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Monetary News, U.S. Interest Rate and Business Cycles in Emerging Economies*

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Abstract

This paper identifies anticipated (news) and unanticipated (surprise) shocks to the U.S. Fed Funds rate using Fed Funds Futures contracts, and assesses their propagation to emerging economies. Anticipated shocks are identified as the expected change in the Fed Funds rate orthogonal to expected U.S. business cycle conditions while unanticipated shocks are the one-step ahead forecast error. Anticipation accounts for 80 percent of quarterly Fed Funds fluctuations and explains 47 percent of the narrative series of monetary policy shocks. To identify the effects of both shocks, I estimate a Panel VAR using a sample of emerging economies. An anticipated (unanticipated) 25 basis points contractionary U.S. interest rate shock induces a fall of 0.5 percent in GDP from its trend one quarter before (after) the shock materializes. This effect is coupled with a depreciation of the exchange rate, an increase in sovereign spreads, and a decline in external credit. Accounting for anticipation almost doubles the role of U.S. interest rate shocks as a driver of business cycles in emerging economies, explaining almost 20 percent of output fluctuations.

JEL Classification: E32, E52, F41, F44.

Keywords: U.S. interest rate, international business cycles, news shocks, emerging economies.

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1 Introduction

Over the last decades most emerging economies have increasingly opened their borders to financial flows. This integration has improved their access to international financial markets and substantially increased their interdependencies with developed economies. In this context, movements in the international interest rate have been identified as an important source of business cycle fluctuations in emerging economies. Fluctuations in the international interest rate may affect borrowing conditions, commodity prices, exchange rates, flows of capital, and the macroeconomic conditions of emerging economies. Although this topic has been widely studied, there is no consensus on the macroeconomic effects of variations in the U.S. interest rate on these economies.[1] Understanding the transmission of U.S. interest rate shocks is crucial not only for explaining business cycle fluctuations in emerging economies but also for designing monetary and macroprudential policies.

A common feature of previous empirical works is that they abstract from potential anticipation effects. However, many movements in the U.S. interest rate are anticipated by the market before they occur. A potential source of monetary anticipation is the practice of "forward guidance" through which the Central Bank informs the future course of monetary policy. Moreover, the Fed Funds Future contracts provide a market-based unbiased expectations indicator of interest rate's evolution (Owens and Webb, 2001; Hamilton, 2009). Capital flows, financial markets, and exchange rates may react to an expected movement before any change in the U.S. interest rate. Hansen and Sargent (1991) demonstrate that, in the case of anticipation, a Vector Autoregressive Model (VAR) with insufficient information (i.e. without considering agents' expectations) fails to capture the true dynamics of the variables. This fact may explain the lack of consensus from previous works about the effects of U.S. monetary policy shocks on emerging economies.

This paper develops a novel way of identifying anticipated and unanticipated U.S. interest rate shocks and assesses their propagation to emerging economies. While anticipated shocks are "news" which have a delayed effect on the U.S. interest rate but affect on impact agents' expectations, unanticipated shocks are "surprises" which change the U.S. interest rate contemporaneously.

[1] See for example: Canova (2005), Uribe and Yue (2006), Mackowiak (2007), Ilzetzki and Jin (2013), Georgiadis (2016), and Dedola, Rivolta, and Stracca (2017).

To identify anticipated and unanticipated shocks, I exploit the different maturities of the Fed Funds Future contracts. First, I compute the anticipated change of the Fed Funds rate between two consecutive quarters and show that it contains useful information to explain its realized changes. Analogously, the unanticipated change is defined as the one step ahead forecast error. Then, following a similar procedure to Romer and Romer (2004), I purge the anticipated and unanticipated policy movements of systematic policy changes which relate to current and expected U.S. business cycle conditions. The identified series of anticipated shocks contains important information to predict the narrative monetary policy shocks of Romer and Romer (2004), updated by Tenreyro and Thwaites (2016).

Using a quarterly sample of emerging economies, I estimate a Panel VAR to identify the effects of the previously identified anticipated and unanticipated shocks on macroeconomic aggregates of emerging economies. The model assumes that these economies are small open economies, which implies that they do not influence the Fed Funds rate. The baseline specification includes international variables (terms of trade and an indicator of global financial conditions), the main macroeconomic variables (GDP, Investment, Trade Balance, and CPI), the exchange rate, the country interest rate, and cross-border bank credit. I incorporate the U.S. interest rate shocks in an exogenous block. Results show that emerging economies react once they receive the news about the future evolution of the Fed Funds, even before the rate changes. In particular, an expected 25 basis points increase of the U.S. interest rate two quarters ahead induces a fall of 0.5 percent in GDP from its linear trend, one quarter before the shock materializes. Unanticipated contractionary interest rate shocks also cause a similar contraction in emerging economies but after the change in the U.S. interest rate. The financial channel, via the country interest rate and cross-border bank credit, and the exchange rate are important for the transmission of these shocks. Moreover, both shocks lead to significantly higher borrowing-lending spreads in the domestic financial sector. Accounting for anticipation almost doubles the contribution of U.S. interest rate shocks to explain business cycles in emerging economies, explaining almost 20 percent of output fluctuations.

The international macroeconomics literature has so far assessed the propagation of U.S. monetary policy to emerging economies without reaching a conclusive evidence. On the one hand, Canova (2005) and Ilzetzki and Jin (2013), using different identification schemes, find that a contractionary shock induces an increase in the domestic interest rate, a depreciation of the exchange rate, and a delayed positive effect on economic activity in emerging economies after 1990. On the other hand, Uribe and Yue (2006) estimate the effects of changes in the U.S. real interest rate and claim that an increase in this rate induces a contraction of GDP in an emerging economy. Mackowiak (2007) and Dedola, Rivolta, and Stracca (2017) show that U.S. monetary policy shocks induce heterogeneous effects on real activity. In this paper, I show that anticipation is key to understand the effects of U.S. interest rate shocks and that a contractionary U.S. interest rate shock induces a decline in output on emerging economies. The financial channel, via the country interest rate and cross-border bank credit, is key for the transmission of these shocks.

Sharp declines in capital inflows, called Sudden Stops, have been considered a major concern for emerging economies (see for example Calvo, Izquierdo, and Talvi, 2006). Usually, they induce immediate output collapses and severely affect the banking sector. The transmission channels and macroeconomic effects identified in this paper are consistent with the findings in this literature (see Chari, Kehoe, and McGrattan, 2005; Kehoe and Ruhl, 2009). More recently, Rey (2013) and Miranda-Agrippino and Rey (2015) show that capital flows, especially credit flows, are largely driven by a *Global Financial Cycle*, which is determined by monetary conditions and by changes in risk aversion and uncertainty. Akinci (2013) shows that the effect of global financial conditions in emerging economies is largely driven by risk aversion, proxied by the BAA corporate spread, while changes in the U.S. interest rate account for a negligible part of business cycles fluctuations in these economies. Anticipated and unanticipated U.S. interest rate shocks may be key determinants of the *Global Financial Cycle* since they induce large declines in cross-border bank credit and increases in sovereign spread. In fact, both shocks explain a significant fraction of BAA corporate spread fluctuations.

There has been a renewed interest in the effects of news shocks, understood as shocks that are observed before they materialize (Beaudry and Portier, 2006). Schmitt-Grohe and Uribe (2012) show that anticipated shocks account for half of the predicted aggregate macroeconomic fluctuations. Following this line, many papers have tried to disentangle the effects of news shocks on different macroeconomic variables. For example, in an open economy framework, Ben Zeev, Pappa, and Vicondoa (2017) highlight the role of terms of trade news shocks to account for business cycles fluctuations in emerging economies. Regarding monetary policy, previous studies have analyzed the effects of unanticipated shocks to the interest rate rule in a closed-economy. Estimating DSGE models, Milani and Treadwell (2012) and Gomes, Iskrev, and Mendicino (2013) find that anticipated (news) shocks in monetary policy are more important than unanticipated (surprise) ones to explain U.S. output fluctuations. Ben Zeev, Gunn, and Kahn (2016) find that a significant fraction of the U.S interest rate rule residuals is anticipated by the private sector. This paper shows that anticipated interest rate shocks have significant effects on business cycles of emerging economies.

The remaining of this paper is organized as follows. Section 2 describes the identification and properties of news and surprise U.S. interest rate shocks and compares them with the narrative series of monetary policy shocks. Section 3 characterizes the empirical strategy used to identify the macroeconomic effects of both types of shocks on emerging economies and displays the empirical results. Section 4 analyzes the role of the domestic banking sector in the transmission of both shocks. Finally, Section 5 concludes.

2 Identification of News and Surprise U.S. Interest Rate Shocks

In this section, I describe the strategy used to identify news and surprise U.S. interest rate shocks. First, I compute anticipated and unanticipated movements in the U.S. interest rate using information from Fed Funds future markets. However, expectations about movements in this interest rate capture expected reaction of the Federal Reserve to anticipated changes in U.S. business cycle conditions. Then, I use market's expectations regarding U.S. main macroeconomic variables to purge pure U.S. interest rate shocks from the systematic changes. Finally, I assess the properties of this series by comparing it to the narrative series of monetary policy shocks.

2.1 Anticipated and Unanticipated Movements in U.S. Interest Rate

To capture private sector's expectations about the evolution of U.S. interest rate, I use data from the Chicago Board of Trade (CBOT) Fed Funds Future Market for different maturities. Hamilton

(2009) shows that these contracts are an excellent predictor of the Fed Funds rate. Unlike using a time series model (like VARs) to compute expectations about interest rates, market-based forecasts have the advantage of adapting to changes in the FED's reaction to the state of the economy (i.e. potential time varying parameters in the Taylor rule, see Cochrane and Piazzesi, 2002).

The price of the Fed Funds future contracts is based on the average monthly Federal Funds interest rate. At the beginning of a month, these prices are based primarily upon future expectations about the Fed Funds effective rate in that month.[2] Considering that I want to compute market's expectation for each quarter, I use the price of Fed Funds futures at the beginning of each period for all the available horizons and I compute an average of all the contracts that belong to that quarter.[3] The anticipated change of this variable over time is defined as:

$$\Delta i^a_{t,t+j} = \mathbb{E}_{t-1}\left(i_{t+j} - i_{t+j-1}\right) \quad \text{for } j = \{0, 1, 2, 3\} \tag{1}$$

where $\Delta^a i_{t,t+j}$ denotes the anticipated movement in the fed funds rate in quarter $t + j$ with respect to the previous one and $\mathbb{E}_{t-1}(i_{t+j})$ represents the expected value of the Fed Funds rate for the period t+j conditional on the information available from the previous period. On the other hand, I define an unanticipated (surprise) movement as:

$$\Delta i^u_t = i_t - \mathbb{E}_{t-1} i_t \tag{2}$$

where $\Delta^u i_t$ denotes the unanticipated movement in the Fed Funds rate, which is defined as

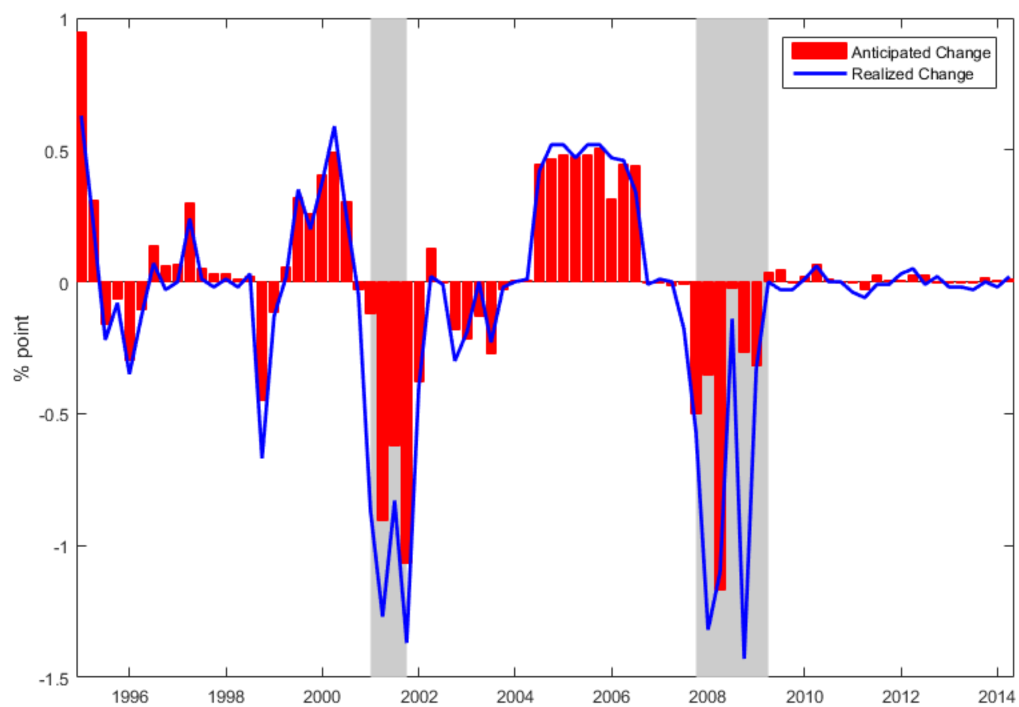
[2] See Owens and Webb (2001) and "Reference Guide: CBOT Fed Fund Futures" for a detailed description on how this market works. One potential source of concern is that the risk premia may drive a wedge between the price of Fed Funds future contracts and the expected rate. Sack (2004) documents the existence of a time varying risk premia in Fed Funds futures but its impact on prices is fairly limited, specially in short maturities. Moreover, the risk premia does not vary significantly across short-term maturities, like the ones used in this paper. Piazzesi and Swanson (2008) show that these excess returns are strongly countercyclical and can be predicted by macroeconomic indicators. In this paper, considering that I use the difference in the price of these contracts (not the level) and that there is no consensus on how to effectively remove the premium, I do not adjust future prices by risk premia. However, as I show in section 2.2, I purge the anticipated and unanticipated movements in the rate from expected and unexpected business cycle fluctuations. Moreover, as robustness exercise in section 3.5.4, I consider an specification that includes the VIX and U.S. GDP together with the interest rate shocks.

[3] For example, for the first quarter of 1995, I take the end of the day prices of January 3, which was the first active day of the quarter. I use the front, 2nd, and 3rd continous contracts to compute expectations about the current quarter interest rate. The 4th, 5th, and 6th and 7th, 8th, and 9th contracts are used, respectively, to compute expectations regarding the next 2 following quarters. Contracts longer than nine months ahead are significantly less liquid.

the difference between the realized rate and the one agents were expecting at the beginning of the quarter. Figure 1 displays the dynamics of the anticipated movement of the interest rate at the beginning of the quarter and the realized one.[4]

Markets tend to anticipate quite accurately the evolution of the Fed Funds rate in the incoming quarter. The contemporaneous correlation between the anticipated movement and the realized one is 0.89. Moreover, anticipated movements explain 80 percent of realized Fed Funds fluctuations. This fact reinforces the relevance of considering anticipation to assess the effects of interest rate shocks. As expected, unanticipated movements, which correspond to the difference between the line and the bars in Figure 1, occur mostly during recessions, when it is more difficult to predict the evolution of monetary policy.[5]

Figure 1: *Anticipated and realized changes in the Fed Funds Rate*



Note: Anticipated Change is computed as difference between market expectations regarding the value of the Fed Funds rate in the current quarter and the realized value of the previous quarter (i.e. $\Delta i_{t,t}$ as defined in equation (1)). The realized change denotes the change in the average Fed Funds rate with respect to the previous quarter. Shaded areas denote the recessions in the U.S defined by NBER.

[4]Note that $\Delta i_t = i_t - i_{t-1} = \Delta i^a_{t,0} + \Delta i^u_t$

[5]Appendix C displays the dynamics of the identified unanticipated U.S. interest rate shocks.

A crucial issue is to determine which is the horizon of anticipation of fluctuations in the Fed Funds rate. For this reason, I estimate the current changes in this rate on the expected change made at the beginning of the current quarter and on the previous three quarters. Table 1 displays the results.[6]

Table 1: *Horizon of forecastability of changes in the Fed Funds*

	Δi_t			
	$\Delta i^a_{t,t}$	$\Delta i^a_{t-1,t}$	$\Delta i^a_{t-2,t}$	$\Delta i^a_{t-3,t}$
Adj.R^2	0.80	0.31	0.11	0.01
F-Stat	308.1	33.8	9.4	0.1

Note: OLS estimates of the projection of Δi_t on the expected change in the interest rate ($\Delta i_{t,t+j}$), as defined in equation (1). Δi_t denotes the contemporaneous change in the Fed Funds rate. $\Delta i^a_{i,t+j}$ denotes the expected change in the interest rate for j quarters ahead with respect to the previous one, conditional on the information available at the beginning of time t. R^2 and $F - Stat$ correspond to the adjusted R-squared and the value of the F statistic, respectively.

The predictive power of forecasts about the change in the Fed Funds rate decline significantly with the horizon. While the contemporaneous and two periods ahead forecasts explain a significant fraction of the realized change, the one made three quarters ahead provides noisy information. Thus, in the empirical analysis, I consider two quarters ahead anticipation for changes in the U.S. interest rate.

2.2 Identifying U.S. Interest Rate Shocks

Some fluctuations of the U.S. interest rate are due to changes in business cycle conditions in the U.S. economy (i.e. they reflect the systematic response to other shocks that affect the U.S. economy). These changes in the interest rate cannot be considered an interest rate shock since they capture the systematic response of the FED to global demand or supply shocks. Thus, I purge anticipated and unanticipated changes in the U.S. interest rate from the ones that are due to expected and unexpected macroeconomic dynamics following a similar procedure to Romer and Romer (2004). In particular, I assume that the evolution of GDP, unemployment, and inflation are the key indicators

[6] In Table 1 I report only the Adj.R^2 and the F-Statistic because I focus on the power of the forecasts to explain the realized evolution of the interest rate.

that the FED is likely to consider when settling the policy. Then, I can identify anticipated and unanticipated shocks by estimating the following equations:[7]

$$\Delta i_t^u = \alpha_0 + \alpha_1 i_{t-1} + \alpha_2 \left(\hat{y}_t - \mathbb{E}_{t-1}\hat{y}_t\right) + \alpha_3 \left(\hat{u}_t - \mathbb{E}_{t-1}\hat{u}_t\right) + \alpha_4 \left(\hat{\pi}_t - \mathbb{E}_{t-1}\hat{\pi}_t\right) + \left(\epsilon_t - \mathbb{E}_{t-1}\epsilon_t\right) \quad (3)$$

$$\Delta i_{t,t+j}^a = \gamma_{0,j} + \gamma_{1,j}\mathbb{E}_{t-1}\left(i_{t+j-1}\right) + \gamma_{2,j}\mathbb{E}_{t-1}\left(\hat{y}_{t+j} - \hat{y}_{t+j-1}\right) + \gamma_{3,j}\mathbb{E}_{t-1}\left(\hat{u}_{t+j} - \hat{u}_{t+j-1}\right) +$$

$$\gamma_{4,j}\mathbb{E}_{t-1}\left(\hat{\pi}_{t+j} - \hat{\pi}_{t+j-1}\right) + \mathbb{E}_{t-1}\left(\epsilon_{t+j} - \epsilon_{t+j-1}\right) \qquad \forall j = \{0,1,2\} \quad (4)$$

Equation (3) decomposes the unanticipated change between unexpected movements in GDP growth ($\hat{y}_t$), unemployment ($\hat{u}_t$), inflation ($\hat{\pi}_t$), and the unanticipated interest rate shock ($s_t^u \equiv \epsilon_t - \mathbb{E}_{t-1}\epsilon_t = \epsilon_t$). Equation (4) expresses an anticipated change as a function of expected changes in the same macroeconomic variables for the different horizons ($j = \{0,1,2\}$) plus the anticipated interest rate shock ($s_{t,t+j}^a \equiv \mathbb{E}_{t-1}\left(\epsilon_{t+j} - \epsilon_{t+j-1}\right)$).[8]

Anticipated and unanticipated changes in the U.S. interest rate are computed using market's expectations. Thus, to estimate equations (3) and (4) with the same information set, I would like to consider private sector's expectations about the evolution of the main macroeconomic variables mentioned before. For this reason, I use the Survey of Professional Forecasters (SPF) data set, a quarterly survey of macroeconomic forecasts published by the Federal Reserve Bank of Philadelphia. This data set, which has been widely used in previous studies, contains forecasts by quarter up to one year ahead of the main macroeconomic variables in the U.S. conditional on the information available from the previous quarter.[9]

All equations are estimated by OLS and I identify the residuals of each of them, the last terms, as the unanticipated and anticipated U.S. interest rate shocks. One source of concern is the poten-

[7] Appendix B contains a detailed derivation of both expressions, assuming a simple Taylor rule.

[8] $E_{t-1}x_{t-1}$, where $x = \{\hat{\pi}, \hat{y}, \hat{u}\}$, denotes the expectations about the variable in the quarter that has just ended, conditional on the information available at that moment. Then, $E_{t-1}x_{t-1}$ may not coincide with the realized value of the variable.

[9] This data set asks to professional forecasters their expectations about the evolution of macroeconomic variables for the following quarters during the first month of the ongoing quarter. In order to use expectations that are aligned with the computation of expected interest rate, I employ the forecasts after the first release of macro data from the previous quarter. The main advantage of this data set is that it contains expectations for each variable and quarter up to one year ahead. For this exercise, I use expectations about GDP growth, Unemployment rate and GDP deflator inflation rate. See `https://www.philadelphiafed.org/research-and-data/real-time-center/survey-of-professional-forecasters/` for more detailed information about this survey.

tial feedback between expected changes in the rate and in macroeconomics dynamics. However, each equation contains macroeconomic forecasts for the same horizon. Considering that there is some lag in the effects of monetary policy, this makes it unlikely that the estimated coefficients are biased due to simultaneity.[10] Moreover, the objective of these regressions is to purge anticipated and unanticipated changes in the U.S. interest rate of movements due to expected changes in U.S. macroeconomic conditions. In this context, the identified series of shocks capture a variety of factors like perceived overreaction or underreaction and/or temporary shifts in the priorities of the FED.

This way of identifying anticipated and unanticipated shocks is conceptually different from the identified monetary policy surprises defined by Gürkaynak, Sack, and Swanson (2005). They identify two components of monetary policy: a "current Fed Funds rate target" and a "future path of policy", by extracting two factors that explain the variability of a set of Fed Funds futures for different maturities around FOMC meetings. However, their approach is not directly comparable to mine since they do not distinguish the exact timing of the policy path (i.e. in which particular month markets expect an increase in the interest rate). Considering the aim of this paper and that U.S. interest rate is exogenous for small open economies, I employ an alternative strategy. First, I do not focus on particular events, making my strategy more comparable to the VAR literature on monetary policy shocks (see Kuttner, 2001). In fact, markets may have already incorporated all the important information by the time of the FOMC meeting from speeches or other announcements. In this case, the surprise defined by Gürkaynak, Sack, and Swanson (2005) would be zero. However, this fact does not mean that there is no expected change in the monetary policy stance for emerging economies. Second, when aggregated to quarterly frequency, the series of Gürkaynak, Sack, and Swanson (2005) are autocorrelated and display non-zero mean, in line with the findings of Ramey (2016).[11] Thus, they are not not necessarily a good proxy for monetary policy shocks at quarterly frequency (see Ramey, 2016).

[10]The evidence about the lag in the effects of monetary policy in the U.S. is robust across different identification assumptions (see for example Romer and Romer, 2004).

[11]These findings hold for different aggregation procedures. The autocorrelation of second order of the aggregated surprises at quarterly frequency for the period 1995-2014 is 0.23 and statistically significant. Both the anticipated and unanticipated U.S interest rate shocks are well behaved.

2.3 Comparison with Series of Monetary Policy Shocks

Previous studies have used different empirical strategies to identify U.S. monetary policy shocks. The narrative series of Romer and Romer (2004), updated by Tenreyro and Thwaites (2016) (TT(2016)), is one of the most popular ones.[12] This series is defined as changes in the reference interest rate at FOMC meetings that are not endogenous reactions to fluctuations in the economy. In particular, Romer and Romer (2004) remove the discretionary policy changes that were responding to the fluctuations in macroeconomic variables within policy makers' information set. Table 2 displays the contemporaneous correlation between this series and the interest rate shocks I identified in the previous subsection.[13]

Table 2: *Correlation across different shocks*

Series	TT(2016)	s_t^u	$s_{t,t}^a$	$s_{t-1,t}^a$	$s_{t-2,t}^a$
s_t^u	0.51***				
$s_{t,t}^a$	0.69***	0.08			
$s_{t-1,t}^a$	0.50***	0.16	0.59***		
$s_{t-2,t}^a$	0.21	0.12	0.29***	0.55***	

*Note: Contemporaneous correlation between the different shocks and their significance levels. ***, **, and * denote 1%, 5% and 10% confidence level. TT(2016) denotes the monetary policy shocks series of Tenreyro and Thwaites (2016), who update the series of Romer and Romer (2004). $s_{i,j}^a$ denotes the anticipated U.S. interest rate shock for quarter j, conditional on the information available at the beginning of quarter i. s_j^u is the unanticipated U.S. interest rate shock in quarter j.*

The first fact that emerges is that the anticipated series about the current quarter is highly and significantly (0.69) correlated with TT(2016) series. Moreover, the correlation of TT(2016) is still positive and significant with respect to the anticipated series made one period in advance. Second, the unanticipated series is also positive correlated with TT(2016) series, which means that a fraction of TT(2016) can be considered unanticipated. Finally, an important fact for the analysis is that surprise and anticipated shocks are orthogonal.

The anticipated series are made at the beginning of each quarter, before the realization of

[12] The series can be downloaded from: https://www.aeaweb.org/articles?id=10.1257/mac.20150016.

[13] Appendix C displays the anticipated and unanticipated shocks together with the narrative series of monetary policy shocks. Similar results hold if I use the anticipated and unanticipated changes in the U.S. interest, without the orthogonalization proposed in Section 2.2.

TT(2016) series for the same quarter, and are orthogonal to unanticipated shocks.[14] These facts may help to disentangle the relationship between these series and TT(2016). In particular, I test whether the series identified in this paper contain useful information to predict the narrative ones. To test this hypothesis formally, I estimate the following equation:

$$\text{TT}_t = \alpha + \beta \text{Shock}_t + \epsilon_t$$

where Shock_t denotes the U.S. interest rate shocks from equations (3) and (4), the predictions about the evolution of the interest rate made at the beginning of this quarter and at the previous ones, and TT_t denotes the contemporaneous series of TT(2016).[15] The shocks proposed in this paper contain useful information to predict the other series if the β is statistically significant. Table 3 displays the results of these regressions:

Table 3: *Predictive power of anticipated shocks*

	TT(2016)	TT(2016)	TT(2016)	TT(2016)
$s^a_{t,t}$	0.73***			0.55***
	(0.11)			(0.15)
$s^a_{t-1,t}$		0.53***		0.32*
		(0.13)		(0.18)
$s^a_{t-2,t}$			0.40	-0.13
			(0.27)	(0.25)
Adj.R^2	0.47	0.24	0.02	0.42
F-Stat	45.74***	16.54***	2.23	12.96***
Obs	52	51	50	50

*Note: OLS regressions between the different shocks. ***, **, and * denote significance at the 1%, 5%, and 10%, respectively. TT(2016) denotes the monetary policy shocks series of Tenreyro and Thwaites (2016), who update the series of Romer and Romer (2004). $s^a_{i,j}$ denotes the anticipated U.S. interest rate shock for quarter j as defined in equation (4), conditional on the information available at the beginning of time i.Adj.R^2 and F-Stat correspond to the adjusted R-squared and the value of the F statistic.*

The current quarter and the one quarter ahead anticipated interest rate shocks contain useful

[14] The narrative series of monetary policy shocks of TT(2016) are computed for each FOMC meeting, which takes place after the first day of each quarter.

[15] Results are robust if I add lags of TT(2016) series to the regression.

information to predict TT(2016) series.[16] In particular, anticipated shocks explain up to 47 percent of the observed fluctuations in TT(2016) shocks. In line with the results of Table 1, the closer to the quarter, the more precise is the forecast.

Given these results, including only the current value of any of these shocks or the narrative series may not be enough to describe the dynamic response of macroeconomic variables. Since markets forecast quite accurately the changes in the U.S. interest rate, emerging economies could start reacting to these shocks even before the change materializes. This fact should be reflected immediately in high frequency variables and may also affect contemporaneous macroeconomic variables.

3 Empirical Analysis

This section presents the estimated macroeconomic effects of news (anticipated) and surprise (unanticipated) U.S. interest rate shocks, identified in the previous section, on emerging economies. First, I specify the empirical model used to assess the effects of both types of shocks on emerging economies. Then, I describe the estimation method and the data set. Finally, I present the Impulse Response Functions (IRFs) and Forecast Error Variance decomposition (FEV) of the main macroeconomic variables of emerging economies to both types of shocks.

3.1 Empirical Model

The empirical model is a VAR system that includes both anticipated and unanticipated interest rate shocks identified in Section 2.2 in an exogenous block:

$$X_t = B + C(L)X_{t-1} + D(L)s_t^u + E(L)s_{t,t}^a + Fs_{t,t+1}^a + Gs_{t,t+2}^a + \epsilon_t \quad (5)$$

where X_t is a vector of endogenous variables, $C(L), D(L), E(L)$ denote P-order lag polynomials, and s_t^u and $s_{t,t+j}^a$ are the surprise and anticipated interest rate shocks, respectively. Following the results of Table 1, I consider only two quarters as the anticipation horizon for U.S. interest rate

[16]The regressions have less observations because the TT(2016) series finishes in December 2007.

shocks. Finally, ϵ_t is a white noise vector of disturbances. This system is similar to the one proposed by Mertens and Ravn (2012) to study the effects of anticipated and unanticipated tax shocks in the U.S. In order to allow for persistence in the changes in U.S. interest rate, the system includes lags of both shocks (i.e. $s^a_{t,t}$ and s^u_t).[17]

In the baseline specification, X_t is a set of variables necessary to capture both the macroeconomic effects (both on economic activity and inflation) and the transmission channels (financial and trade channels). In particular, X_t consists of foreign (exogenous) and domestic variables. The foreign variables are the country-specific terms of trade index, defined as the ratio between the export and import price indexes, and the U.S. corporate bond (BAA) spread. The corporate spread, which is defined as the difference between Moody's BAA corporate yield and the Federal Funds rate, constitutes a good indicator of global financial conditions for emerging economies (Akinci, 2013). The domestic macroeconomic variables consists of seven indicators: external bank credit to financial and non-financial firms, output, investment, trade balance to GDP ratio, the nominal exchange rate, the consumer price index, and the country interest rate. The country interest rate is defined as the ten year U.S. government bond yield plus the country spread, proxied by the JP Morgan EMBI Global Index. External credit, output, and investment are expressed in real terms and in log deviations from a linear trend. CPI is expressed as log deviations from a linear trend. Terms of trade and nominal exchange rate are included as log deviations with respect to the mean. BAA corporate yield, trade balance to GDP ratio, and country interest rate are expressed in percentage points. Details of all the series used are available in Appendix A.

This specification is in line with small open economy models and with previous empirical studies that consider changes in U.S. interest rate as exogenous for emerging economies. One of its main advantages is that the effects of these shocks do not rely on the ordering of the variables. In particular, there is no need to impose zero or sign restrictions on the reaction of domestic variables to changes in U.S. interest rate, nor to identify the other shocks in the system.

[17] In the baseline specification, I include one lag of each shock. However, results are robust to not including any lags or allowing for more lags.

3.2 Estimation Method

I estimate the VAR presented in (5) by pooling quarterly data from Argentina, Brazil, Chile, Mexico, Philippines, South Africa, and Turkey. The sample begins in the first quarter of 1995, when the FED explicitly started to announce its target level for the Fed Funds rate, and ends in the second quarter of 2014.[18] The choice of countries is guided by macroeconomic and financial data availability to construct a representative sample of emerging economies, similar to the ones used by Uribe and Yue (2006) and Akinci (2013). I estimate the system with quarterly data in order to capture more precisely the transmission channels and the macroeconomic effects. Precise definitions of the variables and data sources are included in Appendix A.

The system is estimated using the Least Square Dummy Variable (LSDV) estimator or fixed effects estimator, which has been widely used to estimate Panel VARs with a large time series dimension. As this dimension is significantly larger than the cross-sectional one, the LSDV is preferred to GMM as it has better finite sample properties. Nickell (1981) shows that a potential concern with the Panel VAR is the inconsistency of the least squares parameter estimates due to the combination of fixed effects and lagged independent variables. However, because the time series dimension of the dataset is large (78 observations), the inconsistency problem is likely not to be a major concern.

The estimation procedure imposes that $C(L), D(L), E(L), F$ and G are the same across countries. This assumption seems appropriate since estimations using different country groups yield similar results for news and surprise shocks.[19] Considering the information criteria, I estimate a VAR with 2 lags.[20]

[18]The sample for each country depends on data availability. Prior to 1995 there is no availability of continuous series of future contracts for nine months ahead. Appendix A contains a detailed description of the sample used for each country.

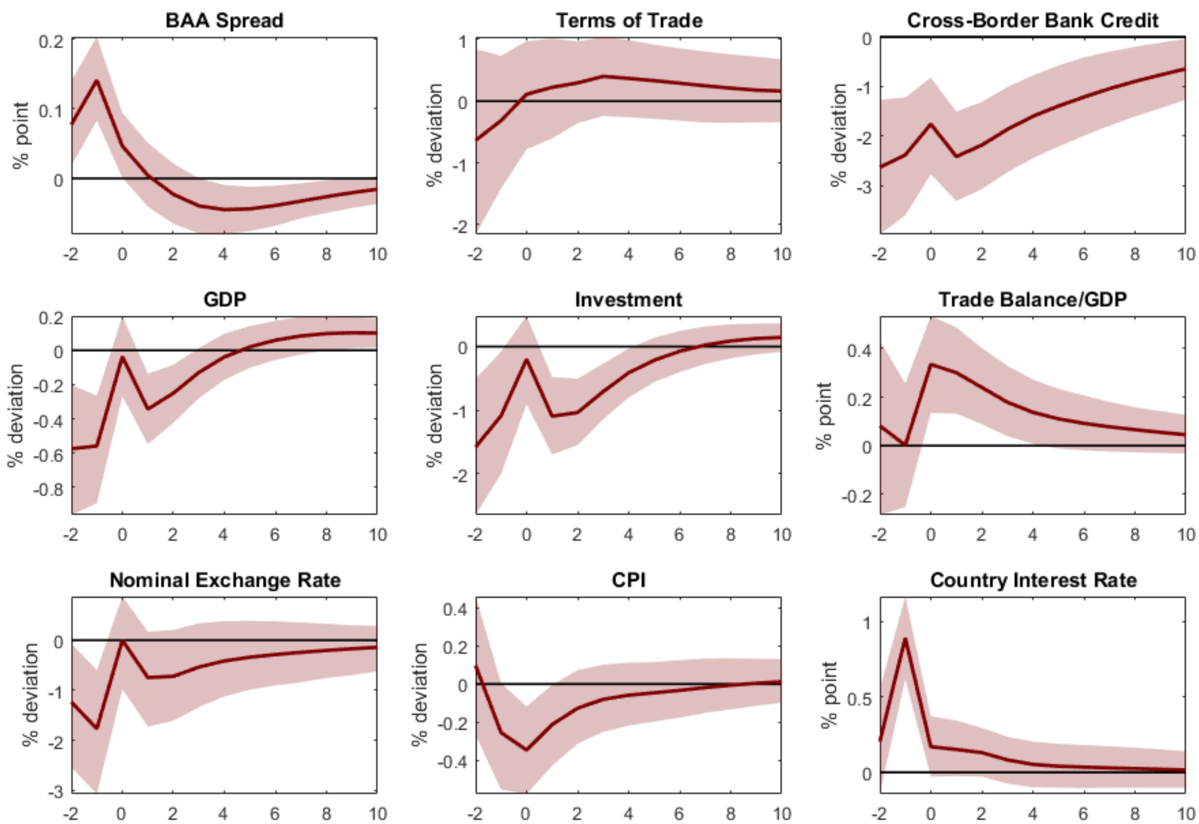
[19]To test that the results are not driven by outliers, I have estimated the system dropping one country at the time. Results, presented in the Online Appendix, are robust and no particular country seems to be affecting the results.

[20]The Akaike Information Criterion (AIC) chooses 2 lags while the Bayesian Information Criterion (BIC) and the Hannan-Quinn (HQ) choose 1 lag. Reduced form residuals are not autocorrelated with the two lags specification but not including only one lag. Results are robust to a specification that includes 4 lags.

3.3 Impulse Responses

In this subsection, I present the macroeconomic responses of emerging economies to the anticipated and surprise shocks identified in Section 2.2. Figure 2 displays the reaction of macroeconomic variables to a two quarters ahead anticipated 25 basis points (one standard deviation) contractionary U.S. interest rate shock.

Figure 2: *IRFs to a 2 quarters ahead anticipated 25bp contractionary U.S. interest rate shock*



Note: Solid lines denote point estimates of impulse responses from the VAR system (5); 90% confidence bands are depicted with light-red shaded areas. The responses of cross-border bank credit, GDP, investment, and CPI are expressed in % deviations from their respective linear trend. The responses of terms of trade and nominal exchange rate are expressed in % deviations. BAA corporate spread, trade balance to GDP ratio, and country interest rate are expressed in annualized % points. $t = 0$ *denotes the period when the U.S. interest rate increases. The previous two periods show the adjustment of the variables before the change in the U.S. materializes (i.e.* $s^a_{t-2,t} = 0.25$, $s^a_{t-1,t} = 0.25$ *and* $s^a_{t,t} = 0.25$*). Confidence bands are computed through 1,000 bootstrap replications. Horizon is in quarters.*

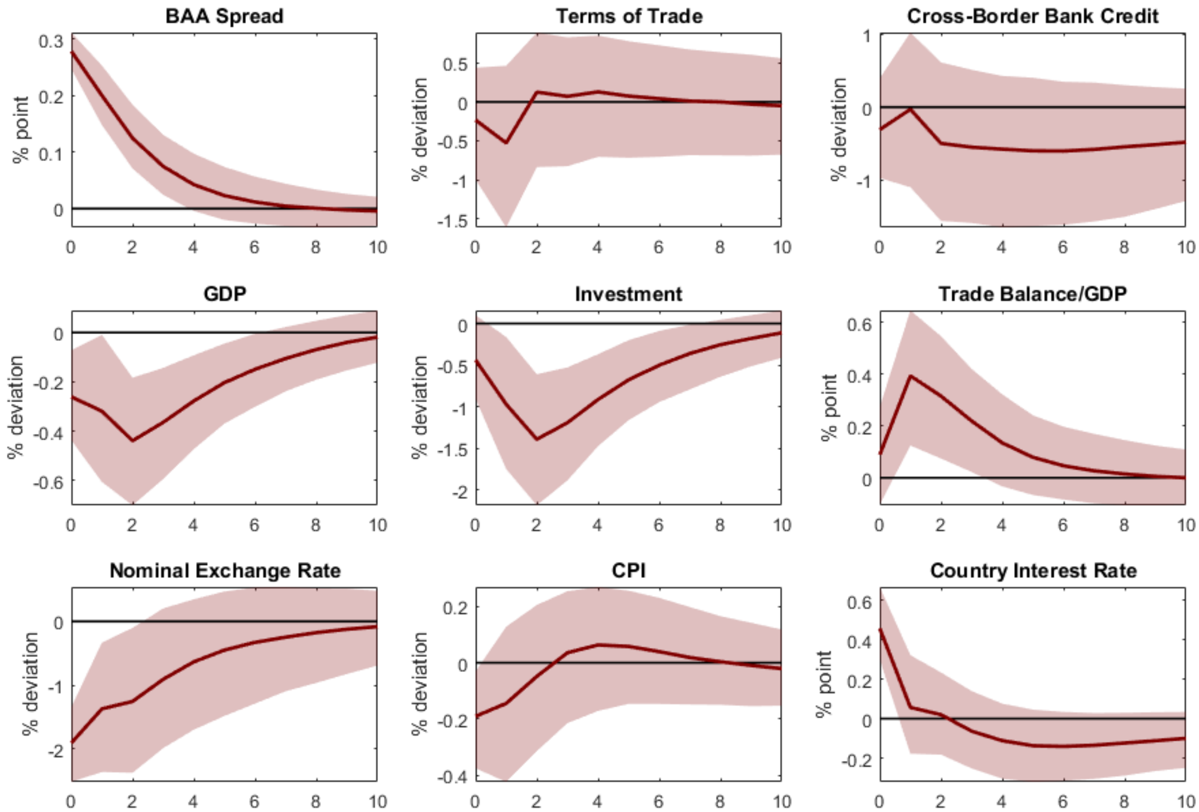
The anticipated contractionary shock induces an immediate contraction of GDP and investment of approximately 0.5 percent and 1.5 percent, respectively, from their linear trends. These results are partially explained by the immediate reduction in the cross-border bank credit and the depreciation of the nominal exchange rate. The country interest rate also increases and reaches its peak one quarter after the shock, which means that the country spread raises before the change in the international interest rate materializes at $t = 0$.[21] An important fact to highlight is that most of the adjustment of these variables occurs within the first two quarters. The trade balance to GDP ratio improves only when the change in the international interest rate materializes and could also be explained by the previous 1.5 percent depreciation of the nominal exchange rate. Finally, the contractionary effect does not have any significant effect on terms of trade but reduces significantly the consumer price index. From this analysis, the financial channel, via cross-border bank credit and the country interest rate, is important to understand the adjustment of macroeconomic variables.

Macroeconomic variables display similar dynamics than in case of a Sudden Stop (Calvo, 1998). This phenomenon is characterized by a sudden slow down in private capital inflows that is followed by a sharp decrease in GDP and investment, a real exchange rate depreciation, and an improvement in the current account. Although I do not consider capital inflows in my analysis, the fast decline and recovery of macroeconomic variables and the cross-border bank credit dynamics are consistent with the findings of this literature. In particular, anticipated movements in the interest rate may trigger Sudden Stops. Figure 3 displays the IRFs to an unanticipated 25 basis points (one standard deviation) contractionary U.S. interest rate shock.

In this case, the reaction is also immediate and reaches its minimum two quarters after the shock. For most of the variables the adjustment is quantitatively similar to the anticipated shock. In this case the shock has a slightly more persistent effect on GDP and investment, taking around six quarters to converge to their trends. The persistence might be induced by the stronger depreciation of the exchange rate. Unlike the findings of Uribe and Yue (2006) and Akinci (2013), country interest rate does not display a delayed reaction to the unanticipated shock. This fact, which coincides with the findings of Canova (2005) and Mackowiak (2007), is consistent with the idea that financial variables react on impact to the new flow of information. Finally, as in the previous case, terms of trade do not react significantly to changes in the U.S interest rate. The lack of significant

[21] The country spread is the difference between the domestic and the U.S. interest rate for the same maturity.

Figure 3: *IRFs to an unanticipated 25bp contractionary U.S. interest rate shock*



Note: Solid lines denote point estimates of impulse responses from the VAR system (5); 90% confidence bands are depicted with light-red shaded areas. The responses of cross-border bank credit, GDP, investment, and CPI are expressed in % deviations from their respective linear trend. The responses of terms of trade and nominal exchange rate are expressed in % deviations. BAA corporate spread, trade balance to GDP ratio, and country interest rate are expressed in annualized % points. Confidence bands are computed through 1,000 bootstrap replications. Horizon is in quarters.

response, which may be surprising given that most of these countries are commodity exporters and commodity prices are sensible to U.S. monetary policy (Frankel, 2006), could be due to the lack of adjustment of manufacturing prices. Overall, the financial channel, through the country interest rate and the cross-border bank flows, is important for the transmission of both types of interest rate shocks, confirming the findings of Canova (2005).

3.4 Forecast Error Variance Decomposition

Table 4 displays the contribution of both shocks in explaining the FEV of the macroeconomic variables included in the VAR. Results obtained in the baseline specification (Base) are robust to ex-

Table 4: *Share of FEV explained by U.S interest rate shocks*

Specification	Shock	BAA	TOT	Credit	GDP	I	TB	NEER	CPI	R
Base	Ant	10.0	1.0	19.1	10.8	9.1	4.9	4.6	3.4	11.9
	Surp	42.3	0.3	1.1	8.1	8.4	5.2	6.5	0.7	3.9
	Total	52.4	1.3	20.2	18.9	17.5	10.1	11.1	4.1	15.8
Base (noBAA)	Ant	–	0.5	13.4	7.9	6.7	4.3	3.3	3.1	10.7
	Surp	–	0.2	3.6	11.5	12.0	7.1	8.9	1.3	2.5
	Total	–	0.7	17.0	19.3	18.7	11.4	12.2	4.4	13.2

Note: Estimated contribution of the Anticipated (Ant) and Unanticipated (Surp) U.S. interest rate shocks to explain the two year variation in the variables included in the baseline VAR (Base) and the baseline specification without including the BAA Spread (Base (noBAA)). Shares are expressed in percent. Column variables are: BAA corporate spread (BAA), terms of trade (TOT), cross-border bank credit (Credit), output (GDP), investment (I), trade balance to GDP ratio (TB), nominal exchange rate (NEER), consumer price index (CPI), and the country interest rate (R).

cluding the BAA corporate spread from the system (Base (noBAA)). Unanticipated U.S. interest rate shocks explain 8 percent of the variation in output, consistent with the findings of Mackowiak (2007) and Akinci (2013). However, accounting for anticipated shocks increases the contribution of U.S. interest rate to 19 percent. While anticipated shocks are particularly important to explain fluctuations in external credit and country interest rate, unanticipated shocks explain a significant fraction of the variation in the BAA spread. Thus, accounting for anticipation is important for measuring the importance of U.S. interest rate shocks as a source of business cycle fluctuations in emerging economies.

3.5 Alternative Empirical Specifications

Both anticipated and unanticipated contractionary U.S. interest rate shocks induce a contraction of economic activity in emerging economies. This fact could be due to the specific measure of external credit to emerging economies, the unconventional monetary policies during the crisis of 2008, the definition of the U.S. interest rate shock, the indicator of global financial conditions, global changes in economic activity that affect the U.S. interest rate, exchange rate regime, and/or the particular set of countries considered in the analysis. In this section, I show that the main findings of the previous section are not due to these reasons. For ease of exposition, I only present the

FEV of all the variables to anticipated and unanticipated U.S. interest rate shocks for the rest of the specifications in Table 5, leaving the impulse responses for the Online Appendix.

3.5.1 Alternative Measures of External Credit

Caballero, Fernández, and Park (2016) and Chang, Fernández, and Gulan (2017) document that the stock of corporate debt in emerging economies has almost quadrupled between 2000 and 2014, explained mainly by bond issuance denominated in U.S. dollars during the post-crisis period. The relative importance of bonds with respect to loans as a source of financing has increased in this period, accompanied by a drop in interest rates faced by these economies. Thus, according to Caballero, Fernández, and Park (2016) and Chang, Fernández, and Gulan (2017), the stock of cross-border bank credit has become less representative as a source of financing for emerging economies. In order to examine the robustness of the external credit response, I estimate the baseline VAR of Section 3.3 including the net equity inflows to emerging economies as a share of total equity as a proxy for external credit.[22] The first three rows of Table 5 show the FEV share of all variables in this specification due to anticipated and unanticipated U.S. interest rate shocks, respectively. Equity inflows as a share of total equity decline on impact in response to both shocks. In line with the findings of Rey (2013) and Miranda-Agrippino and Rey (2015), the U.S interest rate shocks are an important driver of capital flows to emerging economies: anticipated and unanticipated shocks explain 32 and 16 of total variability of capital flows, respectively. The FEV shares and the IRFs of the other variables remain unchanged.

3.5.2 Pre-Crisis Sample

Since 2008, the Federal Reserve has implemented unconventional monetary policies to boost the economy, which could represent a break in the transmission of monetary policy and could be behind previous findings. In order to examine whether previous results are sensitive to the inclusion of the ZLB period, I estimate the baseline VAR of Section 3.3 but restricting the period of analysis up to 2007:Q4, before reaching the ZLB. The fourth and fifth rows of Table 5 show the FEV share of

[22] The series of equity flows comes from Emerging Portfolio Fund Research and starts in 1996:2 for most of the countries in the analysis. Appendix A contains a detailed description of this variable.

all the variables due to anticipated and unanticipated U.S. interest rates shocks, respectively. The FEV share of each variable due to each shock is comparable to the baseline VAR.[23]

3.5.3 Definition of the U.S. Interest Rate Shock

In Section 2.2, I have orthogonalized anticipated and unanticipated movements in the U.S. interest rate from market's expectations to control for policy reactions due to business cycle conditions. However, any movement in the U.S. interest rate, as defined in Section 2.1, can be considered exogenous for a small open economy since what happens in each of these countries does not affect the international interest rate. To examine whether movements in the U.S. interest rate have the same impact as U.S. interest rate shocks, I estimate the VAR including the anticipated and unanticipated changes in the interest rate (i.e. Δi_t^u and $\Delta i_{t,t+j}^a$), as defined in Section 2.1, instead of the interest rate shock series, as defined in 2.2. The seventh and eight rows of Table 5 show the FEV share of all the variables using this alternative definition of anticipated and unanticipated U.S. interest rate shocks, respectively. Results are slightly stronger for the anticipated movement and weaker for the surprise one. Overall, responses are comparable to the ones using the U.S. interest rate shocks.

3.5.4 Global Financial Conditions and Global Shocks

In the baseline specification, following Akinci (2013), I include the BAA corporate spread as a proxy for global financial conditions. However, results could be driven by aggregate shocks to global activity and/or changes in global volatility, not captured by the BAA corporate spread. Miranda-Agrippino and Rey (2015) show that credit flows are largely driven by a global factor, which can be related to U.S. monetary conditions and changes in risk aversion and uncertainty. To assess these hypotheses, I include World GDP in the exogenous block of the VAR and the CBOE Volatility Index (VIX), as a proxy for global financial risk (see Rey, 2013), instead of the BAA corporate spread.[24]

[23]The IRFs, presented in the Online Appendix, are also similar to the baseline ones. For the case of the anticipated U.S. interest rate shock, GDP increases slightly when the shock hits the economy, in line with the findings of Ilzetzki and Jin (2013) for this period. This reaction could be explained by the lack of response of the nominal exchange rate and the less persistent reaction of cross-border bank credit. Thus, missing the anticipation effects in this case distorts the assessment of the effects of these shocks. Similar to the full sample, most of the adjustment occurs before the change in the U.S. interest rate materializes.

[24]For World GDP I use the growth rate of world GDP computed by the IMF.

Table 5: *Share of FEV explained by U.S interest rate shocks - Alternative specifications*

Specification	Shock	BAA	TOT	Credit	GDP	I	TB	NEER	CPI	R	Eq Inf
Eq. Inflow	Ant	12.3	1.5	—	7.4	4.4	1.9	6.4	7.8	15.6	31.9
	Surp	54.4	1.3	—	13.7	15.0	3.1	11.6	3.5	9.4	16.1
	Total	66.7	2.8	—	21.2	19.3	4.9	18.0	11.3	25.0	48.0
Pre-ZLB	Ant	51.1	1.1	18.8	8.5	6.3	1.8	1.0	2.5	10.9	—
	Surp	3.0	1.7	8.7	4.8	12.1	3.5	3.3	2.8	13.4	—
	Total	54.1	2.8	27.5	13.3	18.4	5.3	4.2	5.4	24.3	—
Alt.Shock	Ant	17.7	1.1	24.9	24.5	17.3	5.1	8.3	5.7	17.7	—
	Surp	37.1	1.8	0.4	7.4	4.1	4.6	4.9	1.8	4.4	—
	Total	54.8	2.8	25.2	31.9	21.4	9.7	13.2	7.5	22.0	—
VIX	Ant	—	0.8	13.6	7.8	6.5	4.0	3.2	3.0	10.8	—
	Surp	—	0.3	4.2	7.9	8.4	3.7	10.6	1.5	2.5	—
	Total	—	1.1	17.8	15.6	14.9	7.7	13.8	4.5	13.3	—
WGDP	Ant	9.1	0.8	17.7	10.4	8.8	4.3	4.6	4.4	10.0	—
	Surp	43.2	0.8	0.2	4.3	5.5	3.6	4.3	1.6	6.0	—
	Total	52.3	1.6	17.9	14.7	14.3	7.9	8.9	6.0	16.0	—
Ext.Sample	Ant	17.1	0.8	4.1	7.3	3.6	1.0	2.2	2.7	3.4	—
	Surp	43.3	0.4	0.2	4.7	2.2	1.8	2.9	0.6	5.5	—
	Total	60.3	1.2	4.4	11.9	5.8	2.8	5.1	3.3	9.0	—
Fixed FX	Ant	19.6	0.6	10.5	10.1	7.7	3.3	3.1	3.0	11.1	—
	Surp	35.5	3.0	5.6	3.9	2.8	0.3	0.8	0.7	27.2	—
	Total	55.1	3.6	16.1	14.0	10.5	3.6	4.0	3.7	38.3	—

Note: Estimated contribution of the Anticipated (Ant) and Unanticipated (Surp) U.S. interest rate shocks to explain the two year variation in the variables included in the different specifications of the VAR. Shares are expressed in percent. Column variables are: BAA corporate spread (BAA), terms of trade (TOT), cross-border bank credit (Credit), output (GDP), investment (I), trade balance to GDP ratio (TB), nominal exchange rate (NEER), consumer price index (CPI), the country interest rate (R), and equity inflows as a share of total equity (Eq Inf). Rows denote the following VAR specifications: estimated using equity inflows as a proxy for capital flows (Eq. Inflow, see section 3.5.1), estimated with pre-ZLB sample (Pre-ZLB, see section 3.5.2), using the anticipated and unanticipated changes in the U.S interest rate instead of the shocks (Alt.Shock, see section 3.5.3), including the VIX instead of the BAA corporate spread as a proxy for global financial conditions (VIX, see section 3.5.4), including World GDP growth rate in the exogenous block of the VAR (WGDP, see section 3.5.4), using an extended sample of emerging economies (Ext.Sample, see section 3.5.5), and considering only countries with fixed exchange rate regime (Fixed FX, see section 3.5.6).

Rows ten to fifteen of Table 5 display the FEV share of macroeconomic variables to both types of shocks for these specifications. FEV shares are comparable for all the variables and for both shocks.

3.5.5 Extended Sample of Emerging Economies

Results could also be driven by the particular sample of countries. To entertain this hypothesis, I estimate the same VAR but extending the sample to other emerging economies that are part of the JP Morgan EMBI Global index. In particular, I add the following countries to the previous sample: Bulgaria, Colombia, Ecuador, Hungary, Republic of Korea, Malaysia, Peru, and Thailand.[25] The sixteenth and seventeenth rows of Table 5 display the FEV shares to both types of shocks. Although the FEV shares for most of the variables to an anticipated and unanticipated shocks are slightly lower, the IRFs are comparable both quantitatively and qualitatively to the baseline ones. In particular, both shocks are less important as drivers of cross-border bank credit, investment and trade balance to GDP ratio. This can be due to the fact the sample considers more heterogeneous emerging economies, with different degrees of financial market integration and exposure to U.S. dollar fluctuations.

3.5.6 Exchange Rate Regime

The response of emerging economies to anticipated and unanticipated U.S. interest rate shocks could depend on their exchange rate regime. To test this hypothesis, I estimate the baseline VAR for a subsample of countries with fixed exchange rate regimes. Following the classification developed by Ilzetzki, Reinhart, and Rogoff (2010), I consider fixed exchange rate regimes countries classified as "Pre-Announced Peg" or "Crawling Peg +/- 2%" in the Coarse Classification.[26] The nineteenth and twentieth rows in Table 5 display the FEV share to both types of shocks for this sample of countries. As expected, neither of the shocks is a significant driver of exchange rate fluctuations. However, the FEV shares of the remaining variables are similar to the baseline ones. Most variables respond to the unanticipated shock less significantly, partially due to the reduced

[25]The period of the sample remains 1995:1-2014:2. As in the previous case, the periods for each country differ according to JP Morgan EMBI Global index availability.

[26]The sample consists of 194 observations: Argentina 1995:Q1-2001:Q4, Brazil 1996:Q1-1998:Q4, Ecuador 2000:Q1-2013:Q4, Peru 1997:Q1-2014:Q2, Philippines 2001:Q1-2006:Q4.

number of observations. The stronger reaction of the country interest rate to the unanticipated shock suggests that markets perceive more risk in these economies relative to the ones with flexible exchange rate regime. Overall, the results show that the responses of emerging economies do not depend qualitatively on their exchange rate regime, confirming the findings of Canova (2005) and Dedola, Rivolta, and Stracca (2017).

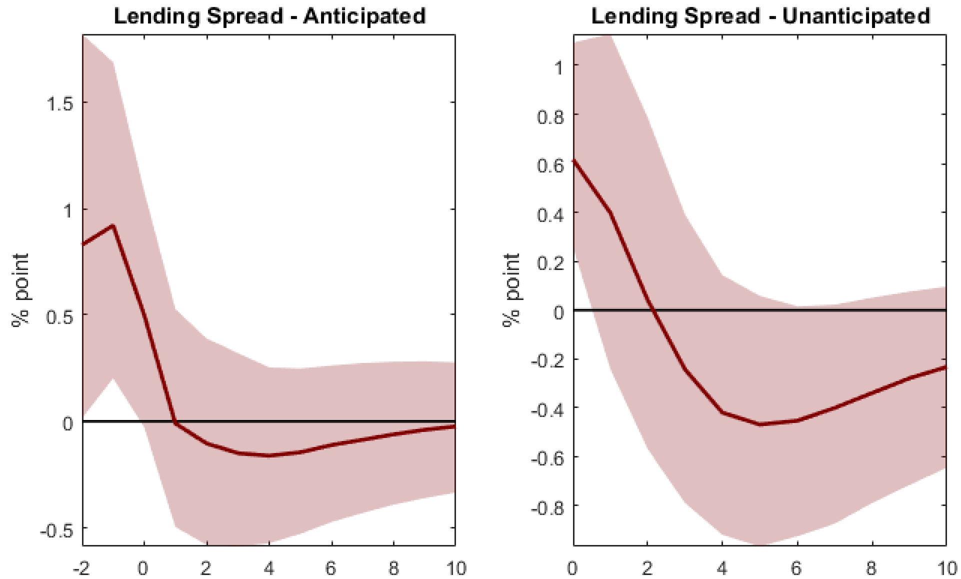
4 Transmission Through the Domestic Credit Market

Some of the economies included in the sample are less exposed to cross-border financial credit and, specially in these cases, the domestic banking channel may be important to understand the response of emerging economies to both shocks. In particular, the link between sovereign spread and the borrowing-lending spreads, proxies for the country and banking risk respectively, might act as an amplification mechanism of U.S. interest rate shocks (Akinci, 2013). In order to analyze the transmission through domestic banks, I augment the baseline VAR (equation 5) with the borrowing-lending spread. Following Akinci (2013), the banking sector borrowing-lending spread is defined as the difference between the domestic lending rate to the corporate sector and the deposit interest rate. Figure 4 displays the IRFs of this variable to anticipated and unanticipated contractionary U.S. interest rate shocks.[27]

The borrowing-lending spread increases in response to an anticipated and unanticipated contractionary U.S. interest rate shocks. While the dynamics are similar to the ones of the country spread, the magnitudes are slightly bigger. This finding confirms that the banking sector, both through external and domestic credit, is important to understand the transmission of both shocks since it amplifies the effects on domestic macroeconomic variables. Moreover, the fast response of the borrowing-lending spread helps to understand the sharp and fast decline on impact of domestic macroeconomic variables to both anticipated and unanticipated contractionary U.S. interest rate shocks.

[27]The responses of the remaining variables remain unchanged. For ease of exposition, the IRFs to the remaining variables are presented in the Online Appendix. Appendix A contains a detailed description of how this variable is computed.

Figure 4: IRF domestic credit market to 25bp anticipated and unanticipated U.S. interest rate shocks



Note: Solid lines denote point estimates of impulse responses from the VAR system (5) including the bank lending spread as an additional variable in the baseline VAR; 90% confidence bands are depicted with light-red shaded areas. The responses of bank lending spread are expressed in % points. Confidence bands are computed through 1,000 bootstrap replications. Horizon is in quarters.

5 Conclusions

This paper has explored the role of anticipation in assessing the effects of U.S. interest rate shocks on emerging economics. Anticipation accounts for 80 percent of the effective quarterly fluctuations in the Fed Funds and 47 percent of the narrative series of monetary policy shocks. Three major conclusions can be derived from the analysis. First, monetary news induce an immediate response of macroeconomic variables, even before the change in the U.S. interest rate materializes. In particular, an anticipated 25 basis points increase in the U.S. Fed Funds rate generates an immediate 0.5 percent decrease in GDP and 1.3 percent fall in investment from their trends. Second, unanticipated contractionary U.S. interest rate shocks induce a comparable contraction of economic activity to anticipated ones but after the actual change in the rate. Finally, the cross-border bank credit, the country interest rate, and the borrowing-lending spread are important for the transmission of both shocks while terms of trade do not display a statistically significant reaction. Overall, anticipated and unanticipated U.S. interest rate shocks explain 19 percent of output fluctuation in emerging economies.

Results show that anticipation is crucial for assessing the effects of U.S. interest rate shocks, since a significant part of the adjustment in emerging economies occurs before a change in the interest rate occurs. These findings help in understanding the adjustment of these economies to the current FED's liftoff. From a policy perspective, movements in the international interest rate pose a significant trade-off to emerging economies. On the one hand, they induce pressures to tight monetary policy in order to avoid large currency depreciations that may affect the banking sector. On the other hand, they create incentives to lower the interest rate to boost economic activity. Aoki, Benigno, and Kiyotaki (2016) show that macroprudential policies are complementary to an inflation targeting regime to enhance welfare but that inflation targeting alone can reduce welfare. However, their theoretical framework considers only a one production sector subject to sticky prices, disregards the anticipation effects of interest rate shocks, and does not include the country spread in the analysis. Thus, it would be interesting to study optimal policy in this framework considering a policy rule that reacts not only to inflation and real exchange rate but potentially also to expected and current foreign interest rate. This topic constitutes a promising opportunity for future research.

References

Akinci, O. (2013): "Global Financial Conditions, Country Spreads and Macroeconomic Fluctuations in Emerging Economies," *Journal of Internacional Economics*, 91(2), 358–371.

Aoki, K., G. Benigno, and N. Kiyotaki (2016): "Monetary and Financial Policies in Emerging Markets," Unpublished Manuscript.

Beaudry, P., and F. Portier (2006): "Stock Prices, News, and Economic Fluctuations," *American Economic Review*, 96(4), 1293–1307.

Ben Zeev, N., C. Gunn, and H. Kahn (2016): "Monetary News Shocks," Carleton Economic Papers.

Ben Zeev, N., E. Pappa, and A. Vicondoa (2017): "Emerging Economies Business Cycles: The Role of Terms of Trade Revisited," *Journal of International Economics*, 108, 368–376.

Caballero, J., A. Fernández, and J. Park (2016): "On Corporate Borrowing, Credit Spreads and Economic Activity in Emerging Economies: An Empirical Investigation," IDB Working Paper IDB-WP-719.

Calvo, G. (1998): "Capital Flows and Capital-Market Crisis: The Simple Economics of Sudden Stops," *Journal of Applied Economics*, 1(1), 35–54.

Calvo, G., A. Izquierdo, and E. Talvi (2006): "Sudden Stops and Phoenix Miracles in Emerging Economies," *American Economic Review*, 96(2), 405–410.

Canova, F. (2005): "The Transmission of U.S. Shocks to Latin America," *Journal of Applied Econometrics*, 20, 229–251.

Chang, R., A. Fernández, and A. Gulan (2017): "Bond Finance, Bank Credit, and Aggregate Fluctuations in an Open Economy," forthcoming *Journal of Monetary Economics*.

Chari, V. V., P. Kehoe, and E. McGrattan (2005): "Sudden Stops and Output Drops," *American Economic Review*, 95(2), 381–387.

Cochrane, J., and M. Piazzesi (2002): "The Fed and Interest Rates - A High-Frequency Identification," *AEA Papers and Proceedings*, 92(2), 90–95.

Dedola, L., G. Rivolta, and L. Stracca (2017): "If the FED Sneezes, Who Catches a Cold?," *Journal of International Economics*, 108(S1), S23–S41.

Frankel, J. A. (2006): "The Effects of Monetary Policy on Real Commodity Prices," NBER Working Paper No. 12713.

Georgiadis, G. (2016): "Determinants of Global Spillovers from US Monetary Policy," *Journal of International Money and Finance*, 67, 41–61.

Gomes, S., N. Iskrev, and C. Mendicino (2013): "Monetary Policy Shocks: We Got News!," Bank of Portugal WP 07/2013.

Gürkaynak, R., B. Sack, and E. Swanson (2005): "Do Actions Speak Louder than Words? The Response of Asset Prices to Monetary Policy Actions and Statements," *International Journal of Central Banking*, 1(1), 55–93.

Hamilton, J. (2009): "Daily Changes in Fed Funds Futures Prices," *Journal of Money, Credit, and Banking*, 41(4), 567–582.

Hansen, L., and T. Sargent (1991): "Rational Expectations Econometrics," in *Rational Expectations Econometrics*. Boulder and Oxford: Westview Press.

Ilzetzki, E., and K. Jin (2013): "The Puzzling Change in the Transmission of U.S. Macroeconomic Policy Shocks," LSE Working Papers.

Ilzetzki, E., C. Reinhart, and K. Rogoff (2010): "Exchange Rate Arrangements Entering the 21st Century: Which Anchor Will Hold?," Unpublished Manuscript.

Kehoe, T., and K. Ruhl (2009): "Sudden Stops, Sectoral Reallocations, and the Real Exchange Rate," *Journal of Development Economics*, 89(2), 235–249.

Kuttner, K. (2001): "Monetary Policy Surprises and Interest Rates: Evidence from the Fed Funds Future Market," *Journal of Monetary Economics*, 47(3), 523–44.

Mackowiak, B. (2007): "External Shocks, U.S. Monetary Policy and Macroeconomic Fluctuations in Emerging Markets," *Journal of Monetary Economics*, 54, 2512–2520.

Mertens, K., and M. Ravn (2012): "Empirical Evidence on the Aggregate Effects of Anticipated and Unanticipated U.S. Tax Policy Shocks," *American Economic Journal: Economic Policy*, 4(2), 145–81.

Milani, F., and J. Treadwell (2012): "The Effects of Monetary Policy "News" and "Surprises"," *Journal of Money, Credit, and Banking*, 44(8), 1667–1692.

Miranda-Agrippino, S., and H. Rey (2015): "World Asset Markets and the Global Financial Cycle," *NBER Working Paper*, (21722).

Nickell, S. (1981): "Biases in Dynamic Models with Fixed Effects," *Econometrica*, 49(6), 1417–26.

Owens, R., and R. Webb (2001): "Using the Federal Funds Futures Market to Predict Monetary Policy Analysis," *Business Economics, The Journal of the National Association for Business Economics*, 36, 44–48.

Piazzesi, M., and E. Swanson (2008): "Futures Prices as Risk-Adjusted Forecasts of Monetary Policy," *Journal of Monetary Economics*, 55, 677–691.

Ramey, V. A. (2016): "Macroeconomic Shocks and Their Propagation," *Handbook of Macroeconomics*, 2, 71–162.

Rey, H. (2013): "Dilemma, Not Trilemma: the Global Financial Cycle and Monetary Policy Independence," Federal Reserve Bank of Kansas City Economic Policy Symposium.

Romer, C., and D. Romer (2004): "A New Measure of Monetary Shocks: Derivation and Implications," *American Economic Review*, 94(4), 1055–1084.

Sack, B. (2004): "Extracting the Future Path of Monetary Policy from Futures Rates," *Journal of Futures Markets*, 24(8), 733–754.

Schmitt-Grohe, S., and M. Uribe (2012): "What's News in Business Cycles," *Econometrica*, 80, 2733–2764.

Tenreyro, S., and G. Thwaites (2016): "Pushing on a String: US Monetary Policy is Less Powefull in Recessions," *Americal Economic Journal: Macroeconomics*, 8(4), 43–74.

Uribe, M., and V. Yue (2006): "Country Spreads and Emerging Countries: Who Drives Whom?," *Journal of International Economics*, 69, 6–36.

Appendix

A Data

The dataset includes quarterly data for Argentina (1995:Q1-2001:Q3), Brazil (1996:Q1-2014:Q2), Chile (2003:Q1-2013:Q4), Mexico (1995:Q1-2014:Q2), Philippines (1998:Q1-2006:Q4), South Africa (1995:Q1-2014:Q2), and Turkey (1999:Q1-2014:Q2). The sample for Argentina ends in 2001:Q3 since after its sovereign default the country interest rate was not allocative. The choice of countries and sample period is guided by macroeconomic and spread data availability. This sample is very similar to the one used by Akinci (2013). For the analysis, I consider emerging economies included in the J.P. Morgan Emerging Market Bond Index Global (EMBI Global).

Macroeconomic series come from IMF International Financial Statistics (IFS) database. Quarterly series of GDP and gross fixed capital formation (proxy for investment) expressed in local currency units and current prices are deflated using the GDP deflator. Trade balance is expressed as share of GDP at current prices and CPI is the consumer price index that includes all the items. Terms of trade are computed as the ratio between export price index and import price index. All these variables are seasonally adjusted using the X13-ARIMA-SEATS before any transformation. For exchange rate, I use the nominal exchange rate index computed by the Bank of International Settlements (BIS). These indexes is calculated as a geometric weighted average of bilateral exchange rates. They are available at monthly frequency and an increase indicates an appreciation. For the analysis, I use the quarterly average. The BAA corporate spread is defined as the difference between Moody's BAA corporate yield and the Federal Funds rate (series: BAAFFM from FRED). Finally, the country interest rate is defined as the U.S. interest rate for 10 years plus the country spread. For emerging economies, the spread is measured using the J.P. Morgan Emerging Markets Bond Index Global (EMBI Global). This index is computed based on: US-dollar denominated Brady bonds, Eurobonds, traded loans, and local market debt instruments issued by sovereign and quasi-sovereign entities. The spread is computed as an arithmetic, market-capitalization-weighted average of bond spreads over U.S. Treasury bonds of similar duration. Instead of selecting countries according to a sovereign credit-rating level, as is done with the EMBI+, the EMBI Global defines emerging markets countries with a combination of World Bank-defined per capita income brackets and each country's debt-restructuring history. http://faculty.darden.virginia.edu/liw/emf/embi.pdf contains a detailed description of the methodology used to compute the index.

Cross-border bank credit denotes total foreign claims (all instruments, in all currencies) outstanding to all the sectors deflated by the U.S. consumer price index. This Locational Banking dataset is complied by the Bank of International Settlements. The equity inflows are computed using the Emerging Portfolio Fund Research. This data set estimates the flow of equity using data from mutual funds since 1996:Q2. For estimation, I use the inflows of equity as a share of total equity. Total credit denotes total bank credit to the non-financial sector from the Bank of International Settlements. Finally, the borrowing-lending spread is computed as as the difference between the domestic lending rate to the corporate sector and the deposit interest rate. Information for both interest rates come from IMF International Financial Statistics (IFS) database.

All the countries are pooled for estimation. GDP, investment, cross-border bank credit, and CPI are expressed as deviations with respect to a country specific log-linear trends. Results are robust to detrending using the Hodrick-Prescott filter. Nominal exchange rate index (in logs), country interest rate and trade balance/GDP are computed as deviations with respect to country-specific means.

To identify anticipated and unanticipated interest rate shocks in the U.S., I use data from the CBOT Fed Futures Market. In particular, I consider the price for each contract at the beginning of each quarter. This data is downloaded from Thomson Reuters Datastream as CBT-30 DAY FED FUNDS CONTINUOUS for different horizons ahead since January 1995. For this reason, the sample starts in January 1995. CBOT Fed Futures Market contracts trade 1 to 12 consecutive months out from a given date. Even if contracts for longer horizon are available, these are not so liquid. The contracts are always settled against the average daily effective fed funds rate for the delivery month. `http://www.jamesgoulding.com/Research_II/Fed%20Fund%20Futures/Fed%20Funds%20(Futures%20Reference%20Guide).pdf` contains detailed information about these contracts. The daily effective fed funds rate is calculated and reported by the Federal Reserve Bank of New York. I download the quarterly average of this series from St. Louis Fed. FRED database and use it as the realized value of this variable, to identify unanticipated shocks.

B Identifying U.S. Interest Rate Shocks

Let's assume that the U.S. interest rate follows the following process:

$$i_t^{US} = i^{ss} + \beta\hat{y}_t + \gamma\hat{u}_t + \lambda\hat{\pi}_t + \epsilon_t$$

Then, the expectation for the interest rate one quarter ahead conditional on the information available at the beginning of quarter t is given by:

$$\mathbb{E}_{t-1}i_{t+j}^{US} = i^{ss} + \beta\mathbb{E}_{t-1}\hat{y_{t+j}} + \gamma\mathbb{E}_{t-1}\hat{u_{t+j}} + \lambda\mathbb{E}_{t-1}\hat{\pi_{t+j}} + \mathbb{E}_{t-1}\epsilon_{t+j}$$

where the last term denotes how much markets expect the Central Bank to deviate from the systematic response. It follows that:

$$\mathbb{E}_{t-1}(i_{t+2}^{US}-i_{t+1}^{US}) = \beta\mathbb{E}_{t-1}\left(\hat{y_{t+2}} - \hat{y_{t+1}}\right)+\gamma\mathbb{E}_{t-1}\left(\hat{u_{t+2}} - \hat{u_{t+1}}\right)+\lambda\mathbb{E}_{t-1}\left(\hat{\pi_{t+2}} - \hat{\pi_{t+1}}\right)+\mathbb{E}_{t-1}\left(\epsilon_{t+2} - \epsilon_{t+1}\right)$$

Thus, we can obtain the expected interest rate surprise as the error term of the regression (i.e. $s_{t,t+2} \equiv \mathbb{E}_{t-1}\left(\epsilon_{t+2} - \epsilon_{t+1}\right)$) of the anticipated change of the U.S. interest rate on the expected evolution of macroeconomic variables. An analogous expression holds for the case of $t, t+1$.

For the case of the current period:

$$\mathbb{E}_{t-1}(i_t^{US}) - i_{t-1}^{US} = \beta\mathbb{E}_{t-1}\left(\hat{y}_t - \hat{y_{t-1}}\right) + \gamma\mathbb{E}_{t-1}\left(\hat{u}_t - \hat{u_{t-1}}\right) + \lambda\mathbb{E}_{t-1}\left(\hat{\pi}_t - \hat{\pi_{t-1}}\right) + \mathbb{E}_{t-1}\left(\epsilon_t - \epsilon_{t-1}\right)$$

where all the variables dated t-1 are known at the period of computing the expectation. In particular, I take the first release of information for these variables that is available in SPF dataset. As usual, the expected shock is obtained as the residuals from this regression (i.e. $s_{t,t}^a \equiv \mathbb{E}_{t-1}\left(\epsilon_t - \epsilon_{t-1}\right)$).

Finally, for the case of unanticipated shocks:

$$i_t - \mathbb{E}_{t-1} i_t = \beta \left(\hat{y}_t - \mathbb{E}_{t-1}\hat{y}_t\right) + \gamma \left(\hat{u}_t - \mathbb{E}_{t-1}\hat{u}_t\right) + \lambda \left(\hat{\pi}_t - \mathbb{E}_{t-1}\hat{\pi}_t\right) + \left(\epsilon_t - \mathbb{E}_{t-1}\epsilon_t\right)$$

The same way of obtaining the pure interest rate shocks as before (i.e. $s_t^u \equiv \epsilon_t - \mathbb{E}_{t-1}\epsilon_t = \epsilon_t$). In all the cases, I follow Romer and Romer (2004) and also control for the level of the interest rate of that period to identify the pure monetary policy shock. I have also tried with Taylor rules that include persistence of the interest rate and the series are highly correlated, without affecting the results of the paper.

C Series of U.S. Interest Rate Shocks

Figure A.1 displays the identified anticipated shock made at the beginning of the quarter for the current one ($s_{t,t}^a$) and the unanticipated one (s_t^u).

D Effects of U.S. Interest Rate Shocks on U.S. Economy

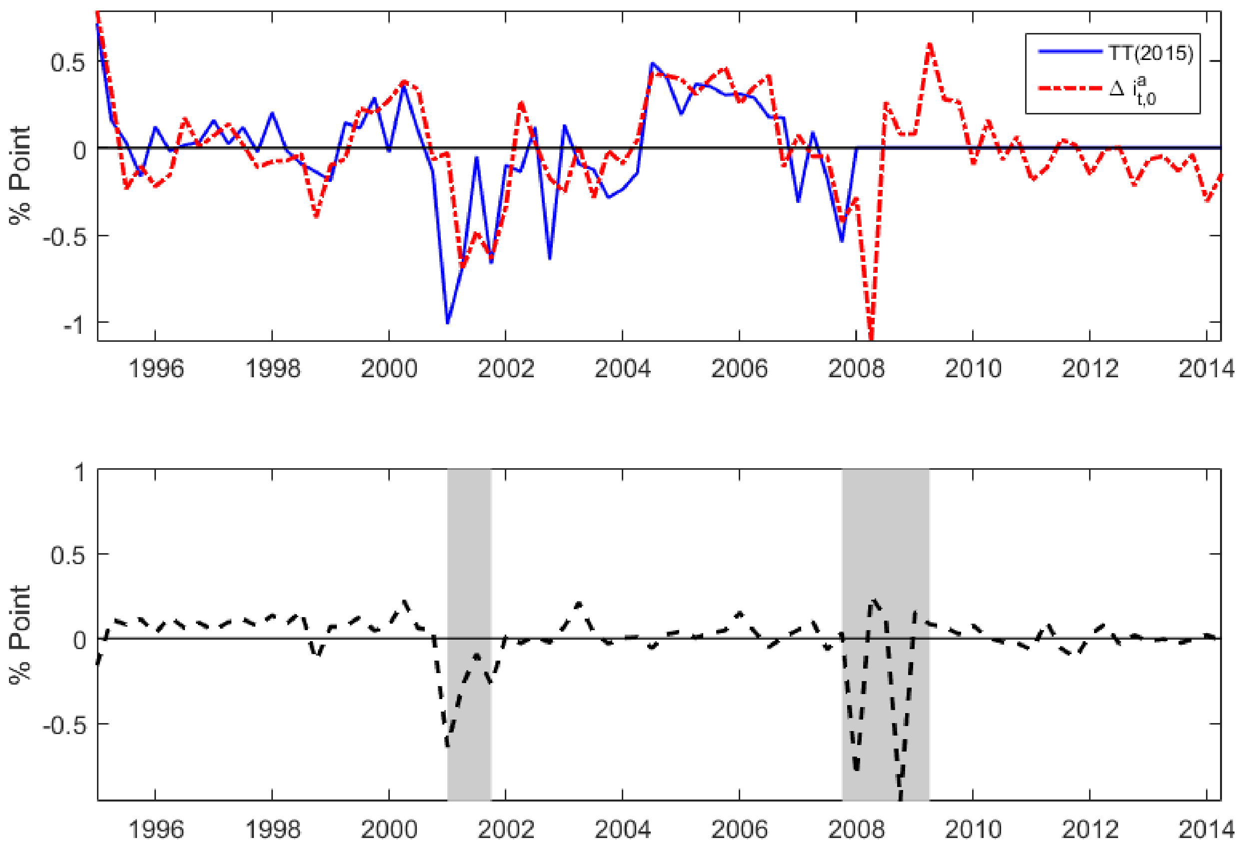
In order to compare with previous monetary policy shocks and to have as a benchmark for the analysis, I estimate the effects of anticipated and unanticipated U.S. interest rate shocks on the U.S. using the empirical model proposed in Section 3.1. Given the short sample (1995:Q1-2014:Q2), I consider three main macroeconomic variables that summarize the macroeconomic effects (vector X_t in expression 5): GDP, GDP Deflator and Corporate Spread.[28]

I estimate the VAR in (log) levels without explicitly modelling the possible cointegration relations among them. In addition to a constant, I include a deterministic linear trend, where dropping it does not affect significantly the results. Following BIC criterion, I estimate a VAR with 2 lags.[29] Figure A.2 displays the IRFs to a two quarters anticipated (left column) and unanticipated (right column) 25 basis points contractionary U.S. interest rate shock.

[28]GDP denotes Real Gross Domestic Product, in billions of chained 2009 Dollars, seasonally adjusted (source: FRED). GDP Deflator corresponds to the Implicit Price Deflator, index 2009=100, seasonally adjusted (source: FRED). Finally, I use the Moody's Seasoned BAA Corporate Bond yield relative to yield on 10-Year Treasury constant maturity as a measure of the BAA Corporate Spread.

[29]Residuals are not autocorrelated with two lags. Results are robust to a four lag specification.

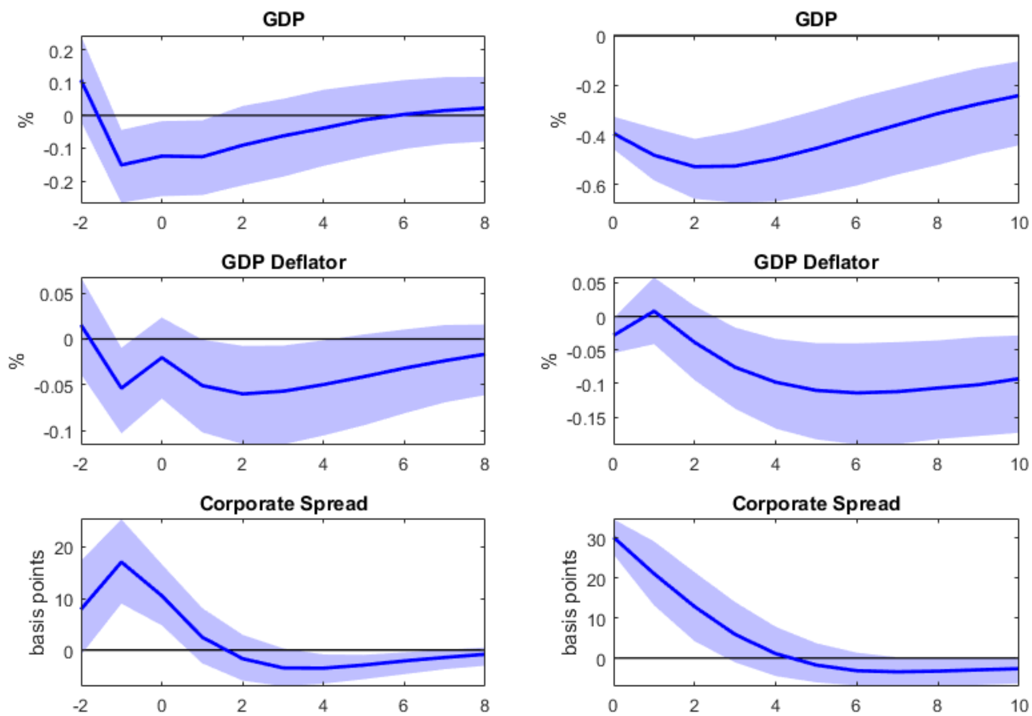
Figure A.1: *Identified Anticipated and Unanticipated Shocks*



Note: Top figure displays the anticipated shock computed at the beginning of the quarter for the current one ($s^a_{t,t}$) and the narrative series of monetary policy shocks (TT(2016)), updated by Tenreyro and Thwaites (2016). Bottom figure shows the unanticipated shock (s^u_t).

Both shocks induce similar qualitative effects in the U.S. economy than in small open developed economies (see Section E). The anticipated shock induces a contraction of GDP that starts one period before the interest rate changes. As in previous cases, this effect is coupled with an immediate increase in the Corporate Spread. Finally, the price level declines 0.05 percent and converges back after 5 quarters. Considering the unanticipated shock, the effect on GDP is stronger and more persistent than for the anticipated shock. Both the magnitudes and signs of the adjustment of all the variables are consistent with previous works in the literature that use different approaches to identify the monetary policy shocks. Compared to the reaction of emerging economies, the response is milder, consistent with the findings of Mackowiak (2007) and when the idea that "when the U.S. sneezes, emerging markets catch a cold".

Figure A.2: *IRFs to an anticipated (right) and unanticipated (left) 25bp U.S. interest rate shocks*



Note: IRFs to a two quarters ahead anticipated (left column) and unanticipated (right column) contractionary U.S. interest rate shock. VAR estimated in log-levels, with 2 lags and a constant and a linear trend over the period 1995:Q1-2014:Q2. Solid lines denote point estimates of impulse responses; 68% confidence bands are depicted with light-red shaded areas. $t = 0$ *denotes the period when the U.S. interest rate effectively increases. The previous two periods show the adjustment of the variables before the change in the U.S. materializes (i.e.* $s^a_{t-2,t} = 0.25$ $s^a_{t-1,t} = 0.25$ *and* $s^a_{t,t} = 1$*). Confidence bands are computed through 1,000 bootstrap replications.*

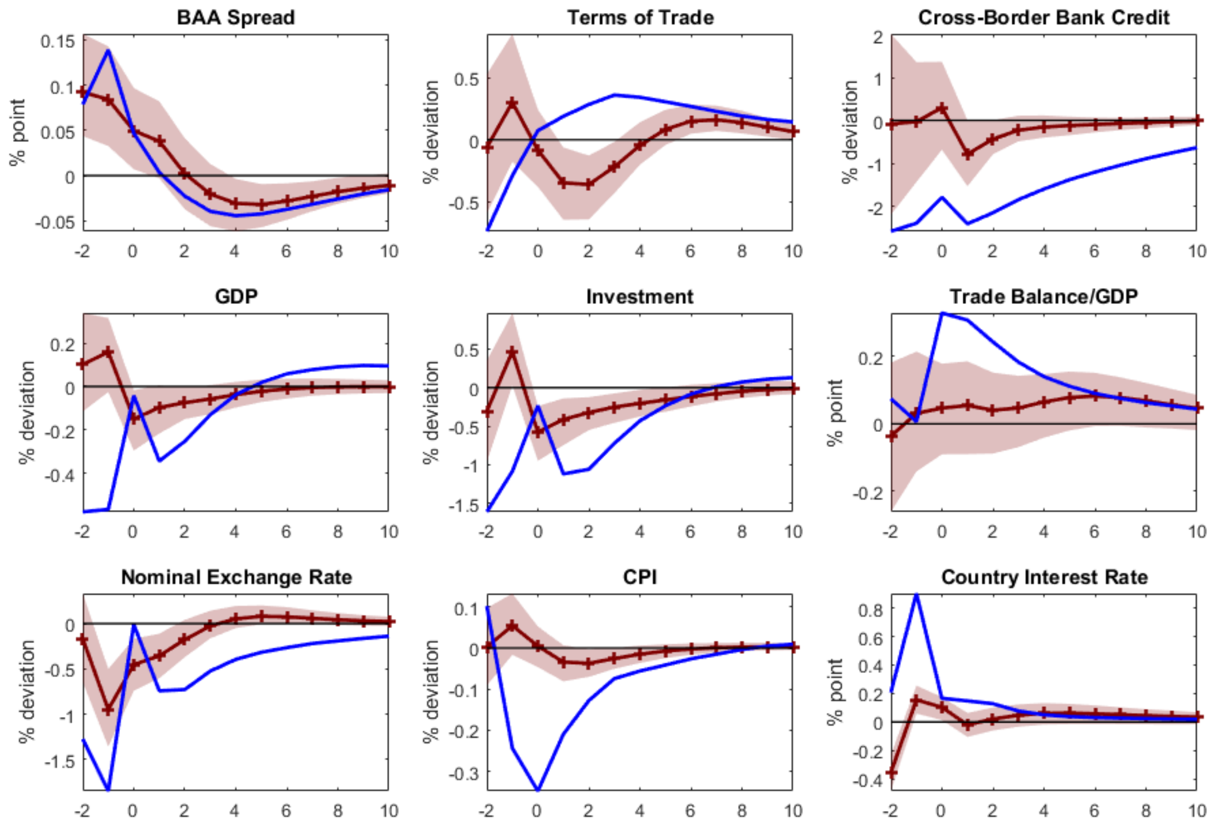
E Comparison with Small Open Developed Economies

To fully understand the transmission of these shocks, I compare the responses of emerging economies to the ones of small open developed economies.[30] For this reason, I estimate the same VAR presented in (5) with data for: Australia, Canada, Denmark, New Zealand, Norway, and Sweden for the period 1995:Q1-2014:Q2.[31] Figure A.3 displays the IRFs to a two quarters ahead anticipated

[30]For comparison with other studies and with developed economies, in Appendix D I present the IRFs of both types of shocks on the U.S. economy.

[31]Macroeconomic series come from IMF International Financial Statistics (IFS) database. The country spread for developed economies is proxied using the Citigroup World Government Bond Index for 10 year maturities. Results are robust is I compute the spread using the Long Term Interest Rate reported by the Organization for Economic Co-

Figure A.3: *IRFs to an anticipated 25bp contractionary U.S. interest rate shock*



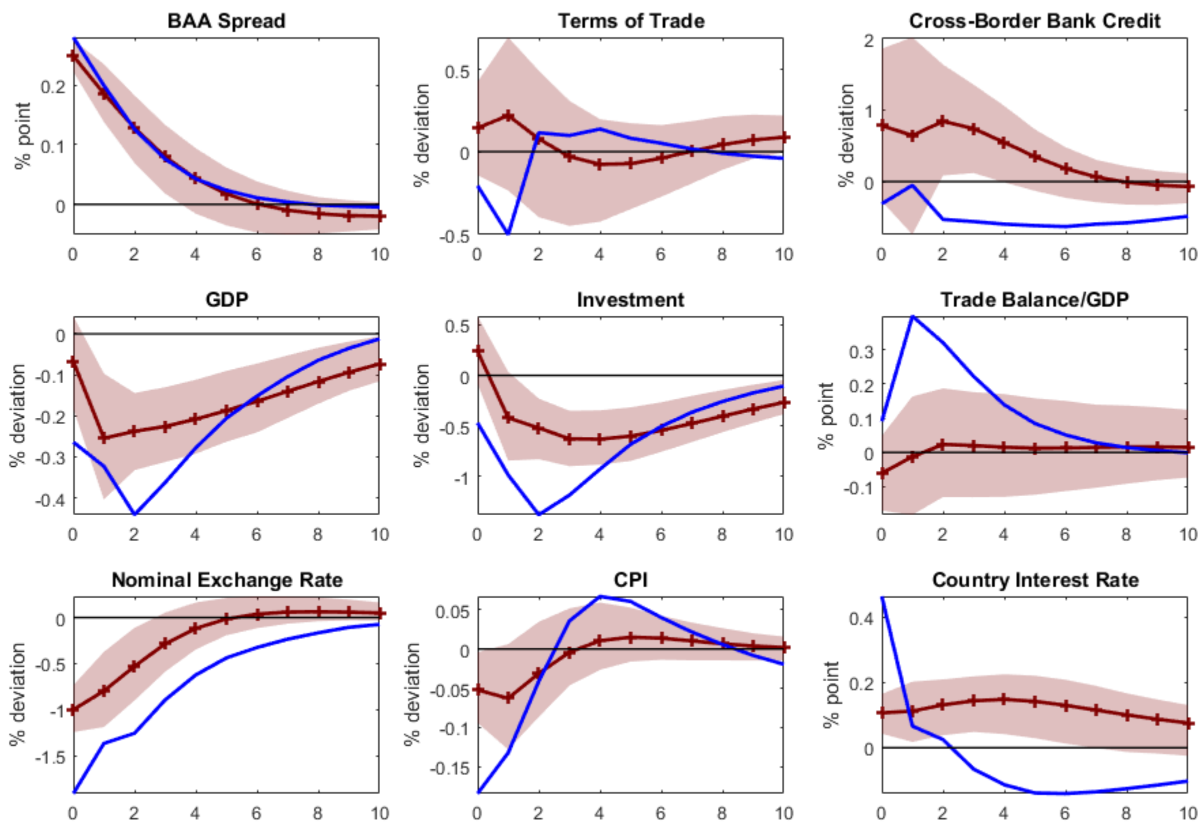
Note: Solid and plus sign lines denote the point estimate of impulse responses for emerging and developed economies, respectively. 90% confidence bands for developed economies are depicted with light-red shaded areas. The responses of cross-border bank credit, GDP, investment, and CPI are expressed in % deviations from their respective linear trend. The responses of terms of trade and nominal exchange rate are expressed in % deviations. BAA corporate spread, trade balance to GDP ratio, and country interest rate are expressed in annualized % points. $t = 0$ *denotes the period when the U.S. interest rate effectively increases. The previous two periods show the adjustment of the variables before the change in the U.S. materializes (i.e.* $s^a_{t-2,t} = 0.25$ $s^a_{t-1,t} = 0.25$ *and* $s^a_{t,t} = 0.25$*). Confidence bands are computed through 1,000 bootstrap replications.*

25 basis points (one standard deviation) contractionary U.S. interest rate shock, including the point estimate of IRFs for emerging economies as a benchmark.

The response of developed economies is more delayed and less strong and persistent than for emerging ones. In particular, GDP and investment decline approximately 0.2 percent and 0.5 percent from their respective trends, only when the change in the U.S. interest rate materializes at $t = 0$. This fact can be explained by the milder responses of the cross-border bank credit, country interest rate and exchange rate. Moreover, the reaction of CPI is also less significant than for

Operation and Development (OECD).

Figure A.4: *IRFs to an unanticipated 25bp contractionary U.S. interest rate shock*



Note: Solid and plus sign lines denote the point estimate of impulse responses for emerging and developed economies, respectively. 90% confidence bands for developed economies are depicted with light-red shaded areas. The responses of cross-border bank credit, GDP, investment, and CPI are expressed in % deviations from their respective linear trend. The responses of terms of trade and nominal exchange rate are expressed in % deviations. BAA corporate spread, trade balance to GDP ratio, and country interest rate are expressed in annualized % points. Confidence bands are computed through 1,000 bootstrap replications.

emerging economies. Finally, unlike emerging economies, the trade balance does not react to this shock. Although the shock is also transmitted by the financial channel, the effects are milder compared to emerging economies. Figure A.4 displays the IRFs to an unanticipated 25 basis points contractionary U.S. interest rate shock.

GDP and investment decline in response to an unanticipated contractionary shock, but their reaction is milder and less persistent than for emerging economies. These dynamics might be explained by the milder response of the country interest rate and the cross-border bank credit, which remain unchanged. Moreover, the depreciation of the nominal exchange rate is also milder and less persistent than for emerging economies. Finally, like for the anticipated case, the CPI, terms of trade and trade balance do not display any significant reaction to the shock. All these responses are similar to the anticipated case.

All in all, the responses of these two groups of economies are different. One of the most important mechanisms to explain this fact is the milder reaction of financial variables (i.e cross-border bank credit and country interest rate). Another significant difference is that the trade channel is not significant for developed economies but it is significant for emerging ones.