\mathbf{V}}^{-1} + \mathbf{Z}'\mathbf{\Sigma}\mathbf{Z})^{-1}$, and $\overline{\mathbf{a}} = \overline{\boldsymbol{V}}\left(\underline{\boldsymbol{V}}^{-1}\underline{\mathbf{a}} + \mathbf{Z}'\mathbf{\Sigma}\mathbf{y}\right)$. The conditional posterior of $\mathbf{\Omega}^{-1}$ follows a Wishart distribution, i.e., $\mathbf{\Omega}^{-1}|\mathbf{y}, \mathbf{a} \sim W(\overline{\mathbf{S}}^{-1}, \overline{\boldsymbol{\nu}})$, where $\overline{\nu} = T + \underline{\nu}$ and $\overline{\mathbf{S}} = \underline{\mathbf{S}} + (\mathbf{Y} - \mathbf{X}\mathbf{A})'(\mathbf{Y} - \mathbf{X}\mathbf{A})$. The model is estimated using uninformative priors, i.e., $\underline{\mathbf{a}} = \underline{\mathbf{V}}^{-1} = \underline{\mathbf{S}} = \underline{\nu} = \mathbf{0}$.