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A New Dataset of High-Frequency Monetary Policy Shocks

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ABSTRACT:
This paper presents a new dataset of monetary policy shocks for 21 advanced economies and 8 emerging markets from 2000-2022. We use daily changes in interest rate swap rates around central bank announcements to identify unexpected shocks to the path of monetary policy. The resulting series can be used to examine cross-country heterogeneity in the impact of monetary policy shocks. We establish a new empirical fact on monetary policy spillovers across countries: the monetary policy decisions of small open economy central banks, and not just major central banks, have substantial spillover effects on swap rates and bond yields in other countries.

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Introduction

The surge in inflation that followed the COVID-19 recession has led policymakers to reassess the effectiveness and transmission of monetary policy. Since central banks react to economic developments when formulating policy, estimating the effects of monetary policy requires a way of identifying the component that is exogeneous to economic activity. Approaches to identifying exogeneous monetary policy shocks include the narrative approach (e.g. Romer and Romer, 1994) and, more recently, the "high-frequency" method which makes use of financial market "surprises" that accompany monetary policy events. These are measured as the changes in prices of financial market instruments in a narrow window around central bank announcements. Use of this method goes back to Kuttner (2001) and Bernanke and Kuttner (2005) for studies of the United States and, more recently, includes and Nakamura and Steinsson (2018). The high-frequency approach has also been used to study the effects of monetary policy in the eurozone (e.g., Altavilla et al., 2019), the United Kingdom (Cesa-Bianchi et al., 2020; Braun et al., 2023), and China (Das and Song, 2023). Researchers have applied these shocks to study the impact of monetary policy on a wide range of financial variables (e.g., Gurkaynak et al., 2005; D'Amico and Farka, 2011; Hanson and Stein, 2015), macroeconomic indicators (e.g., Gertler and Karadi, 2015; Ramey, 2016; Bauer and Swanson, 2023a) and firm-level outcomes (e.g., Ottonello and Winberry, 2020; Cloyne et al., 2023; Jeenas, 2023).

In this paper, we describe a newly-constructed cross-country database of monetary policy shocks using the high-frequency method for 29 countries—both advanced economies (AE) and emerging market (EM) economies—from 2000 to 2022. We use the shocks to confirm findings in the existing literature and present novel results on monetary policy transmission. We contribute to several strands of literature in empirical monetary economics.

First, we construct monetary policy shocks, at a daily frequency, for a sample of 29 countries, corresponding to 20 central banks, 12 AE central banks and 8 EM central banks. While the high-frequency method has previously been used to study monetary policy in a few individual-country studies, this is the first cross-country database with standardized monetary policy shocks using this method. Emphasizing the importance of measuring surprises consistently using the same type of financial instrument (Brennan et al., 2024), we collect series on one-year interest rate swaps (IRS) for each country, where the index rate has the shortest maturity possible. For most countries the index rate is the overnight rate. We collect announcements for a total of 3,545 monetary policy events, 60 percent of which are from AEs and 40 percent from EMs. We construct monetary policy *surprises* using daily changes in the IRS rates around the central bank announcements. We then introduce a simple framework that splits these surprises into an exogenous monetary policy *shock* and an endogenous central bank information effect. The latter reflects news about economic conditions. This methodology draws on the literature on information effects embedded in monetary policy surprises (e.g., Jarociński and Karadi, 2020; Miranda-Agrippino and Ricco, 2021; Bauer and Swanson, 2023a, b).

The main advantages of this database over other recent cross-country databases of monetary policy shocks lies in the careful approach taken to identification of shocks as well as the breadth of coverage. Other cross-country datasets (e.g., Willems, 2020; Jorda et al., 2020; Brando-Marques et al., 2021; Deb et al., 2023; Checo et al., 2024) rely on more stringent identification assumptions.[2] Moreover, the panel dimension of the database allows for improvements on existing one-country studies of monetary policy, with a greater number of events to increase statistical power and greater variation of shocks. These additional observations can be used to study various types of state-dependence of monetary policy transmission.[3] Furthermore, the daily nature of our surprise series allows for the study of high-frequency impact of monetary policy spillovers across countries.

This paper is also related to recent work that uses high-frequency identification to study the effects of unconventional monetary policy during the pre-Covid-19 period when short-term nominal interest rates were at the zero lower bound in many advanced economies (e.g., Wright 2012; Gilchrist et al., 2015; Bauer and Swanson, 2022).

Our second contribution is to use our high-frequency monetary policy shocks to estimate the effects of monetary policy on a variety of asset prices using panel local projections, confirming results

[2] Willems (2020) selects episodes as years when a protracted period of loose monetary policy was suddenly followed by sizeable interest rate increases. Jorda et al. (2020) use the trilemma of international finance to construct annual monetary interventions that are plausibly exogenous with respect to domestic factors. Brandao-Marques et al. (2021) use monthly deviations from a simple forecast-based Taylor rule to identify shocks to interest rates. Deb et al. (2023) identify monetary policy shocks using quarterly forecast errors for interest rates. Checo et al. (2024) use the forecast errors of financial analysts' forecasts of monetary policy rates.

[3] The cross-sectional dimension of this new dataset allows researchers to study the state-dependence of monetary policy effectiveness under milder exogeneity assumptions than time series alone (e.g., Tenreyo and Thwaites, 2016). The main identification assumption underlying such an approach is that there is variation in the macroeconomic impact of changes in the state-dependent variable across countries and time periods but that this variation is not, on average, correlated with other factors that make the economy more sensitive to high-frequency monetary policy shocks.

previously found in the literature on our expanded cross-country sample. We also find evidence consistent with an exchange rate puzzle in EMs. Unlike the effects predicted by textbook macroeconomic models, we find that contractionary monetary policy shocks lead to small exchange rate *depreciations* in emerging markets. Finally, we contribute to the literature on monetary policy spillovers, which has largely focused on the effects of US monetary policy abroad (e.g., Georgiadis, 2016; Albagli et al., 2019; Kalemli-Ozcan, 2019; Miranda-Agrippino and Rey, 2020; Di Giovanni and Hale, 2022) and included a few studies of the spillovers of European Central Bank (ECB) policy (e.g., Fratzscher et al., 2016; Jarocinski, 2022). We document a novel empirical finding: that the monetary policy events of not just the major central banks, but also those of small open economy central banks, have substantial spillovers to interest rates in other countries. These results suggest that monetary policy spillovers can manifest through information effects, rather than only through traditional trade and financial channels.

The rest of this paper is organized as follows. Section II provides a detailed description of our methodology for constructing the cross-country database of monetary policy shocks using the high-frequency method. We outline the steps taken to standardize monetary policy surprises across different countries and central banks, ensuring consistency and comparability in our analysis, and present a simple framework for decomposing monetary policy *surprises* into monetary policy *shocks* and central bank information effects. In Section III, we empirically examine the impact of monetary policy surprises and shocks on various daily financial variables in the sampled countries, as well as study monetary policy spillovers to foreign countries. Section IV concludes and identifies avenues for future research.

II. Data and methodology

This section describes the new dataset and the framework used for calculating monetary policy surprises and identifying monetary policy shocks.

A. Data

Coverage. Our daily dataset covers the period from 2000 to 2022. This begins later and ends later than existing series of shocks for the Federal Reserve (e.g., Kuttner, 2001; Gurkaynak et al., 2005; Gertler and Karadi, 2015; Nakamura and Steinsson, 2018; Bauer and Swanson, 2018) and the ECB (e.g., Altavilla et al., 2019). It includes 20 central banks, with a total of 3,545 monetary policy events.

For the euro area, we collect financial data for 10 countries. This brings the total to 29 countries, out of which 21 countries are advanced economies (AEs) and 8 are emerging markets (EMs).[4] Annex I provides detailed information on data collection.

Announcements. Central bank announcements are collected from the Bloomberg Economic Calendar. The data series contains the dates and time of monetary policy announcements following central bank meetings.[5] The frequency of regularly scheduled meetings varies from four (Switzerland) to twelve (Hungary) times per year, hence the time between meetings is one to three months (Table A.3). In most countries in our sample, announcements occur before financial markets close, with some exceptions (e.g., Brazil and Chile) which announce changes in policy rates after market close. We account for the timing of announcements as follows when calculating monetary policy surprises:

- For central banks that announce during or before the market open, we measure surprises as the change in the closing price of financial instruments compared to the closing price the day before the announcement.
- For announcements after the market close, the surprise is the measured as the difference between the closing price on the day after the announcement compared to the day of the announcement.
- When announcements are made during the weekends, surprises are the difference between the closing price on Monday and the previous Friday.

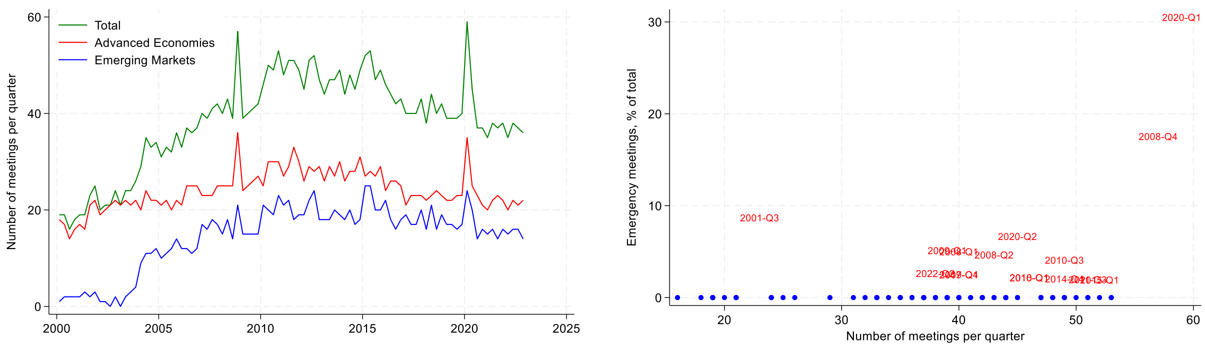
For every central bank, we classify a meeting as an 'emergency meeting' when it takes place outside the regular meeting schedule. In total, we collect announcements for about 40 meetings per quarter, of which 20 are for AEs and 20 for EMs (Figure 1, Panel A). Emergency meetings are relatively rare, with most of them occurring following major crises: e.g. during the aftermath of the 9/11 terrorist attacks, the Global Financial Crisis (GFC), the European sovereign debt crisis, the 2013-2014 Taper Tantrum, and the Covid-19 pandemic (Figure 1, Panel B). In most quarters, the share of emergency meetings is zero.

[4] We classify countries based on the April 2000 World Economic Outlook classification. Advanced economies included are Australia, Austria, Belgium, Canada, Switzerland, Germany, Spain, Finland, France, United Kingdom, Ireland, Israel, Italy, Japan, Korea, Netherlands, Norway, New Zealand, Portugal, Sweden, and the United States. Emerging markets included are Brazil, Chile, China, Hungary, India, Mexico, Poland, and Thailand.

[5] With the exception of China, all monetary policy announcements in the dataset are associated with a central bank meeting.

Figure 1: Central bank meetings over time

Panel A: Meetings by country group (Number of meetings per quarter) | Panel B: Emergency meetings (Percentage per quarter, nonzero in red)



Notes: See text for details.
Sources: See Annex I.

Existing studies use different maturities of futures contracts and interest rate swaps to construct monetary policy surprises. For the US, some studies use the change in the current-month futures contract that pertains to the policy rate (e.g., Kuttner, 2001), while others use three months ahead futures (e.g., Gertler and Karadi, 2015) or a range of futures contracts (e.g., Gurkaynak et al., 2005; Nakamura and Steinsson, 2018; Bauer and Swanson, 2022). Altavilla et al. (2019) employ a range of Overnight Indexed Swaps (OIS) for the euro area.

We measure surprises in a consistent manner across countries, to ensure comparability of the series for different countries. This is important to ensure that estimates of monetary policy transmission across countries are not driven by methodological differences in how surprises are calculated. Studies have found that, even for monetary policy events from the same central bank, the use of different financial instruments to calculate surprises gives rise to relatively low correlations between different series. For example, the series of Nakamura and Steinsson (2018) and Bu et al. (2021) for the United States have a correlation coefficient of only 0.5 and the same sign for only two-thirds of observations (Brennan et al., 2024). Our dataset uses one-year interest rate swaps (IRS) where the index rate has the shortest maturity possible. For most countries the index rate is the overnight rate.[6] The use of an IRS with one-year maturity has two main advantages. First, Brennan et al. (2024) show that series calculated from financial instruments with short maturities are impacted by the level

[6] Lloyd (2021) compares 1- to 24-month US, UK, Eurozone and Japanese OIS rates and finds that these accurately measure expectations of future short-term interest rates.

of the policy rate relative to the effective lower bound. Second, monetary policy surprises are sometimes split into a “target” factor, which reflects the unexpected change in the policy rate, and the “path” factor, which reflects the unexpected change in the future path of policy (e.g., Gurkaynak et al., 2005; Altavilla et al., 2019). Because the surprise of the one-year IRS on the overnight rate equals a weighted average of the target and path factors, it parsimoniously captures some of the main features of both factors. This includes the impact of newer central bank tools such as forward guidance and large-scale asset purchases which became prevalent after the GFC.

B. Identification of shocks

Framework. Consider a monetary policy event for a given country *n* at time *t*. We can write the central bank’s monetary policy function as:

$$i_{nt+j} = f_n(\boldsymbol{X_{nt+k}}) + \mu_{nt+k} \quad (1) \ ,$$

where i_{nt+j} denotes the policy rate at time *t*+*j*, $\boldsymbol{X_{nt+k}}$ is a vector that summarizes the state of the economy on the day of the central bank meeting (at *t*+*k*, where $k \leq j$), and $f_n(\cdot)$ is a country-specific function (the reaction function) that maps the state of the economy to how the central banks sets policy. μ_{nt+k} is a monetary policy “shock”, i.e., an exogenous random deviation of the policy rate from the central bank’s reaction function on the day of the central bank meeting. In our dataset, the horizon *j* always equals one year.

The day before a monetary policy event, the market prices the future policy rate using

$$E_{nt-1} i_{nt+j} = g_{nt-1}(E_{nt-1}\boldsymbol{X_{nt+k}}) + E_{nt-1}\mu_{nt+k} \quad (2) \ ,$$

where $g_{nt-1}(\cdot)$ is the private sector’s belief of the central bank reaction function. $E_{nt-1}\boldsymbol{X_{nt+k}}$ is the private sector’s expectation of the state of the economy on the day of the central bank meeting.

Constructing the high-frequency monetary policy surprises. First, we measure the “raw” monetary policy surprise mps_{nt} as the difference between the expected policy rate after the announcement and the market price the day before the announcement:

$$mps_{nt} \equiv E_{nt} i_{nt+j} - E_{nt-1} i_{nt+j} \quad (3) \ .$$

Extracting shocks from surprises. It is well known that monetary policy surprises, including those constructed using high-frequency data, tend to be predictable ex-post (e.g., Cieslak, 2018; Miranda-Agrippino and Ricco, 2021). A literature on the "information channel' of monetary policy proposes that this is because central banks may have private information about the state of the economy $\boldsymbol{X_{nt+k}}$ which influences monetary policy decisions and is correlated with past macroeconomic data.[7] This interpretation was recently challenged by Bauer and Swanson (2023,a,b) who argue that surprises are predictable ex-post due to biased expectations. We incorporate both possibilities into our framework. Using (1) and (2) and rearranging gives:

$$mps_{nt} \equiv \Delta E_{nt}\mu_{nt+k} + [g_{nt}(E_{nt}\boldsymbol{X_{nt+k}}) - g_{nt}(E_{nt-1}\boldsymbol{X_{nt+k}})] + \Delta g_{nt}(E_{nt-1}\boldsymbol{X_{nt+k}}) \quad (4) \quad ,$$

which summarizes three different sources of a monetary policy surprise:

(i) an exogenous monetary policy shock,

(ii) a "central bank response to news" effect (Bauer and Swanson, 2023), when the monetary policy event changes the private sector's estimate of the central bank reaction function, and

(iii) a "central bank information" (CBI) effect (e.g. Campbell et al., 2012, 2017; Nakamura and Steinsson, 2018), when the central bank's observation of the state of the economy on the day of the event differs from the previous expectation of the private sector.

We proceed by imposing some structure on the beliefs of the private sector, the central bank reaction function, and the dynamics of the macro fundamentals:

$$g_{nt}(E_{nt}\boldsymbol{X_{nt+k}}) = (c_{nt-1} + \phi_{nt})E_{nt}\boldsymbol{X_{nt+k}} \quad (5)$$
$$\boldsymbol{X_{nt+k}} = \gamma_n \boldsymbol{X_{nt}} + \boldsymbol{\tilde{\gamma}_{nt+k}} \quad (6)$$
$$\boldsymbol{X_{nt}} = \zeta_n \boldsymbol{X_{nt-1}} + \boldsymbol{\tilde{\eta}_{nt}} \quad (7)$$

where $\boldsymbol{\tilde{\gamma}_{nt}}$ and $\boldsymbol{\tilde{\eta}}_{nt}$ are vectors of exogenous i.i.d. shocks, potentially within the central bank information set but uncorrelated with $\boldsymbol{X_{nt-1}}$. The parameter c_{nt-1} is the prior of the private sector and ϕ_{nt} is an update to the beliefs of the private sector.[8] We can now estimate regressions of the form

[7] This literature goes back to at least Romer and Romer (2000). See also Cieslak and Schrimpf (2019), Hansen et al. (2019), Kerssenfischer (2022), and Pinchetti and Szczepaniak (2023).

[8] See Bauer and Swanson (2023).

$$mps_{nt} = \alpha_n + \beta_n \boldsymbol{X_{nt-1}} + \tilde{\epsilon}_{nt} \quad (8) \quad ,$$

where $\beta_n \equiv \gamma_n \zeta_n \bar{\phi}_n$ and $\tilde{\epsilon}_{nt} \equiv \Delta E_{nt} \mu_{nt}^k + (c_{nt-1} + \phi_{nt}) \tilde{\eta}_{nt}$.[9] $\bar{\phi}_n$ is the average update to beliefs of the private sector in the sample.[10] The "orthogonalized" monetary policy surprise is then extracted as

$$mps_{nt}^o = mps_{nt} - \hat{\beta}_n \boldsymbol{X_{nt-1}} \quad (9) \quad .$$

This orthogonalized surprise is, by construction, uncorrelated with the macroeconomic data $\boldsymbol{X_{nt-1}}$ on the day before the event.

Central bank information effect. Note that the orthogonalized monetary policy surprise mps_{nt}^o still includes $(c_{nt-1} + \phi_{nt-1}) \tilde{\eta}_{nt}$, the change in the private sector belief of the future policy rate due to a change in macroeconomic fundamentals. Following Jarociński and Karadi (2020), we decompose the orthogonalized surprise into the monetary policy shock component and a central bank information shock:

$$mps_{nt}^o \equiv \epsilon_{nt}^{MP} + \epsilon_{nt}^{CBI} \quad (10)$$

where ϵ_{nt}^{CBI} is the central bank information shock.

We use the response of stock prices to mps_{nt}^o to disentangle the two shocks. The intuition is simple: if a positive monetary policy shock is caused by a response of the central bank to an improvement in macroeconomic fundamentals $\tilde{\eta}_{nt}$, then investors will revise up corporate earnings and stock prices will increase (at rate s_{nt}) despite the higher discount rate. But if the shock is caused by a true monetary policy shock that tightens monetary policy conditional on macroeconomic fundamentals,

[9] Annex II contains a derivation.

[10] The central bank does not "respond to news" if the update to beliefs is zero on average. Bauer and Swanson (2023a, b) argue that markets have underestimated the responsiveness of the Fed to underlying strength in the economy such that $\bar{\phi}_n > 0$. Farmer et al. (2024) propose a learning model that can rationalize these beliefs.

stock prices will fall as investors expect lower earnings and a higher discount rate. We use "poor man's sign restrictions" (Jarociński and Karadi, 2020) such that[11]

$$\epsilon_{nt}^{MP,1} = mps_{nt}^{o} \; if \; mps_{nt}^{o} \times s_{nt} \leq 0, 0 \; otherwise \quad (11)$$

$$\epsilon_{nt}^{CBI,1} = 0 \; if \; mps_{nt}^{o} \times s_{nt} \leq 0, mps_{nt}^{o} \; otherwise \quad (12)$$

That is, each monetary policy surprise is categorized as either a monetary policy shock or a central bank information shock, depending on the corresponding co-movement between the policy rate and stock price change.

C. Implementation

Estimates of monetary policy surprises. We first construct series of mps_{nt} using the identity in equation (3) and data on swap rates and central bank announcements. We then estimate equation (8) using the elastic net operator with the following set of predictors, focusing on macroeconomic news and financial variables that were previously found by Bauer and Swanson (2023a, b) to be good predictors of monetary policy surprises:

- *Stock prices:* the growth rate, 65 trading days before the central bank event to the day before the event.
- *Exchange rate:* the growth rate of a country's nominal effective exchange rate (NEER) of from three months (65 trading days) before the central bank event to the day before the event.
- *Sovereign bonds*: the changes in the yields of sovereign bonds with 1-year and 10-year maturities from three months (65 trading days) before the central bank event to the day before the event.

[11] An alternative is the use of "rotational sign restrictions" approach (Jarociński, 2022). In this case, the decomposition satisfies $\boldsymbol{M} = \boldsymbol{UC}$ where $\boldsymbol{M} = (mps^{o}, s)$ is a $Tx2$ matrix and $\boldsymbol{U} = (\epsilon^{MP,2}, \epsilon^{CBI,2})$ is a $Tx2$ matrix such that the shocks are orthogonal. $\boldsymbol{C} = (1, c)$ is a $2x2$ matrix with the second vector satisfying $c_1 < 0$, $c_2 > 0$. This approach would impose the assumption that stock prices respond differently to monetary policy and central bank information shocks across countries, making it difficult to determine whether differences in pass-through to financial variables are due to this assumption or other factors. We therefore prefer to use the more transparent poor man's sign restriction approach.

- *Sovereign yield curve:* the change in the slope of the sovereign yield curve, measured as the difference between the 10-year yield and the 1-year yield, from three months (65 trading days) before the central bank event to the day before the event.
- *Commodity prices:* the growth rate of the Bloomberg Commodity Spot Price index from three months (65 trading days) before the central bank event to the day before the event.
- *Financial market volatility:* the change in the Chicago Board Options Exchange's CBOE Volatility Index (VIX) from three months (65 trading days) before the central bank even to the day before the event.
- *Expected macroeconomic fundamentals:* the one-year ahead mean forecast of the 3-month interest rate, the year-on-year percentage change in real GDP, and the year-on-year percentage change of the consumer price index (CPI) from Consensus Forecasts.
- *Forecast errors of macroeconomic fundamentals:* the forecast errors of the one-year ahead mean forecast of the 3-month interest rate, the year-on-year percentage change in real GDP, and the year-on-year percentage change of the consumer price index (CPI) from Consensus Forecasts.

Importantly, we use only data that was available on the day before the central bank meeting. We perform this procedure country by country. The elastic net prevents overfitting on the historical data and ensures that the orthogonalization procedure picks only predictors that help predict ex-post surprises out of sample. Table 1 contains nonzero coefficients by country. For 60 percent of the countries in the sample, the ability of the macroeconomic news and financial variables to predict ex-post monetary policy surprises is low and the elastic net does not select any variables. The R-squared ranges from 0 to 0.22, with a mean of 0.04 and a median of 0.

D. Summary statistics

Table 2 provides summary statistics of the monetary policy surprises and shocks, and central bank information shocks by country group, where we group countries into AEs and EMs. Annex Table A.5 provides detailed summary statistics for individual countries.

Monetary policy surprises, including orthogonalized surprises, center around zero for both AEs and EMs. Surprises are considerably more dispersed and have fatter tails for EMs (Figure 1, Panel A). Compared to daily changes in IRS rates on non-event days, surprises also display more dispersion, both for AEs and EMs.

Table 1: Orthogonalization procedure

	3-month change						1-year ahead forecast			Last forecast error			
	Stock prices	Commodity prices	NEER	1Y	10Y	VIX	3M yield	Growth	Inflation	3M yield	Inflation	Growth	R^2
AUS	-	0.10	-	0.01	0.02	(0.09)	-	-	(2.63)	-	-	-	0.13
AUT	-	-	-	-	-	-	-	-	-	-	-	-	0.00
BEL	-	-	-	-	-	-	-	-	-	-	-	-	0.00
BRA	-	0.03	-	0.01	-	(0.10)	-	-	-	(0.26)	-	-	0.07
CAN	-	-	-	0.02	-	-	-	-	-	-	-	-	0.05
CHE	-	-	-	-	-	(0.03)	-	-	-	-	-	-	0.06
CHL	-	-	(0.97)	0.03	-	(0.09)	-	-	6.06	(0.76)	-	-	0.22
CHN	-	0.10	(0.44)	0.00	0.02	-	-	-	-	-	-	-	0.17
DEU	-	-	-	-	-	-	-	-	-	-	-	-	0.00
ESP	-	-	-	-	-	-	-	-	-	-	-	-	0.00
FIN	-	-	-	-	-	-	-	-	-	-	-	-	0.00
FRA	-	-	-	-	-	-	-	-	-	-	-	-	0.00
GBR	-	-	-	-	-	-	-	-	-	-	-	-	0.00
HUN	-	-	-	-	-	-	-	-	-	-	-	-	0.00
IND	-	-	-	-	-	-	-	-	-	-	-	-	0.00
IRL	-	-	-	-	-	-	-	-	-	-	-	-	0.00
ISR	-	-	-	-	-	-	-	-	-	-	-	-	0.00
ITA	-	-	-	-	-	-	-	-	-	(0.07)	-	-	0.01
JPN	-	-	-	(0.05)	-	-	(0.45)	-	-	-	-	-	0.09
KOR	-	-	-	-	-	-	-	-	-	-	-	-	0.00
MEX	-	-	-	-	-	-	-	-	-	-	-	-	0.00
NLD	0.01	-	-	0.01	-	-	-	-	-	(0.08)	-	-	0.03
NOR	-	-	-	0.03	-	-	-	-	1.45	-	(0.16)	-	0.08
NZL	-	-	-	-	-	-	-	-	-	-	-	-	0.00
POL	-	-	-	-	0.01	-	-	-	-	-	-	-	0.04
PRT	-	-	-	-	-	-	-	-	-	-	-	-	0.00
SWE	-	0.05	-	0.06	-	-	-	-	0.21	-	-	-	0.21
THA	-	-	-	-	-	-	-	-	-	-	-	-	0.00
USA	-	-	-	-	-	-	-	-	-	-	-	-	0.00

Notes: See text for details. The dependent variable is the monetary policy surprise in basis points. For the euro area, the procedure is applied to each country individually. Brackets indicate negative coefficients.
Sources: See Annex I.

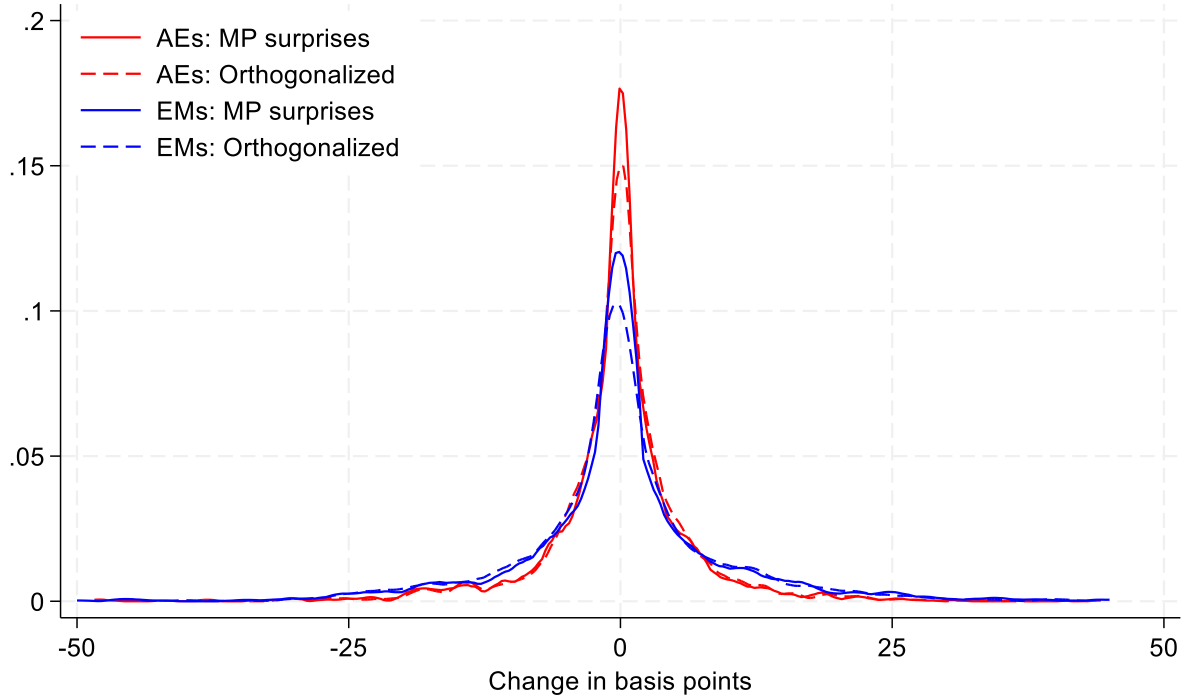
Table 2: Summary statistics of monetary policy surprises and shocks (basis points)

	Obs.	Mean	Median	Std. dev.	Min.	Max.
Event days						
Advanced economies						
mps_{nt}	2,216	-0.2	0.0	9.6	-85.0	306.5
mps^{o}_{nt}	2,216	0.0	0.0	9.5	-73.3	305.2
$\epsilon^{MP,1}_{nt}$	2,216	0.0	0.0	8.4	-73.3	305.2
$\epsilon^{CBI,1}_{nt}$	2,216	0.0	0.0	4.3	-46.0	27.5
Emerging markets						
mps_{nt}	1,329	0.3	0.0	11.5	-93.0	137.0
mps^{o}_{nt}	1,329	0.0	-0.2	11.2	-89.6	137.2
$\epsilon^{MP,1}_{nt}$	1,329	-0.1	0.0	9.0	-89.6	137.2
$\epsilon^{CBI,1}_{nt}$	1,329	0.1	0.0	6.6	-57.6	75.6
Other days						
Advanced economies						
mps_{nt}	61,237	0.0	0.0	4.0	-374.5	121.0
mps^{o}_{nt}	61,237	0.0	0.0	4.0	-371.0	120.7
$\epsilon^{MP,1}_{nt}$	61,237	0.0	0.0	2.9	-371.0	120.7
$\epsilon^{CBI,1}_{nt}$	61,237	0.0	0.0	2.7	-124.3	103.7
Emerging markets						
mps_{nt}	37,344	0.0	0.0	6.8	-123.0	167.0
mps^{o}_{nt}	37,344	0.0	0.0	6.8	-125.1	165.4
$\epsilon^{MP,1}_{nt}$	37,344	0.0	0.0	5.3	-120.4	165.4
$\epsilon^{CBI,1}_{nt}$	37,344	0.0	0.0	4.3	-125.1	127.6

Notes: See text for details. Annex I contains detailed tables by country.

Sources: See Annex I.

Figure 1: Distributions of monetary policy surprises and shocks
(mps_{nt} and mps^{o}_{nt} in basis points, Red: Advanced Economies; Blue: Emerging Markets)

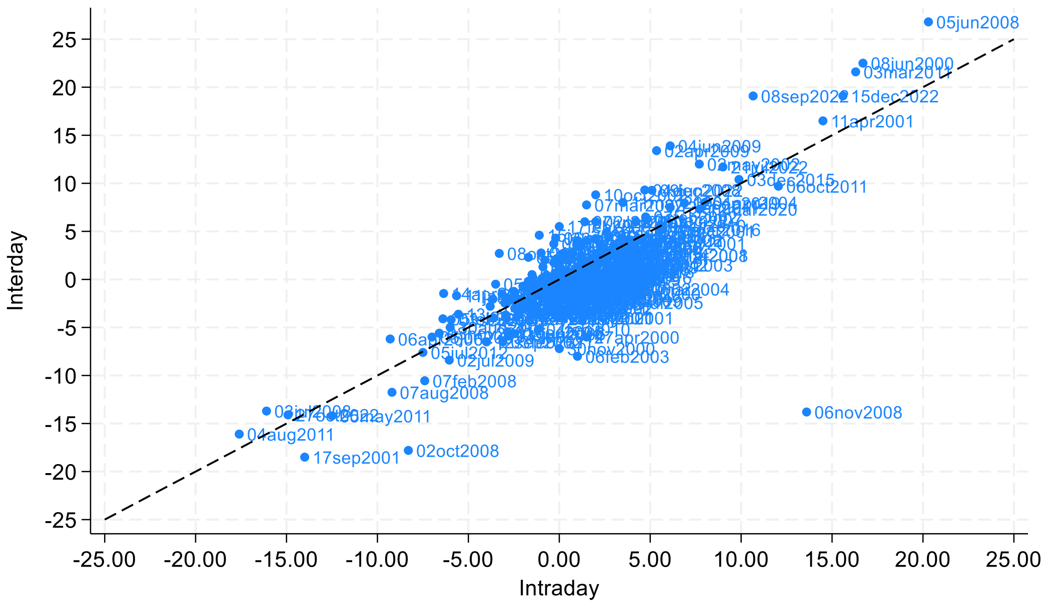


Notes: See text for details.
Sources: See Annex I.

Frequency. Our daily surprises for the ECB are similar to those constructed using changes in the one-year OIS during short intra-day windows by other authors. Figure 2 plots our raw monetary policy surprises against the surprises from Altavilla et al. (2019). Reassuringly, the correlation between our surprises and the intra-day surprises is 0.84. This is relatively large compared to correlations between surprise series for the United States from Kuttner (2001), Nakamura and Steinsson (2018), and Bu et al. (2021), which range from 0.29 to 0.78 (Brennan et al., 2024). This finding also confirms Gurkaynak et al. (2005), who show that for the US, monetary policy surprises based on daily or intraday changes tend to be similar.

Liquidity. Analysis of bid-ask spreads suggests that the IRS rates that we use to calculate surprises are liquid. In the advanced economies in our sample, the average bid-ask spread is about 3 basis points between 2015 and 2021, ranging from 2 basis points in Australia, Canada, the eurozone and Japan, to 5 basis points in New Zealand and Norway. In emerging markets, bid-ask spreads are higher but still relatively low, averaging 5 basis points. In several EMs, including Mexico and Thailand, bid-ask spreads of the swaps are similar to those in AEs (Figure A.1).

Figure 2: Comparison of monetary policy surprises with intra-day surprises for ECB
(one-year OIS, intra-day from Altavilla et al. (2019))



Notes: Monetary policy surprises in the one-year OIS plotted for interday (y-axis) and intra-day (x-axis). ECB surprises cover 2000-2022. See text for more details.
Sources: Altavilla et al. (2019). See Annex I for details.

III. The High-Frequency Impact of Monetary Policy Shocks

In this section, we first estimate the transmission of monetary policy to a variety of interest rates and asset prices, using both a daily event study approach and panel local projections (Jordà 2005). We then explore the spillover effects of the monetary policy of AEs in our sample by estimating the effects of monetary policy on foreign IRS rates and sovereign bond yields.

A. Same-day responses

We start by presenting estimates of the same-day effects of monetary policy announcements. The first empirical specification takes the form:

$$\Delta y_{nt} = \alpha_n + \beta m_{nt} + \delta_t + \epsilon_{nt} \quad (14) \ ,$$

where Δy_{nt} is the daily change in an interest rate or asset price in country *n* and m_{nt} is the monetary policy surprise or shock. α_n is a country-specific fixed effect and δ_t is a fixed effect for the year-month of the surprise. The dependent variables studied are sovereign bond yields at different maturities, FX-denominated sovereign bond spreads, nominal effective and bilateral exchange rates, and stock market indices. We winsorize y_{nt} and m_{nt} at the 1 percent tails and cluster standard errors at the country-level.

Sovereign bond yields. Table 1 reports the estimation results for sovereign bond yields, with AEs in columns 1 to 4 and for EMs in columns 5 to 8. The coefficient in each column represents the impact of a 100 basis point increase in a measure of the surprise on the corresponding bond yield. We highlight three main results.

First, monetary policy surprises have a stronger effect on sovereign bond yields in the middle of the yield curve, with a large impact on 1-year, 2-year and 5-year yields than on 3-month or 10-year yields. In AEs, a surprise of 100 basis points leads to the 3-month yield increasing by about 40 basis points, the 1-year by 68 basis points, the 2-year by 77 basis points, the 5-year by 71 basis points and the 10-year yield by 45 basis points. This pattern confirms that our surprise series capture more persistent changes in monetary policy than the policy rate, reflecting the fact that a substantial share of the variation in the policy rate reflects changes in the timing of the rate adjustment, rather than persistent adjustment in the policy rate (Kuttner, 2001; Gertler and Karadi, 2015).

Second, the pass-through upon impact to medium-term sovereign bond yields is higher in AEs than in EMs. The average response of 1-year yields to a 100 basis point surprise is 38 basis points in EMs, 44 percent lower than in AEs. Similarly, the average pass-through of monetary policy surprises to the 2-year and the 5-year yields is 32 percent and 29 percent lower in EMs.

Third, transmission of orthogonalized monetary policy surprises to sovereign bond yields is almost identical to the transmission of raw monetary policy surprises. The point estimates are almost the same, and the standard errors and regression R-squared are very similar. These estimates suggest that the predictability of monetary policy surprises does not affect pass-through to sovereign bond yields in standard high-frequency event-study regressions. With respect to the effects of monetary policy shocks, their effects are larger in magnitude than the effects of the monetary policy surprises for both AEs and EMs.

Table 3: Sovereign Bond Yield Responses to Monetary Policy Surprises and Shocks

	Advanced Economies				Emerging Markets			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable	mps_{nt}	mps_{nt}^{o}	$\epsilon_{nt}^{MP,1}$	$\epsilon_{nt}^{CBI,1}$	mps_{nt}	mps_{nt}^{o}	$\epsilon_{nt}^{MP,1}$	$\epsilon_{nt}^{CBI,1}$
3-month yield	40	39	48	38	40	39	48	42
SE	7.6	7.4	9.7	6.7	7.8	8.1	11.6	10.6
R^2	0.25	0.25	0.24	0.24	0.29	0.29	0.28	0.28
1-year yield	68	67	78	73	38	36	48	33
SE	4.6	4.4	5.7	4.9	5.5	5.6	9.0	5.8
R^2	0.48	0.47	0.46	0.46	0.36	0.35	0.34	0.34
2-year yield	77	75	87	85	52	46	58	48
SE	4.3	4.2	5.0	6.0	8.1	8.9	14.0	13.0
R^2	0.54	0.53	0.52	0.52	0.45	0.42	0.40	0.40
5-year yield	71	69	81	81	50	47	66	45
SE	6.1	5.9	6.7	7.4	4.9	6.4	8.5	9.1
R^2	0.46	0.46	0.46	0.46	0.37	0.36	0.36	0.36
10-year yield	45	44	52	51	46	43	60	41
SE	4.8	4.8	6.6	5.8	5.7	6.7	7.4	10.2
R^2	0.36	0.35	0.36	0.36	0.38	0.36	0.36	0.36
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Year-month FE	YES	YES	YES	YES	YES	YES	YES	YES

Notes: Estimated coefficients from regressions using equation 14. Standard errors clustered at country level. Unbalanced sample from 2000 to 2022. Lefthand side and righthand side variables are winsorized at 1 percent tails. See text for details.
Sources: See Annex I.

Table 4 presents the estimation results for other asset prices in a similar format. We highlight three results.

Sovereign bond spreads. Sovereign bond spreads are measured as the yield of USD or Euro-denominated bonds for each country minus the yield of similar profile US Treasury bonds or German government bonds. The effects of monetary policy on sovereign bond spreads is negligible in AEs, but larger in EMs. In AEs, positive surprises and contractionary monetary policy shocks of 100 basis points push up sovereign bond spreads by 1.1 and 3.7 basis points on average, but these impacts are not significant. In EMs, these impacts are larger, at 1.9 and 5.5 basis points respectively, and statistically significant.

Exchange rates. Second, the differential impact of monetary policy on exchange rates in AEs compared to EMs is striking. In AEs, a 100 basis points surprise is associated with a 2.1 and 2.2 percent same-day appreciation of the nominal effective exchange rate (NEER) and the nominal exchange rate vis a vis the US dollar, respectively. In EMs, the estimated responses to monetary policy surprises are negative, indicating an average depreciation of the NEER of 0.2 percent and of the bilateral rate of 0.4 percent, but the impact is not significant. For contractionary monetary policy shocks, however, the effect is statistically significant in EM, indicating that the NEER depreciates by 1.2 percentage points on average, while the bilateral depreciation against the US dollar is 2.1 percent on average.

Stock returns. Finally, the effect of monetary policy shocks on stock markets is large in both AEs and EMs, associated with a 16 percent same-day decline in stock market indices on average in both groups of countries.

Table 4: Other Asset Price Responses to Monetary Policy Surprises and Shocks

	Advanced economies				Emerging markets			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable	mps_{nt}	mps^{o}_{nt}	$\epsilon^{MP,1}_{nt}$	$\epsilon^{CBI,1}_{nt}$	mps_{nt}	mps^{o}_{nt}	$\epsilon^{MP,1}_{nt}$	$\epsilon^{CBI,1}_{nt}$
NEER	2.1	2.0	2.0	2.6	-0.2	-0.2	-1.2	0.6
SE	0.7	0.7	0.9	0.8	0.4	0.4	0.8	0.4
R^2	0.16	0.15	0.16	0.16	0.15	0.15	0.16	0.16
ER vs. USD	2.2	2.1	1.3	3.3	-0.4	-0.5	-2.1	1.0
SE	0.8	0.8	1.0	1.0	0.7	0.6	1.2	0.3
R^2	0.31	0.31	0.31	0.31	0.17	0.17	0.19	0.19
Stock market	0.0	-0.1	-16.2	16.0	-2.2	-2.4	-15.8	12.7
SE	0.7	0.7	1.1	1.1	0.9	0.9	1.7	1.5
R^2	0.34	0.34	0.56	0.56	0.19	0.19	0.50	0.50
Sovereign bond spread	1.1	0.6	3.7	-5.4	1.9	2.4	5.5	-1.2
SE	3.2	3.4	6.1	3.7	1.8	1.5	2.6	3.4
R^2	0.31	0.31	0.31	0.31	0.24	0.24	0.24	0.24
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Year-month FE	YES	YES	YES	YES	YES	YES	YES	YES

Notes: Estimated coefficients using equation (14). Standard errors clustered at country level. Unbalanced sample from 2000 to 2022. Lefthand side and righthand side variables are winsorized at 1 percent tails. See text for details.
Sources: See Annex I.

B. Dynamic impact

Next, we study the persistence and cumulative effects of monetary policy. The second specification estimates the impulse response of financial variables y_{nt} at horizon $h \in \{0, H\}$ to the shock m_{nt} as the coefficient β_n^h in the local projection:

$$y_{nt+h} - y_{nt-1} = \delta_{n,h} + \delta_{t+h} + \beta_h m_{nt} + \boldsymbol{\gamma}' \boldsymbol{x_{nt-1}} + u_{nt} \quad (15) \ ,$$

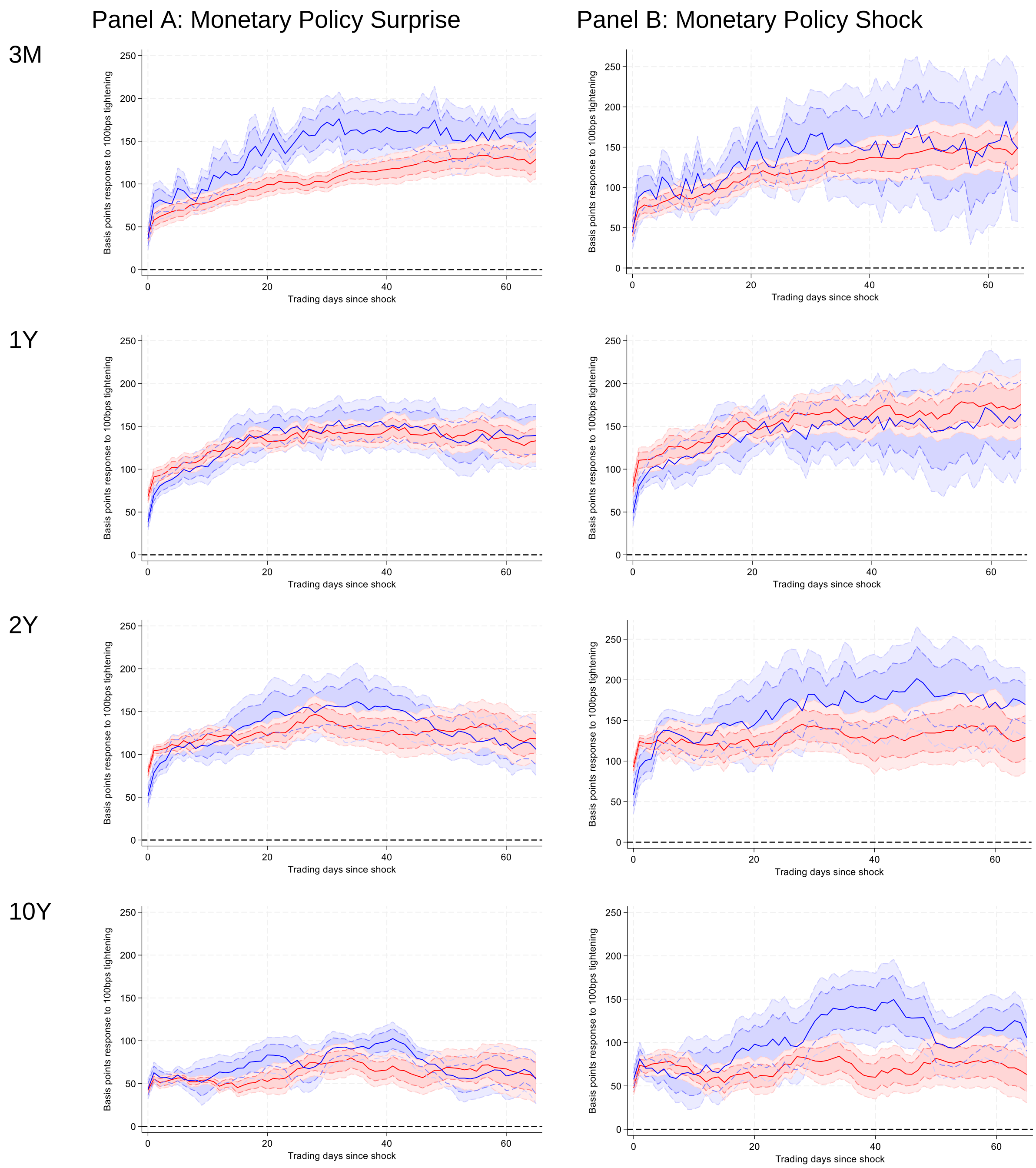
where $\delta_{n,h}$ and δ_{t+h} are country- and time-fixed effects, and $\boldsymbol{x_{nt-1}}$ is a vector of control variables on the day before the meeting. The dependent variables are again sovereign bond yields at different maturities, FX-denominated sovereign bond spreads, nominal effective and bilateral exchange rates, and stock market indices. The control variable include the three-month growth rates of the country's stock price index, nominal effective exchange rate, bilateral exchange rate vis a vis the USD, global commodity prices, and Brent crude oil prices, as well as the three-month change in the country's 3-month, 1-year, and 10-year government bond yields, and the CBOE Volatility Index (VIX). We examine impulse responses up to 65 trading days (approximately three months) for monetary policy surprises and monetary policy shocks. We report impulse responses for the orthogonalized monetary policy surprises and central bank information shocks in Annex III.

Sovereign bond yields. Figure 3 shows the impulse responses of the 3-month, 1-year, 2-year, and 10-year bond yields to a monetary policy surprise or shock. These are estimated separately for AEs and EMs. In each case, the panels report the estimated impulse responses along with 90 and 68 percent confidence bands with standard errors clustered at the country-level. The impulse responses of the 5-year bond yield is in Annex III.

Overall, the impulse responses suggest shocks transmit gradually but strongly to government bond yields. As shown in the top left panel of Figure 3, the effect of a 100 basis points monetary policy surprise on the 3-month yields in AEs and EMs continue to increase during the first two months, leading to cumulative, persistent impacts of about 150 and 125 basis points after three months. Transmission is similar for monetary policy shocks, as shown in the right panel. These results imply that the cumulative transmission to short-term bond yields is similar in emerging markets relative to advanced economies. We find similar patterns for transmission using orthogonalized monetary policy surprises and for central bank information shocks.

Figure 3: Dynamic Effects on Sovereign Bond Yields to MP Surprise and Shock

(Red: Advanced Economies; Blue: Emerging Markets)



Notes: Estimated coefficients and regression using equation (15). Standard errors clustered at country level. Unbalanced sample from 2000 to 2022. Lefthand side and righthand side variables are winsorized at 1 percent tails. See text for details.
Sources: See Annex I.

Similarly, following the immediate impact of a 100 basis points monetary policy surprise on the 1-year bond yield, the impact doubles in AEs and triples in EMs after six weeks, rising to about 150 basis points, and persists at least three months in both AEs and EMs. The impact of monetary policy shocks on 1-year yields is similar, and transmission to 2-year bond yields follows similar patterns as to the 1-year.

For the 10-year yields, the same-day impact of a 100 basis points monetary policy surprise is similar to that on shorter-maturity government bond yields, but the effects increase by less over time, flattening out at around 60 basis points higher in the three months after the shock. The effect of monetary policy shocks is of comparable magnitude, although the impact rises gradually to about 90 basis points after to three months.

Exchange rates. Figure 4 shows, as with the same-day impacts, monetary policy shocks appear to affect exchange rates differently in AEs and EMs. Following a monetary policy shock of 100 basis points, NEERs in AEs appreciate quickly, with a peak impact of 6.3 percent appreciation after 20 trading days, remaining at 3.3 percent after three months. In contrast, a 100-basis points shock leads to a slight depreciation in the NEER, by about 0.8 percent after 20 trading days, and bilateral exchange rates vis a vis the US dollar in EMs, with the effect disappearing after three months.

This finding for EMs is unexpected from standard open-economic macroeconomic models in which exchange rates appreciate in response to a monetary tightening. Other authors have documented this puzzle using other modeling approaches and methods for estimating the effects of monetary policy.[12] Kohlscheen (2014) finds evidence of this exchange rate puzzle for three Latin American countries, where unexpected rate hikes are not associated with currency appreciations on impact. We are, to our knowledge, the first to document this impact using high-frequency monetary policy shocks for a larger range of emerging markets, and to document its persistence. To explain this puzzle, the literature focuses on channels resulting from fiscal dominance (e.g., Alberola et al. 2022,

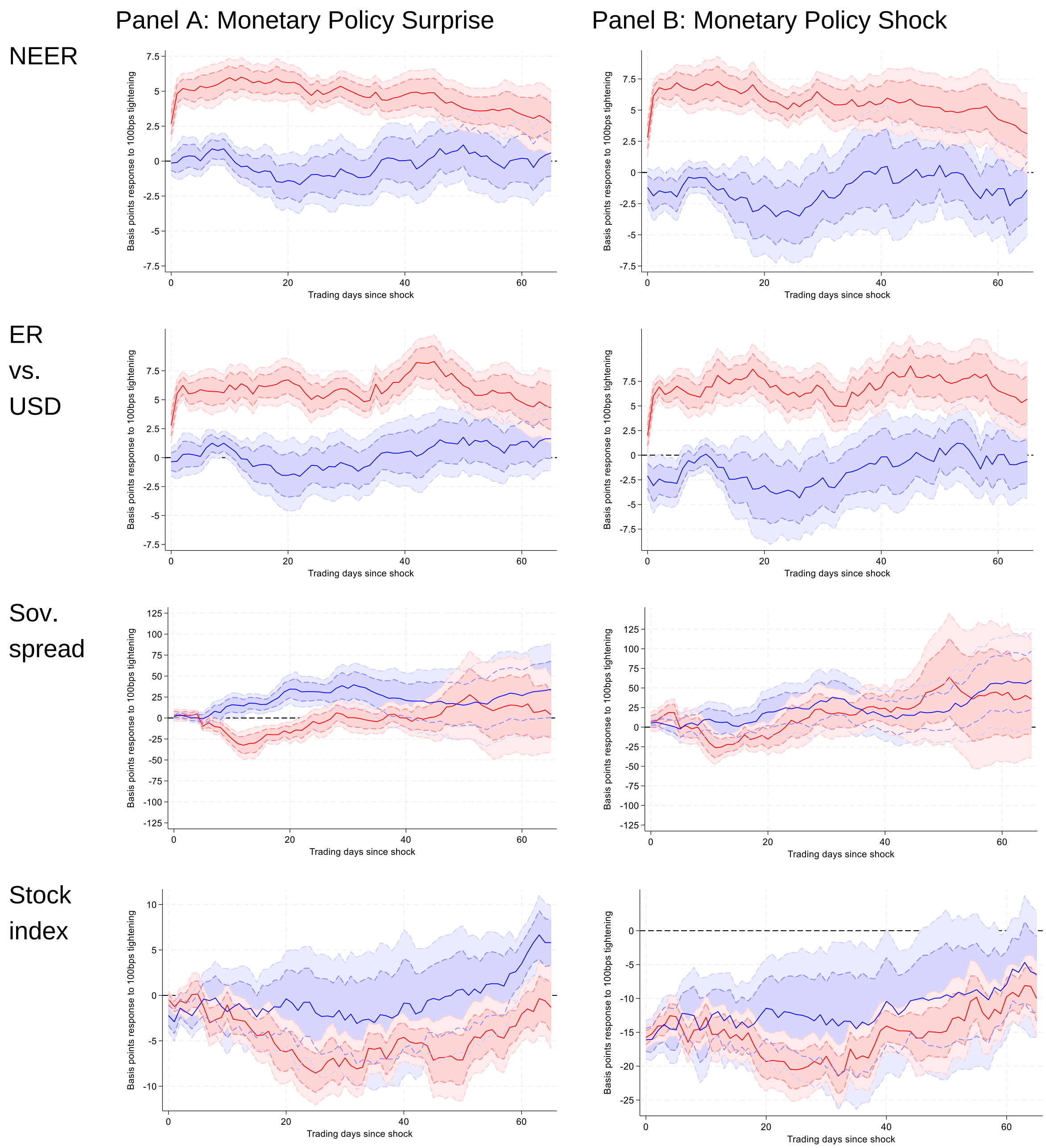
[12] Blanchard (2005) uses a structural model and macro data to argue that a central-bank-engineered increase in the real interest rate led to an exchange rate depreciation in Brazil in 2002 and 2003. Hnatkovska et al. (2016) run country-specific VARs and find that most developing countries in their sample show an exchange rate depreciation following a positive interest rate shock on impact. Alberola et al. (2022) examine daily movements of the Brazilian real around monetary policy announcements and find that an unconventional response of the exchange rate occurs when fiscal fundamentals are deteriorating and markets' concern about debt sustainability is rising. In a recent paper, Dominguez and Foschi (2024) find that currencies in emerging markets depreciated in response to announcements of large-scale asset purchase programs during the Covid-19 pandemic.

Blanchard 2005, Daniel 2001a, b, 2010, and Witheridge 2024). Increases in real interest rates can increase default risks in EMs when the fiscal authority does not take actions to fully offset higher interest costs. In this case, contractionary monetary policy can lead to a nominal exchange rate depreciation if changes in the risk premium dominate the increase in the interest rate differential. This can be explored in future research using our monetary policy shocks.

Sovereign bond spreads. Explanations that emphasize fiscal risks in EMs are supported by the impulse responses of spreads on sovereign bond yields (Figure 4). Sovereign spreads increase significantly by 31 basis points 20 trading days after a 100-basis points monetary policy surprise in EMs, whereas spreads in AEs fall by 16 basis points. After three months, spreads are 38 basis points higher in EMs, and spreads have fallen by 29 basis points in AEs. These differences are larger for monetary policy shocks. In EMs, the impact of a 100 basis points monetary policy shock on spreads is 63 basis points after three months, whereas this impact is -20 basis points in AEs.

Figure 4: Short-Run Dynamic Effects on Other Asset Prices to MP Surprise and Shock

(Red: Advanced Economies; Blue: Emerging Markets)



C. High-frequency spillovers

The third specification examines international spillovers of monetary policy events in AEs and takes a form similar to the previous specification. We pool observations for all countries *n* (AEs and EMs) other than the source country *m*, and estimate the following equation separately for each source country *m*:

$$y_{nt+h} - y_{nt-1} = \delta_{n,h} + \beta_h m_{m\neq n,t} + \boldsymbol{\gamma}' \boldsymbol{x_{nt-1}} + \boldsymbol{\eta}' \mathbf{z_t} + u_{nt} \quad (16) \ ,$$

where $m_{m\neq n,t}$ is the surprise or shock originating in source country *m*. $\boldsymbol{x_{nt-1}}$ is again the set of controls from section III, equation (15). To ensure we capture spillovers that account for differences in time zones, we use an horizon of three trading days for the main specification. The dependent variables are IRS rates and 3-month, 1-year, 2-year, and 10-year sovereign yields. $\mathbf{z_t}$ includes controls that reflect global shocks around the monetary policy surprise and includes the three-day change in the VIX, and the three-day growth rate of the Brent oil price.[13] We add the three-day change in the one-year US Treasury yield as a control for non-US source countries. The estimated coefficients β_h reflect the average impact of foreign shocks on these domestic variables.

Table 5 reports the results of these regressions for monetary policy shocks and central bank information shocks originating in AEs. Spillovers originating in EMs can be explored in future research. We report results for raw and orthogonalized monetary policy surprises in Annex III, as well as results for horizons of 10 trading days in Annex III.

The estimates suggests that policy decisions of AE central banks have substantial spillover effect on expected monetary policy rates in other countries (Table 5, columns 1 and 2). As expected, impacts are largest for the major central banks. A 100 basis points monetary policy surprise or shock by the Federal Reserve leads to increases in IRS rates in other countries by 19 basis points and 21 basis points respectively. For the ECB, the impacts are 39 and 41 basis points respectively. Monetary policy surprises and shocks by the Bank of Japan (BoJ) raise foreign swap rates by 38 and 71 basis points. Bank of England (BoE) monetary policy surprises and shocks increase foreign swap rates by 28 and 21 basis points. Overall, these results confirm previous findings from the literature on

[13] We use the Brent oil price instead of the WTI oil price because the latter becomes negative during the Covid crisis (Corbet et al., 2021).

monetary policy spillovers of the largest central banks, including the Federal Reserve (e.g., Albagli et al., 2019) the ECB (e.g., Walerych and Wesolowski, 2021), and the BoJ (IMF 2023, Box 1.2).

Remarkably, monetary policy decisions of even relatively small open economies spill over to the expected policy path in other countries. A 100 basis points monetary policy surprise or shock by the Reserve Bank of Australia raises swap rates in other countries by 24 basis points and 27 basis points. The impact of the Bank of Canada's monetary policy surprises and shocks is 14 and 26 basis points. Surprises and shocks originating in Sweden also raise the expectations of tighter monetary policy abroad, by 30 and 36 basis points respectively. Among all AE central banks in the sample, only shocks originating in Norway and New Zealand are associated with muted foreign effects. Overall, the median foreign impact of a 100 basis points monetary policy surprise among non-US central banks is 24 basis points, and the median impact of monetary policy shocks is 26 basis points. These impacts persist after 10 trading days (Annex Table A.7).

Monetary policy decisions of non-US central banks are also estimated to have considerable impact on medium- to long-term government bond yields in foreign countries. As shown in Table 5, among non-US central banks, the median pass-through of a 100 basis points monetary policy shock to foreign one-year, two-year and 10-year bond yields is 18, 24 and 29 basis points, respectively. Magnitudes are similar, although a bit smaller, for central bank information shocks.

What could explain the significant spillovers from monetary policy shocks originating in small open economies like Canada and Sweden? The literature on monetary policy spillovers has focused on how changed financial conditions in the source country transmits to other economies, through international trade flows (e.g., Di Giovanni and Hale, 2022; Zhang, 2022) and financial flows (e.g., Kalemli-Ozcan, 2019). The more limited trade and financial linkages of the small open economies to other economies in the sample, alongside the still substantial spillovers of their monetary policy shocks, suggest an important part of the spillovers may result from central bank information effects. For example, when macroeconomic shocks are correlated across countries, the private sector may update its estimates of macroeconomic fundamentals following the monetary policy decisions of foreign central banks as well as its own. This will be explored further in future research.

Table 5: International Spillovers of MP Surprises and Shocks in 3 Days – IRS Rates and Sovereign Bond Yields

	Swap rate		3-month		1-year		2-year		10-year	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Source country	mps_{nt}	$\epsilon_{nt}^{MP,1}$	mps_{nt}	$\epsilon_{nt}^{MP,1}$	mps_{nt}	$\epsilon_{nt}^{MP,1}$	mps_{nt}	$\epsilon_{nt}^{MP,1}$	mps_{nt}	$\epsilon_{nt}^{MP,1}$
United States	19	21	4	15	13	17	0	25	-21	3
SE	2.4	10.0	3.5	8.2	4.8	6.5	3.9	8.5	5.5	6.0
R^2	0.08	0.08	0.03	0.03	0.05	0.05	0.05	0.05	0.06	0.06
Australia	24	27	-1	-1	14	17	19	17	21	7
SE	2.8	5.3	3.7	6.6	2.9	4.6	2.7	3.7	2.7	4.4
R^2	0.18	0.18	0.07	0.07	0.11	0.12	0.13	0.13	0.09	0.09
Canada	14	26	-5	-1	9	20	15	24	16	29
SE	3.0	4.8	3.0	5.1	3.2	5.4	3.3	5.2	3.5	5.9
R^2	0.15	0.15	0.07	0.07	0.09	0.09	0.12	0.13	0.07	0.07
Eurozone	39	41	8	14	18	21	40	46	27	37
SE	5.7	6.9	6.3	10.9	5.7	8.1	6.7	11.3	8.1	10.6
R^2	0.16	0.16	0.06	0.06	0.11	0.11	0.18	0.18	0.12	0.12
Japan	38	71	-2	3	24	41	58	112	140	242
SE	11.5	17.2	10.7	16.4	14.1	17.7	14.7	19.7	15.3	21.1
R^2	0.09	0.09	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.09
Norway	6	0	3	2	11	9	14	4	6	-3
SE	2.2	3.1	3.3	2.7	2.8	4.8	4.2	5.7	3.3	4.8
R^2	0.11	0.11	0.04	0.04	0.07	0.07	0.09	0.09	0.04	0.04
New Zealand	8	2	-1	-5	4	1	6	5	2	-1
SE	2.5	3.1	2.2	4.3	1.9	3.2	2.3	2.7	1.8	4.1
R^2	0.08	0.09	0.04	0.04	0.07	0.07	0.08	0.08	0.06	0.06
Sweden	30	36	11	-1	24	18	30	44	26	62
SE	4.0	5.6	3.7	5.8	4.2	6.4	5.2	9.2	3.7	7.9
R^2	0.11	0.11	0.06	0.06	0.09	0.09	0.12	0.13	0.10	0.11
United Kingdom	28	21	5	5	29	24	39	41	17	45
SE	4.9	6.5	2.8	5.3	5.7	6.3	6.7	8.0	6.6	7.0
R^2	0.11	0.11	0.04	0.04	0.09	0.09	0.11	0.11	0.06	0.07
Mean non-US	24	28	2	2	17	19	28	37	32	52
Median non-US	24	26	-1	-1	14	18	19	24	17	29
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: Estimated coefficients and regression from regressions using equation (16). Standard errors clustered at country level, in parentheses. Unbalanced sample from 2000 to 2022. Lefthand side and righthand side variables are winsorized at 1 percent tails. See text for more details.
Sources: See Annex I.

V. Conclusions

This paper introduces a cross-country dataset of monetary policy shocks spanning 21 advanced economies and 8 emerging markets from 2000 to 2022. Leveraging the high-frequency method, we identify unexpected shifts in monetary policy through changes in interest rates swap rates around central bank announcements. We calculate these monetary policy surprises in a consistent manner across countries and use a simple framework to (i) remove the “central bank response to news” effect (Bauer and Swanson, 2023), and (ii) decompose the remaining surprises into exogenous monetary policy shocks and central bank information shocks (Jarociński and Karadi, 2020). Our dataset not only enables the examination of cross-country differences in the effects of monetary policy shocks but can shed light on the patterns of monetary policy spillovers between countries.

Our analysis unveils two notable empirical findings that challenge conventional macroeconomic theory. First, our results are consistent with previous studies that have documented an exchange rate puzzle for EMs, where contractionary monetary policy shocks lead to small exchange rate depreciations, instead of exchange rate appreciations as suggested by macroeconomic models and found empirically in AEs. Second, while previous studies have found that the monetary policy decisions of major central banks spill over to foreign economies, we uncover that there are also significant spillover effects from small open economies central banks to interest rates in other economies. These findings indicate that monetary policy spillovers may occur via information channels in addition to standard trade and financial channels.

This study opens avenues for further research into the drivers of exchange rate dynamics in response to monetary policy shocks in emerging markets and the mechanisms underlying the transmission of monetary policy spillovers. Our dataset can serve as a starting point for this research.

References

Albagli, E., Ceballos, L., Claro, S., & Romero, D. (2019). Channels of US monetary policy spillovers to international bond markets. *Journal of Financial Economics*, *134*(2), 447-473.

Alberola, E., Cantu Garcia, C., Cavallino, P., & Mirkov, N. (2022). *Fiscal regimes and the exchange rate* (No. 2022-01). Swiss National Bank.

Altavilla, C., Brugnolini, L., Gürkaynak, R. S., Motto, R., & Ragusa, G. (2019). Measuring euro area monetary policy. *Journal of Monetary Economics*, *108*, 162-179.

Bauer, M. D., & Swanson, E. T. (2023). A reassessment of monetary policy surprises and high-frequency identification. *NBER Macroeconomics Annual*, *37*(1), 87-155.

Bauer, M. D., & Swanson, E. T. (2023). An alternative explanation for the “Fed information effect”. *American Economic Review*, *113*(3), 664-700.

Bernanke, B. S., & Kuttner, K. N. (2005). What explains the stock market's reaction to Federal Reserve policy?. *The Journal of finance*, *60*(3), 1221-1257.

Blanchard, O. (2005). *Fiscal dominance and inflation targeting: lessons from Brazil*. NBER Working Paper 10389.

Brand, C., Buncic, D., & Turunen, J. (2010). The impact of ECB monetary policy decisions and communication on the yield curve. *Journal of the European Economic Association*, *8*(6), 1266-1298.

Braun, R., Miranda-Agrippino, S., & Saha, S. (2023). Measuring monetary policy in the UK: the UK Monetary Policy Event-Study Database.

Brandao-Marques, M. L., Gelos, M. R., Harjes, M. T., Sahay, M. R., & Xue, Y. (2020). *Monetary policy transmission in emerging markets and developing economies*. International Monetary Fund.

Brennan, C. M., Jacobson, M., Matthes, C., & Walker, T. B. (2024). Monetary Policy Shocks: Data or Methods?. Finance and Economics Discussion Series Federal Reserve Board, Washington, D.C

Bu, C., Rogers, J., & Wu, W. (2021). A unified measure of Fed monetary policy shocks. *Journal of Monetary Economics*, *118*, 331-349.

Camara, S. (2021). Spillovers of US interest rates: Monetary policy & information effects. *arXiv preprint arXiv:2111.08631*.

Campbell, J. R., Evans, C. L., Fisher, J. D., Justiniano, A., Calomiris, C. W., & Woodford, M. (2012). Macroeconomic effects of federal reserve forward guidance [with comments and discussion]. *Brookings papers on economic activity*, 1-80.

Campbell, J. R., Fisher, J. D., Justiniano, A., & Melosi, L. (2017). Forward guidance and macroeconomic outcomes since the financial crisis. *NBER Macroeconomics Annual*, *31*(1), 283-357.

Cesa-Bianchi, A., Thwaites, G., & Vicondoa, A. (2020). Monetary policy transmission in the United Kingdom: A high frequency identification approach. *European Economic Review*, *123*, 103375.

Choi, S., Willems, T., & Yoo, S. Y. (2024). Revisiting the monetary transmission mechanism through an industry-level differential approach. *Journal of Monetary Economics*, 103556.

Cieslak, A. (2018). Short-rate expectations and unexpected returns in treasury bonds. *The Review of Financial Studies*, *31*(9), 3265-3306.

Cieslak, A., & Schrimpf, A. (2019). Non-monetary news in central bank communication. *Journal of International Economics*, *118*, 293-315.

Cloyne, J., Ferreira, C., Froemel, M., & Surico, P. (2023). Monetary policy, corporate finance, and investment. *Journal of the European Economic Association*, *21*(6), 2586-2634.

Corbet, S., Hou, Y. G., Hu, Y., & Oxley, L. (2021). An analysis of investor behaviour and information flows surrounding the negative WTI oil price futures event. *Energy Economics*, *104*, 105589.

D'Amico, S., & Farka, M. (2011). The Fed and the stock market: An identification based on intraday futures data. *Journal of Business & Economic Statistics*, *29*(1), 126-137.

Daniel, B. C. (2001). A fiscal theory of currency crises. *International Economic Review*, *42*(4), 969-988.

Daniel, B. C. (2001). The fiscal theory of the price level in an open economy. *Journal of Monetary Economics*, *48*(2), 293-308.

Daniel, B. C. (2010). Exchange rate crises and fiscal solvency. *Journal of Money, Credit and Banking*, *42*(6), 1109-1135.

Das, S., & Song, W. (2023). Monetary Policy Transmission and Policy Coordination in China. *China Economic Review*, *82*.

Deb, P., Estefania-Flores, J., Firat, M., Furceri, D., & Kothari, S. (2023). Monetary Policy Transmission Heterogeneity: Cross-Country Evidence. *IMF Working Papers*, *2023*(204).

Di Giovanni, J., & Hale, G. (2022). Stock market spillovers via the global production network: Transmission of US monetary policy. *The Journal of Finance*, *77*(6), 3373-3421.

Dominguez, K. M., & Foschi, A. (2024). *Whatever-It-Takes Policymaking during the Pandemic* (No. w32115). National Bureau of Economic Research.

Farmer, L., Nakamura, E., & Steinsson, J. (2024). Learning about the long run. *Journal of Political Economy*, forthcoming.

Fratzscher, M., Lo Duca, M., & Straub, R. (2016). ECB unconventional monetary policy: Market impact and international spillovers. *IMF Economic Review*, *64*, 36-74.

Georgiadis, G. (2016). Determinants of global spillovers from US monetary policy. *Journal of international Money and Finance*, *67*, 41-61.

Gertler, M., & Karadi, P. (2015). Monetary policy surprises, credit costs, and economic activity. *American Economic Journal: Macroeconomics*, *7*(1), 44-76.

Gilchrist, S., López-Salido, D., & Zakrajšek, E. (2015). Monetary policy and real borrowing costs at the zero lower bound. *American Economic Journal: Macroeconomics*, *7*(1), 77-109.

Gürkaynak, R. S., Kara, A. H., Kısacıkoğlu, B., & Lee, S. S. (2021). Monetary policy surprises and exchange rate behavior. *Journal of International Economics*, *130*, 103443.

Gürkaynak, R., Karasoy-Can, H. G., & Lee, S. S. (2022). Stock market's assessment of monetary policy transmission: The cash flow effect. *The Journal of Finance*, *77*(4), 2375-2421.

Gürkaynak, R. S., Sack, B., & Swanson, E. (2005). The sensitivity of long-term interest rates to economic news: Evidence and implications for macroeconomic models. *American economic review*, *95*(1), 425-436.

Hansen, S., McMahon, M., & Tong, M. (2019). The long-run information effect of central bank communication. *Journal of Monetary Economics*, *108*, 185-202.

Hanson, S. G., & Stein, J. C. (2015). Monetary policy and long-term real rates. *Journal of Financial Economics*, *115*(3), 429-448.

Hnatkovska, V., Lahiri, A., & Vegh, C. A. (2016). The exchange rate response to monetary policy innovations. *American Economic Journal: Macroeconomics*, *8*(2), 137-181.

International Monetary Fund, October 2023, Regional Economic Outlook Asia and Pacific, Challenges to Sustaining Growth and Disinflation, Box 1.2.

Jarociński, M. (2022). Central bank information effects and transatlantic spillovers. *Journal of International Economics*, *139*, 103683.

Jarociński, M., & Karadi, P. (2020). Deconstructing monetary policy surprises—the role of information shocks. *American Economic Journal: Macroeconomics*, *12*(2), 1-43.

Jeenas, P. (2023). *Firm balance sheet liquidity, monetary policy shocks, and investment dynamics*. Universitat Pompeu Fabra, Department of Economics and Business.

Jordà, Ò., Schularick, M., & Taylor, A. M. (2020). The effects of quasi-random monetary experiments. *Journal of Monetary Economics*, *112*, 22-40.

Kalemli-Özcan, Ṣ. (2019). *US monetary policy and international risk spillovers* (No. w26297). National Bureau of Economic Research.

Kerssenfischer, M. (2022). Information effects of euro area monetary policy. *Economics Letters*, *216*, 110570.

Kohlscheen, E. (2014). The impact of monetary policy on the exchange rate: A high frequency exchange rate puzzle in emerging economies. *Journal of International Money and Finance*, *44*, 69-96.

Kuttner, K. N. (2001). Monetary policy surprises and interest rates: Evidence from the Fed funds futures market. *Journal of monetary economics*, *47*(3), 523-544.

Lloyd, S. P. (2021). Overnight indexed swap-implied interest rate expectations. *Finance Research Letters*, *38*, 101430.

Miranda-Agrippino, S., & Rey, H. (2020). US monetary policy and the global financial cycle. *The Review of Economic Studies*, *87*(6), 2754-2776.

Miranda-Agrippino, S., & Ricco, G. (2021). The transmission of monetary policy shocks. *American Economic Journal: Macroeconomics*, *13*(3), 74-107.

Nakamura, E., & Steinsson, J. (2018). High-frequency identification of monetary non-neutrality: the information effect. *The Quarterly Journal of Economics*, *133*(3), 1283-1330.

Ottonello, P., & Winberry, T. (2020). Financial heterogeneity and the investment channel of monetary policy. *Econometrica*, *88*(6), 2473-2502.

Pinchetti, M., & Szczepaniak, A. (2023). Global spillovers of the Fed information effect. *IMF Economic Review*, 1-47.

Romer, C. D., & Romer, D. H. (1994). Monetary policy matters. *Journal of Monetary Economics*, 43(1), 75-88.

Romer, C. D., & Romer, D. H. (2000). Federal Reserve information and the behavior of interest rates. *American economic review*, *90*(3), 429-457.

Rogers, J. H., Scotti, C., & Wright, J. H. (2014). Evaluating asset-market effects of unconventional monetary policy: a multi-country review. *Economic Policy*, *29*(80), 749-799.

Swanson, E. T. (2021). Measuring the effects of federal reserve forward guidance and asset purchases on financial markets. *Journal of Monetary Economics*, *118*, 32-53.

Tenreyro, S., & Thwaites, G. (2016). Pushing on a string: US monetary policy is less powerful in recessions. *American Economic Journal: Macroeconomics*, *8*(4), 43-74.

Willems, T. (2020). What do monetary contractions do? Evidence from large tightenings. *Review of Economic Dynamics*, *38*, 41-58.

Witheridge, W. (2024). *Monetary Policy and Fiscal-led Inflation in Emerging Markets*. Mimeo.

Wright, J. H. (2012). What does monetary policy do to long-term interest rates at the zero lower bound?. *The Economic Journal*, *122*(564), F447-F466.

Zhang, T. (2022). Monetary policy spillovers through invoicing currencies. *The Journal of Finance*, *77*(1), 129-161.

Annex I. Data

A. Sample and variables

Our starting sample contains 28 central banks for which interest rate swaps (IRS) are available in Refinitiv Datastream. We drop Colombia, Iceland, Indonesia, Malaysia, Philippines, Russia, South Africa, and Turkey because data on one-year government bond yields is missing, the maturity of the IRS is too short, or because the IRS is not liquid enough. This leaves us with 20 central banks. For the euro area, we collect financial data for 10 countries (Austria, Belgium, Germany, Spain, Finland, France, Ireland, Italy, Netherland, and Portugal). This brings the total to 29 countries, out of which 22 countries are advanced economies (AEs) and 8 are emerging markets (EMs).

We use IRS rates to construct our surprise variable. Data is extracted from Refinitiv DataStream. Table A.1 below shows the specific IRS data we use for each country. The maturities of our interest swap series are one year. If available, we use the overnight index swap (OIS) rate in which the overnight interbank borrowing rate serve as the floating end of the contract. If the OIS is not available, we use an IRS with an underlying floating rate that has the shortest possible tenor.

Our data for central bank announcements is from Bloomberg Economic Calendar. The data series contains the dates and time of monetary policy announcements as well as current and previous monetary policy rate. In Table A.2, we presented the target policy rates being announced and the corresponding maturities. We also report the frequency and timing of central bank announcements in the last two columns. Most countries in our sample have announcements before financial market close with exceptions including Brazil, Chile and Philippines which announce policy rates after market close. Therefore, for most countries, monetary surprises are constructed as the difference in the swap rate at t and t-1. For Brazil, Chile, and Philippines, since the announcement is supposed to affect financial market rate on the next day, the monetary surprise is constructed as the difference of the swap rates at t+1 and t. For cases where announcements are made during the weekends, the monetary surprise is the difference of swap rates on Monday and previous Friday.

Other variables we use in this paper are listed in Table A.3. They are categorized based on the availability of the frequency into daily, monthly, and quarterly data. We interpolate missing observations for bond yields with maturities ranging from three months to 10 years. The data sources for government bond yields are Haver and the Global Financial Data (GFD), whichever has the best coverage across time periods.

Table A.1 Interest rate derivative rates from Bloomberg

Country	Name of Swap Series	Code	Unit	Tenor	Type of floating rate
Australia	ICAP AUD 1Y OIS	IA$OI1Y	A$	Overnight	Interbank rate (AONIA)
Brazil	BRAZIL DI-PRE FIXED FLOAT IRS 1Y	BRDPR1Y	C	Overnight	Interbank rate (DI)
Canada	ICAP CAD 1Y OIS	IC$OI1Y	C$	Overnight	Repo rate (CORRA)
Chile	CHILEAN PESO 1Y CAMARA OIS	CL1YOIS	CE	Overnight	Interbank rate (CLPCamara)
China	RFV CNY QM A/365 7D REPO IRS 1Y	CNQMR1Y	CH	7 days	Repo rate
Eurozone	EURO 1 YEAR OIS	OIEUR1Y	E	Overnight	Interbank rate (EONIA to €STR)
Hungary	RFV HUF AB A/365 6M BUBOR IRS 1Y	TRHN61Y	HF	6 months	Interbank rate (BUBOR)
India	INDIAN RUPEE OIS 1 YEAR	INROS1Y	IR	Overnight	Interbank rate (MIBOR)
Israel	RFV ILS AM A/365 3M TELBO IRS 1Y	ICILS1Y	I£	3 months	Interbank rate (TELBOR)
Japan	JAPANESE YEN 1 YEAR OIS	OIJPY1Y	Y	Overnight	Interbank rate (TONAR)
Mexico	RFV MXN 28D BND/28D TIIE IRS 13M*	ICMX13M	MP	28 days	Repo rate (TIIE)
New Zealand	RFV NZD SM A/365 3M BK BILL IRS 1Y	TRNZD1Y	Z$	3 months	Interbank rate (BKBM)
Norway	ICAP NOK AB 30/360 3M OIBOR IRS 1Y	ICNOK1Y	NK	3 months	Interbank rate (OIBOR)
Poland	POLISH ZLOTY 1 YEAR OIS	OIPLN1Y	PZ	Overnight	Interbank rate (WIBOR)
Korea	RFV KRW QM A/365 91 DAY CD IRS 1Y	TRKOI1Y	KW	91 days	CD rate
Sweden	SWEDEN KRONA OIS 1Y INDEX	OISSD1Y	SK	Overnight	Interbank rate (STIBOR)
Switzerland	SWISS FRANC 1 YEAR OIS	OICHF1Y	SF	Overnight	Interbank rate (SARON)
Thailand	RFV THB SB A/365 6M THBFIX IRS 1Y	ICTHB1Y	TB	6 months	Interbank rate (THBFIX)
United Kingdom	RFV GBP AM A/365 3M LIBOR IRS 1Y	TRUK31Y	£	3 months	Interbank rate (LIBOR)
United States	US DOLLAR 1 YEAR OIS	OIUSD1Y	U$	Overnight	Interbank rate (EFFR)

Notes:

1/ The series with (*) are selected because one-year swap series are not available in those countries.

2/ Repo market is the secured segment under interbank borrowing market.

Source: Refinitiv DataStream.

Table A.2. Central Bank Monetary Policy Announcements

Country	Meeting frequency (per year)
Australia	11
Brazil	8
Canada	8
Chile	8
China 1/	N/A
Euro Area 2/	8
Hungary	12
India	6
Israel	8
Japan 3/	8
Korea	8
Mexico	8
New Zealand	7
Norway	8
Poland	11
Sweden	5
Switzerland	4
Thailand	6
United Kingdom	8
United States	8

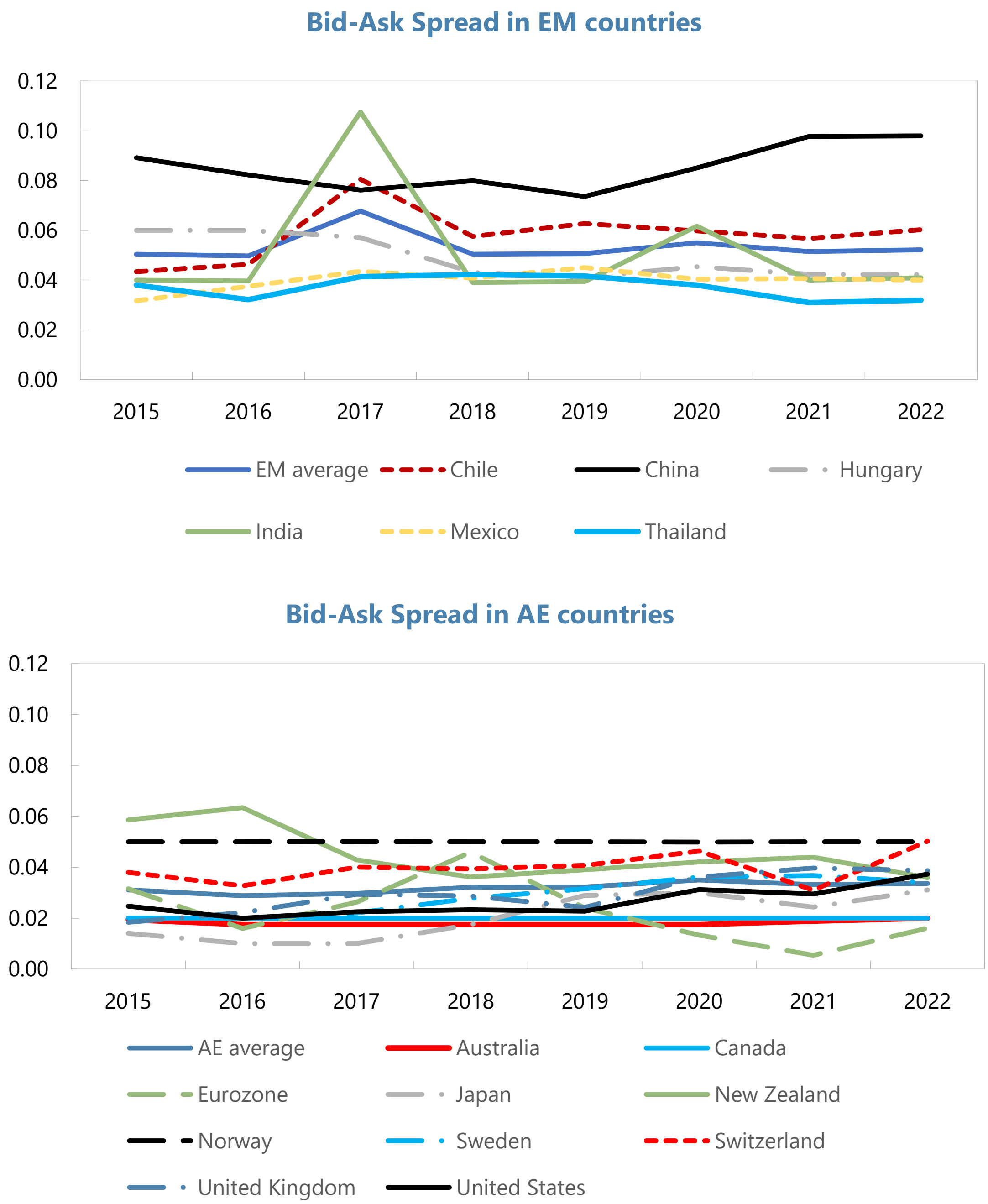
Notes:
1/ China: we use the series provided by Das et al. (2023). They consider policy events when there are changes to the PBC's main policy instruments from 2008 onwards. There are: (i) the reserve requirement ratio (RRR); (ii) PBC's 7-day reverse repo rate; (iii) benchmark deposit and lending rates (LDR); (iv) the rate on the PBC's medium-term lending facility (MLF).
2/ ECB: Their main monetary policy rates include: (i) the interest rate on the main refinancing operations (MRO); ii) the interest rate on the deposit facility (DFR), and iii) the interest rate on the marginal lending facility (MLF). Here we consider announcements regarding the MRO rate.
3/ Japan: Their main monetary policy rates include: (i) Interest rate applied to the Policy-Rate Balance in current account; (ii) JGB yields. Here we consider the announcements regarding the policy balance rate.
Source: Central bank websites, BIS.

Table A.3. Dependent variables

Frequency	Variable	Unit	Source
Daily	Government bond yield (3m-10y)	%	Haver; GFD
	Stock market index	index	Haver
	Nominal effective exchange rate (NEER)	index	Haver
	Exchange rate per US$	LCU	Haver
	Commodity price index	index	Bloomberg
	Inflation data	index	State Street
	Monetary policy rate	%	Haver
	Sovereign spread (FX denominated bonds) – weighted average	index	IMF
	United States CBOE Volatility Index	index	Haver
	BofA Merrill Lynch Option Volatility Estimation Index (1,3, and 6 months)	index	Haver

Notes: GFD refers to Global Financial Data.

Figure A.1. Liquidity measures



Note: Bid-ask spread defined as average daily bid minus average daily ask. Figure plots annual means by country, and for EMs and AEs as group (unweighted means).
Source: Refinitiv Datastream.

B. Surprise series

Table A.5: Summary statistics of monetary policy surprises and shocks

		(1)	(2)	(3)	(4)
		mps_{nt}	mps_{nt}^{o}	$\epsilon_{nt}^{MP,1}$	$\epsilon_{nt}^{CBI,1}$
Australia	Obs.	230	230	230	230
	Mean	-0.3	0.0	-0.4	0.4
	Median	0.0	-0.2	0.0	0.0
	S.D.	9.9	9.2	7.5	5.3
Brazil	Obs.	110	110	110	110
	Mean	-0.6	0.0	-0.3	0.3
	Median	0.0	0.6	0.0	0.0
	S.D.	14.2	14.2	11.4	8.5
Canada	Obs.	175	175	175	175
	Mean	-0.1	0.0	0.1	-0.1
	Median	0.0	0.1	0.0	0.0
	S.D.	7.8	7.7	6.9	3.3
Chile	Obs.	136	136	136	136
	Mean	1.8	0.0	0.4	-0.4
	Median	0.0	0.0	0.0	0.0
	S.D.	14.7	13.0	11.7	5.7
China	Obs.	166	166	166	166
	Mean	-0.8	0.0	-0.2	0.2
	Median	0.0	0.1	0.0	0.0
	S.D.	8.5	7.8	6.0	5.0
Eurozone	Obs.	267	267	267	267
	Mean	0.2	0.0	0.0	0.0
	Median	-0.1	-0.2	0.0	0.0
	S.D.	5.9	5.9	4.4	4.0
Hungary	Obs.	237	237	237	237
	Mean	-0.2	0.0	0.0	0.0
	Median	0.0	0.2	0.0	0.0
	S.D.	12.9	12.9	11.9	5.1
India	Obs.	125	125	125	125
	Mean	2.3	0.0	-0.2	0.2
	Median	1.0	-1.3	0.0	0.0
	S.D.	15.1	15.1	12.1	9.0
Israel	Obs.	177	177	177	177
	Mean	1.3	0.0	0.5	-0.5
	Median	0.0	-1.3	0.0	0.0
	S.D.	24.2	24.2	23.9	3.7
Japan	Obs.	142	142	142	142
	Mean	0.2	0.0	-0.1	0.1
	Median	0.0	-0.1	0.0	0.0
	S.D.	1.2	1.2	0.9	0.7

Notes: See text for details.
Sources: See Annex I.

Table A.5: Summary statistics of monetary policy surprises and shocks (continued)

		(1)	(2)	(3)	(4)
		mps_{nt}	mps_{nt}^{o}	$\epsilon_{nt}^{MP,1}$	$\epsilon_{nt}^{CBI,1}$
Korea	Obs.	253	253	253	253
	Mean	-0.4	0.0	-0.3	0.3
	Median	0.0	0.0	0.0	0.0
	S.D.	7.5	7.2	5.6	4.6
New Zealand	Obs.	179	179	179	179
	Mean	-0.6	0.0	-0.3	0.3
	Median	0.0	0.6	0.0	0.0
	S.D.	8.5	8.5	6.8	5.1
Norway	Obs.	183	183	183	183
	Mean	-0.6	0.0	0.4	-0.4
	Median	0.0	0.6	0.0	0.0
	S.D.	7.6	7.6	5.6	5.2
Poland	Obs.	209	209	209	209
	Mean	0.6	0.0	-0.3	0.3
	Median	0.0	-0.7	0.0	0.0
	S.D.	7.8	7.6	4.8	5.9
Sweden	Obs.	135	135	135	135
	Mean	-1.0	0.0	-0.1	0.1
	Median	-0.5	0.2	0.0	0.0
	S.D.	7.6	6.7	4.5	5.0
Switzerland	Obs.	48	48	48	48
	Mean	-0.6	0.0	0.4	-0.4
	Median	0.6	1.1	0.0	0.0
	S.D.	8.1	8.1	2.4	7.7
Thailand	Obs.	157	157	157	157
	Mean	0.0	0.0	-0.1	0.1
	Median	0.0	0.0	0.0	0.0
	S.D.	5.0	5.0	2.9	4.0
United Kingdom	Obs.	253	253	253	253
	Mean	-0.4	0.0	0.1	-0.1
	Median	-0.1	0.3	0.0	0.0
	S.D.	4.8	4.8	3.3	3.5
United States	Obs.	174	174	174	174
	Mean	-0.4	0.0	0.0	0.0
	Median	0.0	0.4	0.0	0.0
	S.D.	5.2	5.2	2.7	4.5

Notes: See text for details.
Sources: See Annex I.

Annex II. Framework

The monetary policy surprise is given by

$$(\boldsymbol{A.1})\quad mps_{nt} \equiv \Delta E_{nt}\mu_{nt+k} + [g_{nt}(E_{nt}\boldsymbol{X_{nt+k}}) - g_{nt-1}(E_{nt-1}\boldsymbol{X_{nt+k}})] \quad .$$

inserting equation (5) gives

$$(\boldsymbol{A.2})\quad mps_{nt} = \Delta E_{nt}\mu_{nt+k} + (c_{nt-1} + \phi_{nt})E_{nt}\boldsymbol{X_{nt+k}} - c_{nt-1}E_{nt-1}\boldsymbol{X_{nt+k}} \quad .$$

Equations (6) and (7) imply $E_{nt}\boldsymbol{X_{nt+k}} = \gamma_n(\zeta_n\boldsymbol{X_{nt-1}} + \boldsymbol{\tilde{\eta}_{nt}})$ and $E_{nt-1}\boldsymbol{X_{nt+k}} = \gamma_n\zeta_n\boldsymbol{X_{nt-1}}$. Inserting into (A.1) and (A.2) gives

$$(\boldsymbol{A.3})\quad mps_{nt} = \Delta E_{nt}\mu_{nt+k} + \gamma_n\zeta_n\,\phi_{nt}\boldsymbol{X_{nt-1}} + (c_{nt-1} + \phi_{nt})\tilde{\eta}_{nt}$$

Equation (A.3) corresponds to equation (8) in the main text, with $\beta_n \equiv \gamma_n\zeta_n\,\bar{\phi}_n$ and $\tilde{\epsilon}_{nt} \equiv \Delta E_{nt}\mu_{nt}^{k} + (c_{nt-1} + \phi_{nt})\tilde{\eta}_{nt}$.

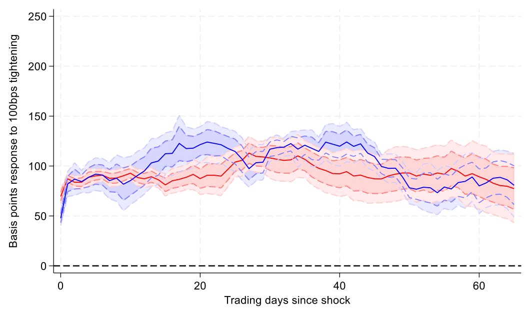
Annex III. Additional results

Figure A.2. Short-Run Dynamic Effects of Monetary Policy Surprises and Shocks – 5-year Sovereign Bond Yield

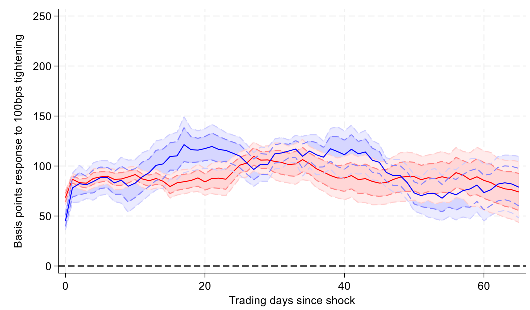
(Red: Advanced Economies; Blue: Emerging Markets)

Panel A: Monetary Policy Surprise

5Y

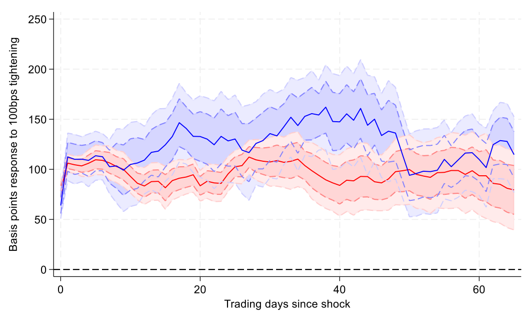


Panel B: Orthogonalized Monetary Policy Surprise

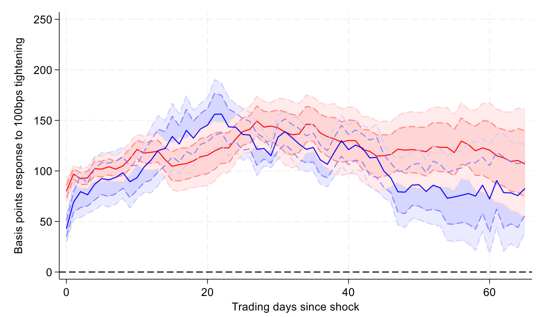


Panel C: Monetary Policy Shock

5Y



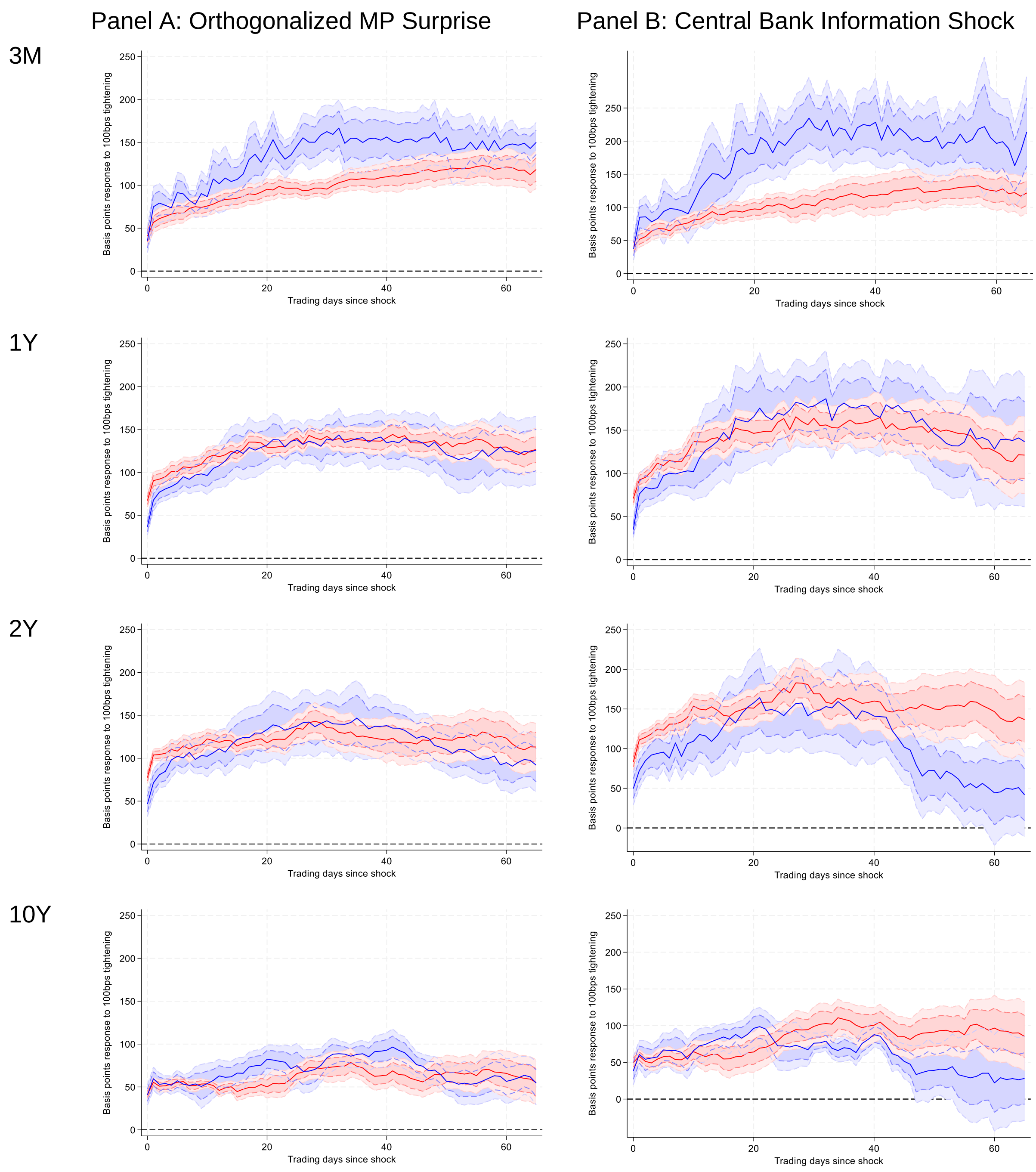
Panel D: Central Bank Information Shock



Notes: Estimated coefficients and regression using equation (15). Standard errors clustered at country level. Unbalanced sample from 2000 to 2022. Lefthand side and righthand side variables are winsorized at 1 percent tails. See text for more details.
Sources: See Annex I.

Figure A.3: Short-Run Dynamic Effects of Monetary Policy Surprises and Central Bank Information Shocks – Sovereign bond yields

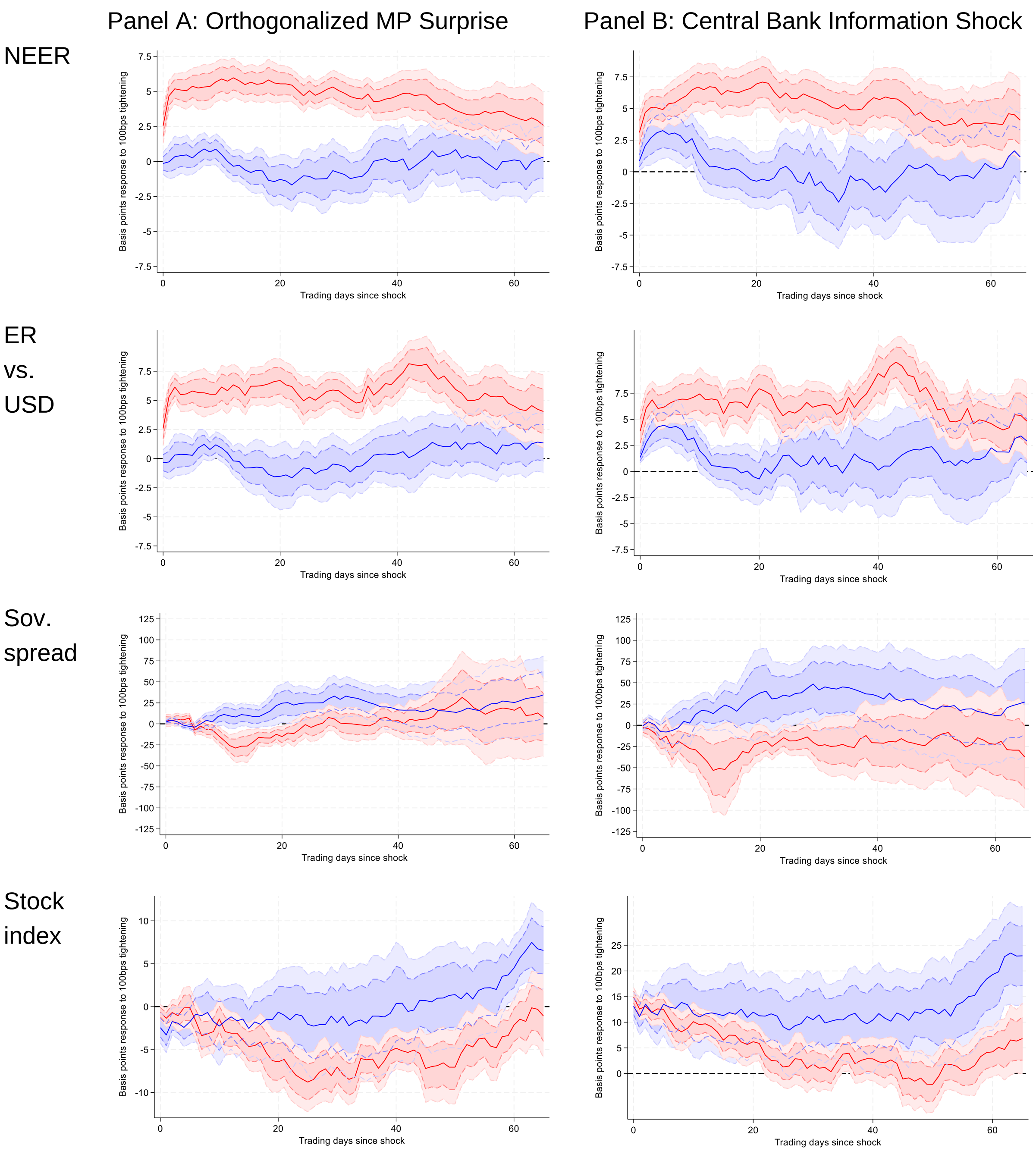
(Red: Advanced Economies; Blue: Emerging Markets)



Notes: Estimated coefficients and regression using equation (15). Standard errors clustered at country level. Unbalanced sample from 2000 to 2022. Lefthand side and righthand side variables are winsorized at 1 percent tails. See text for details.
Sources: See Annex I.

Figure A.4: Short-Run Dynamic Effects of Monetary Policy Surprises and Central Bank Information Shocks – Other Asset Prices

(Red: Advanced Economies; Blue: Emerging Markets)



Notes: Estimated coefficients and regression using equation (15). Standard errors clustered at country level. Unbalanced sample from 2000 to 2022. Lefthand side and righthand side variables are winsorized at 1 percent tails. See text for details.
Sources: See Annex I.

Table A.6: International Spillovers of MP Surprises and Shocks in 10 Days – IRS rates and Sovereign Bond Yields

	Swap rate		3-month		1-year		2-year		10-year	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Source country	mps_{nt}	$\epsilon_{nt}^{MP,1}$	mps_{nt}	$\epsilon_{nt}^{MP,1}$	mps_{nt}	$\epsilon_{nt}^{MP,1}$	mps_{nt}	$\epsilon_{nt}^{MP,1}$	mps_{nt}	$\epsilon_{nt}^{MP,1}$
United States	49	52	-6	22	33	48	46	68	0	73
SE	8.0	9.9	8.1	11.9	5.6	9.8	5.0	12.3	6.6	8.6
R^2	0.11	0.11	0.07	0.08	0.09	0.09	0.07	0.07	0.04	0.04
Australia	19	18	-11	-28	10	1	15	12	28	3
SE	6.1	12.7	4.8	10.2	4.0	6.4	4.2	6.1	3.4	6.3
R^2	0.15	0.15	0.11	0.11	0.11	0.11	0.11	0.11	0.04	0.05
Canada	43	48	-3	-4	24	29	37	42	32	23
SE	3.1	5.6	4.7	6.0	5.5	8.6	5.3	8.8	4.3	8.0
R^2	0.18	0.18	0.10	0.10	0.09	0.09	0.12	0.12	0.05	0.05
Eurozone	38	54	0	15	11	18	37	41	29	46
SE	13.7	20.1	7.8	15.3	9.9	15.1	10.1	18.3	8.4	16.5
R^2	0.14	0.14	0.09	0.09	0.12	0.12	0.14	0.14	0.08	0.08
Japan	-25	12	-49	-15	-16	16	-34	24	18	147
SE	23.2	37.2	21.1	36.6	13.5	27.1	20.1	29.4	20.2	29.8
R^2	0.06	0.06	0.10	0.10	0.05	0.05	0.05	0.05	0.05	0.06
Norway	13	-5	7	0	17	5	19	-10	8	-15
SE	4.6	10.4	4.9	6.1	4.5	6.8	4.9	8.1	2.3	4.9
R^2	0.16	0.16	0.13	0.14	0.10	0.11	0.09	0.10	0.07	0.07
New Zealand	12	-2	0	-8	9	4	16	9	22	18
SE	3.4	4.5	3.7	7.5	3.9	5.7	3.7	5.1	3.8	6.8
R^2	0.12	0.12	0.08	0.08	0.10	0.10	0.09	0.09	0.07	0.07
Sweden	21	-5	8	-12	22	-6	29	12	43	67
SE	9.7	13.2	4.5	9.8	7.9	11.3	6.9	8.8	7.0	10.6
R^2	0.13	0.13	0.10	0.10	0.11	0.12	0.12	0.12	0.08	0.09
United Kingdom	20	12	3	2	20	14	18	7	6	44
SE	7.6	11.1	7.2	10.3	7.9	10.9	7.0	8.0	8.1	10.1
R^2	0.11	0.11	0.08	0.08	0.09	0.09	0.09	0.09	0.06	0.07
Mean non-US	18	16	-6	-6	12	10	17	17	23	42
Median non-US	19	12	0	-6	14	9	18	12	25	34
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: Estimated coefficients and regression from regressions using equation (16). Standard errors clustered at country level, in parentheses. Unbalanced sample from 2000 to 2022. Lefthand side and righthand side variables are winsorized at 1 percent tails. See text for more details.
Sources: See Annex I.

Table A.7: International Spillovers of MP Surprises and CBI in 10 Days – IRS rates and Sovereign Bond Yields

	Swap rate		3-month		1-year		2-year		10-year	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Source country	mps_{nt}^{o}	ϵ_{nt}^{CBI1}	mps_{nt}	ϵ_{nt}^{CBI1}	mps_{nt}	ϵ_{nt}^{CBI1}	mps_{nt}	ϵ_{nt}^{CBI1}	mps_{nt}	ϵ_{nt}^{CBI1}
United States	49	58	-6	-24	32	26	45	40	0	-40
SE	8.0	15.0	8.0	13.1	5.6	10.7	5.0	8.5	6.6	13.4
R^2	0.11	0.11	0.07	0.08	0.09	0.09	0.07	0.07	0.04	0.04
Australia	22	30	-7	8	13	25	17	23	27	49
SE	6.0	5.6	5.3	7.4	4.6	8.0	4.1	5.6	3.3	6.1
R^2	0.16	0.15	0.11	0.11	0.11	0.11	0.11	0.11	0.04	0.05
Canada	41	40	-6	-10	21	13	37	35	31	53
SE	2.9	6.6	4.9	8.5	5.8	6.7	5.3	10.9	4.6	7.0
R^2	0.18	0.18	0.10	0.10	0.09	0.09	0.12	0.12	0.05	0.05
Eurozone	37	20	0	-16	11	4	37	40	29	13
SE	13.6	22.0	7.7	15.4	9.8	13.5	10.1	13.3	8.4	11.9
R^2	0.14	0.14	0.09	0.09	0.12	0.12	0.14	0.14	0.08	0.08
Japan	-16	-47	-48	-85	-6	-30	-8	-45	64	-30
SE	23.0	20.5	24.0	33.7	14.3	17.5	18.3	18.9	21.9	27.5
R^2	0.06	0.06	0.10	0.10	0.05	0.05	0.05	0.05	0.05	0.06
Norway	13	47	7	18	17	39	19	65	8	42
SE	4.5	7.4	4.8	8.9	4.4	7.0	4.9	6.8	2.2	5.5
R^2	0.16	0.16	0.13	0.14	0.10	0.11	0.09	0.10	0.07	0.07
New Zealand	12	34	0	7	9	17	16	29	22	38
SE	3.4	6.3	3.6	6.2	3.8	7.4	3.6	8.5	3.7	6.5
R^2	0.12	0.12	0.08	0.08	0.10	0.10	0.09	0.09	0.07	0.07
Sweden	18	34	-1	8	17	38	31	50	45	35
SE	11.6	13.7	5.7	11.0	8.3	10.7	6.9	8.6	6.6	7.2
R^2	0.13	0.13	0.10	0.10	0.11	0.12	0.12	0.12	0.09	0.09
United Kingdom	20	30	3	0	20	29	18	39	6	-53
SE	7.6	14.2	7.2	11.7	7.8	11.6	6.9	12.6	8.1	13.8
R^2	0.11	0.11	0.08	0.08	0.09	0.09	0.09	0.09	0.06	0.07
Mean non-US	19	24	-6	-9	13	17	21	30	29	19
Median non-US	19	32	0	4	15	21	18	37	28	37
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: Estimated coefficients and regression from regressions using equation (16). Standard errors clustered at country level, in parentheses. Unbalanced sample from 2000 to 2022. Lefthand side and righthand side variables are winsorized at 1 percent tails. See text for details.
Sources: See Annex I.

PUBLICATIONS