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The Asymmetric and Persistent Effects of Fed Policy on Global Bond Yields*

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Abstract

We document that U.S. monetary policy shocks have highly persistent but asymmetric effects on U.S. Treasury and global bond yields, with a clear break around the Great Financial Crisis (GFC). Prior to the GFC, tightening shocks used to lead to a pronounced hump-shaped increase of Treasury yields across maturities. Yields used to respond little to easing shocks as term premiums would rise strongly, offsetting the associated decline of expected policy rates. Since the GFC, term premiums have been declining persistently following both tightening and easing shocks. As a result, post-GFC tightening shocks only have transitory positive effects on yields, which reverse later. The response of advanced-economy and emerging market sovereign yields essentially mimics the pattern observed for Treasury yields. Consistent with recent work by Kekre et al. (2022) we find that changes in the duration of primary dealer Treasury portfolios pre- and post-GFC are highly informative about the sign of the term premium response to policy shocks, but cannot explain the full picture. The observed puzzling persistence of returns is likely to stem at least in part from slow and persistent mutual fund flows following monetary policy surprises.

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1. Introduction

How monetary policy gets transmitted through bond markets is a central question in macroeconomics and finance. The impact of monetary policy actions on the yield curve shapes domestic financial conditions, borrowing costs, and savings returns, and thereby the effects on real activity. In the case of the United States, the centrality of its financial markets and the Federal Reserve in the global financial system means that assessing the effect of U.S. monetary policy on Treasury yields and global bond markets is also key to gauge its overall impact.

Most studies on these issues have focused on the impact over short horizons. Recent research, however, suggests that at least prior to the GFC, the effects of U.S. monetary shocks on longer-term yields tended to build up gradually over time, beyond a horizon of one month (Brooks et al. (2020)). This finding prompts many questions, including whether the pattern still holds after the GFC, whether it is also visible in global spillovers, and whether the effects are symmetric for monetary tightenings and easings. A gradual, persistent buildup of the impact also raises questions regarding the underlying mechanisms.

In this paper, we conduct an in-depth examination of the impact of U.S. monetary policy surprises on U.S. Treasury and global bond yields through 2022, assessing the behavior of expected rates and term premiums, and differentiating between tightening- and easing shocks. We further explore possible explanations behind the observed patterns.

We base our baseline analysis on the high-frequency based measure of U.S. monetary policy shocks by Nakamura and Steinsson (2018) , a series which has been extended by Acosta (2022). We then estimate (panel) local projections of Treasury yields as well as advanced and emerging market economies' sovereign yields on these shocks. We use the decomposition of yields into expected future short rate and term premium components from Adrian et al. (2019), and separately study their response to U.S. monetary policy surprises. We also use panel local projections to assess the impact of monetary policy shocks on flows into and out of mutual funds invested in the respective sovereign debt markets. Importantly, we consider horizons up to 50 weeks into the future in all our regressions.

We first show that the persistence of monetary policy surprises documented by Brooks et al. (2020) for the pre-GFC period is driven entirely by tightening shocks. Surprise changes of Fed policy are followed by a persistent hump-shaped response of U.S. Treasury yields with a peak impact after around 10 weeks across maturities. Strikingly, this response is an order of magnitude larger than the initial bond market reaction. Decomposing Treasuries into expected rate and term premium components, we show that both respond positively to restrictive policy surprises. In sharp contrast, Treasury yields only respond little to Federal Reserve easing shocks. The reason is that term premiums rise strongly and persistently following accommodative policy news, more than offsetting the decline of short-rate expectations particularly for longer maturities. Hence, there is a clear asymmetry in the response of Treasury yields to Fed easing and tightening surprises in the pre-GFC period. Yields used to respond little to easing shocks as term premiums would rise strongly, offsetting the associated decline of expected policy rates.

Second, we document that the asymmetric effects of Fed surprises on Treasury yields feature a clear break around the GFC. While Treasury term premiums increase persistently following Fed easing shocks until 2007, both yields and term premiums decline in a protracted manner following such shocks in the post-GFC sample. By contrast, following a brief initial increase, yields and term premiums persistently fall following tightening shocks in the post-GFC sample. This change does not seem to stem from the adoption of quantitative easing.

Third, we find that global sovereign bond yields largely mimic these dynamics of U.S. Treasury yields. Based on a sample of 18 advanced economies' local currency yields and their decomposition into expected rate and term premium components, we show that before the GFC, Fed easing shocks were followed by a persistent increase of global term premiums. In contrast, post-GFC global term premiums persistently decline following Fed easing *as well as* tightening shocks. We confirm the asymmetry of term premium dynamics post-GFC for a panel of 15 emerging market economies.

These yield curve dynamics are difficult to square with traditional frictionless models of the term structure. We entertain several potential explanations for our findings. First, inspired by recent work by Kekre et al. (2022) and Du et al. (2022), we study whether the structural shift in balance sheet positions of U.S. primary dealers can account for the shift in Treasury yield dynamics following Federal Reserve surprises. We confirm that the net duration of dealer balance sheets has switched sign from net negative to net positive around the GFC and that this duration is highly informative about the sign of the term premium response to monetary policy surprises. Specifically, periods with negative primary dealer balance sheet duration are associated with an increase of term premiums in response to easing shocks, while periods with positive duration are associated with a decline of term premiums following easing shocks. However, while the model matches the switching sign of the term premium response to easing shocks around the GFC, it fails to explain the asymmetry between easing and tightening shocks that we document.

The large magnitude of the yield response to policy shocks several months after the announcement could potentially be explained by the fact that the Federal Reserve communicates its policy intentions carefully and as such surprises measured by the high frequency response to policy announcements are small relative to the change in the expected policy path. However, controlling for the actual change in the federal funds rate does not meaningfully affect our estimates. Moreover, separating genuine monetary policy shocks from news which lead the Fed to adjust its policy and private sector forecasters to update their forecasts also does not affect our results.

Another potential explanation could be related to slow-moving capital flows following policy surprises (Brooks et al., 2020). We use granular data on sovereign debt mutual fund flows to show that these flows also respond persistently and asymmetrically to U.S. monetary policy. In the post-GFC sample, Federal Reserve easing surprises are followed by substantial and highly persistent inflows into mutual funds invested in advanced and emerging market economies' sovereign debt. Moreover, mutual fund flows display a similar break to the yield responses to U.S. monetary policy shocks around the GFC.

Our results may provide insights for central bankers and practitioners trying to gauge the potential effects of Federal Reserve policy on international bond markets. While the current cycle may be different from previous ones given the sharp increase of inflation rates globally, the muted increase of international term premiums in response to recent tightenings by the Fed is in line with our post-GFC evidence.

Our paper is related to a large literature that has assessed the impact of U.S. monetary policy on domestic and international financial markets. In addition to the aforementioned study of Treasury yields by Brooks et al. (2020), a different strand of the literature has documented a sizable and relatively persistent response of U.S. long-term nominal rates to movements in short-term rates (Cochrane and Piazzesi, 2002; Hanson and Stein, 2015; Tillmann, 2020; Hanson, Lucca and Wright, 2021).

There is some emerging evidence that such persistent effects are also present when it comes to spillovers to foreign bond yields. Kalemli-Özcan (2019) reports that in response to an exogenous increase in the U.S. policy rate, 12-month government bond rates in emerging markets increase more than one for one, while they rise less than one for one in advanced economies. The positive effects on interest rate differentials are quite persistent, and significant for about six quarters.

More generally, the size and nature of U.S. monetary policy spillovers on foreign asset markets, and whether and how they have changed with the adoption of unconventional monetary policy since the global financial crisis remain subject of debate. For example, Albagli, Ceballos, Claro and Romero (2019) and Lombardi, Siklos and Amand (2018) find that U.S. monetary policy spillovers to international long-term yields have risen substantially since the global financial crisis. Hoek, Kamin and Yoldas (2020) suggest that U.S. interest rate hikes resulting from stronger U.S. growth generate only modest spillovers, while those due to a more hawkish Fed policy stance or inflationary pressures can lead to a significant tightening of emerging market economies' financial conditions. Fratzscher, Lo Duca and Straub (2018) find that Fed measures since 2010 boosted equities worldwide, while they had a muted impact on yields across countries. In an early study, Chen, Mancini Griffoli and Sahay (2014) report that unconventional monetary policy surprises had larger effects on asset prices than those of conventional monetary policy. Gilchrist, Yue and Zakrajsek (2018) document that yields on foreign dollar-denominated sovereign bonds are highly responsive to

U.S. monetary policy surprises and that the pass-through of unconventional policy to foreign bond yields is roughly comparable to that of conventional policy, echoing findings by Curcuru, Kamin, Li and Rodriguez (2018).[1]

The remainder of this paper is organized as follows. In Section 2, we study the effects of Federal Reserve policy rate surprises on U.S. Treasury Yields in the pre- and post-GFC sample. In Section 3, we then document asymmetric and persistent spillovers of U.S. monetary policy shocks to global sovereign debt markets. In Section 4, we explore several potential explanations for our findings. Section 5 concludes.

2. U.S. Monetary Policy and Treasury Yields

Brooks, Katz and Lustig (2020) show that while longer-term Treasury yields respond only little on impact to target rate shocks, they subsequently increase for about 50 days after an FOMC meeting. The authors refer to this phenomenon as the "Post-FOMC announcement drift in U.S. Bond Markets".

In this section, we extend the analysis in Brooks et al. (2020) in several important ways. First, while Brooks et al. (2020) study the period from 1989 to 2007, we consider a longer sample that covers at least part of the recent Fed tightening cycle. Second, we decompose Treasury yields into expected short rate and term premium components and study their differential response to Federal Reserve surprises separately. Third, we separately study the effects of monetary policy easing and tightening surprises and document a strong asymmetry. Finally, we uncover a structural break in the asymmetric response of Treasury yields and their components to Fed surprises around the GFC.

In this section, we first present our baseline empirical approach in Section 2.1. We then discuss the data in Section 2.2. Finally, we present and discuss the results in Section 2.3.

2.1. Empirical Approach

Our main results are based on the following local projections in the spirit of Jordà (2005):

$$\Delta_h y_t^{(n)} = \alpha + \beta^h MP_t + \delta_{-1}^h MP_{-1} + \delta_{-2}^h MP_{-2} + \gamma^h X_t + \varepsilon_t^h, \quad (1)$$

where the dependent variables $\Delta_h y_t^{(n)} = y_{t+h}^{(n)} - y_{t-1}^{(n)}$ measure cumulative changes of the yield of maturity n between weeks $t-1$ and $t+h$, respectively. MP_t is the U.S. monetary policy

1 Some studies have also explored the impact of U.S. monetary policy surprises on capital flows, mostly focusing on short-term effects, and reporting a range of findings. See, for example Chen, Mancini Griffoli and Sahay (2014), Fratzscher, Lo Duca and Straub (2018), Chari, Stedman and Lundblad (2021), Dahlhaus and Vasishtha (2020), and Cenedese and Elard (2021)

surprise in week t. The coefficients of interest are the β^h. As discussed in Jordà (2005) and subsequent work, these coefficients represent model-free impulse response functions and, under mild assumptions, coincide with impulse response functions one would obtain in a vector autoregressive model. To account for potential serial correlation in the monetary policy surprise series, we control for the two previous monetary policy surprises, MP_{-1} and MP_{-2}.[2] The vector of controls, X_t, includes five lags of the dependent variable. To study the longer-term response of Treasury yields to Federal Reserve surprises, we consider horizons h up to 50 weeks. We report Newey and West (1987) standard errors to adjust for potential autocorrelation and heteroskedasticity.

2.2. Data and Measurement

We conduct our analysis at the weekly frequency. We use Treasury data from Gürkaynak et al. (2007) and the decomposition into expected short rate and term premium components from Adrian et al. (2019) which is based on the model and estimation approach in Adrian et al. (2013).

In line with a sizeable recent literature (see, e.g., Kuttner, 2001; Gürkaynak, Sack and Swanson, 2005; Gertler and Karadi, 2015; Nakamura and Steinsson, 2018; Miranda-Agrippino and Ricco, 2021), we measure U.S. monetary policy shocks using high frequency data around monetary policy announcements. Brooks et al. (2020) rely on Kuttner (2001)'s measure of monetary policy surprises. These are daily changes in the Fed Fund futures contract that expire at the end of the month and thus measure surprises to the Federal funds target rate.

Our sample period covers several years after the Global Financial Crisis when the fed funds rate was at the zero lower bound and the Federal Reserve resorted to forward guidance as an additional policy tool. To also fully capture surprises about the expected path of policy rates, we rely on the monetary policy surprise measure from Nakamura and Steinsson (2018) which has been updated by Acosta (2022) through September 2022.[3] In this approach, the monetary policy shock is constructed as the first principal component of changes in several short-term interest rates from 10 minutes before until 20 minutes after scheduled FOMC announcements. The identifying assumption is that the yield changes in this time window are entirely unanticipated and can be fully attributed to the FOMC announcement, thus ensuring that no other events contaminate the measured monetary policy surprise. The

2 In Appendix B.1 we also show that our results are robust to controlling for the monetary policy surprises that occur between period t and $t + h$. See, e.g. Alloza et al. (2020) and Miranda-Agrippino and Ricco (2021) for a discussion of this approach.

3 These authors rely on five fixed income securities: the current and next month federal funds futures contract and the Eurodollar futures maturing in two, three, and four quarters. Since our analysis spans the period of the zero lower bound, the comovement in these five rates arguable captures changes in policy rate expectations better than simply the current month fed funds futures contract as used in, e.g., Kuttner (2001). We thank Miguel Acosta for kindly sharing the updated surprise series with us.

resulting shock series is re-scaled such that it affects the one-year U.S. sovereign bond yield one to one on impact.

We study impulse responses up to 50 weeks into the future. We make sure that the same sample is used for impulse responses at all horizons. Therefore, our baseline sample ends in November 2021, 50 weeks prior to the end of the sample which the updated NS policy surprise measure covers.

Some authors (e.g. Jarociński and Karadi (2020) and Miranda-Agrippino and Ricco (2021)) have recently suggested to "cleanse" monetary policy surprises from interest rate changes arising due to central bank communication about the state of the economy. However, as argued by Bauer and Swanson (2020) such central bank information effects disappear when properly accounting for other economic news.[4] In Section 2.6, we show that our results are robust to using the monetary policy surprise series by Bauer and Swanson (2023b). We also show that our findings are robust to controlling for the actual change in the federal funds rate between the time of the policy announcement and when the yield response is measured. Hence, our results are not driven by monetary policy changes that are well communicated ex-ante and thus associated with only small measured monetary policy surprises.

2.3. The pre-GFC Period

In this section, revisit and extend the evidence in Brooks, Katz and Lustig (2020) who document that U.S. Treasury yields rise persistently following Federal Reserve target rate surprises from Kuttner (2001).

Local projections for the pre-GFC period show a pronounced hump-shaped response of both maturities' Treasury yields to target rate surprises, in line with Brooks et al. (2020). Figure 1 shows impulse responses of two-year and ten-year U.S. Treasury yields to Kuttner target rate surprises for the sample period from June 1989 through November 2007. Specifically, we report the coefficients β^h based on the regression in equation (1). A small and insignificant initial response is followed by a persistent rise and subsequent decline. In line with Brooks et al. (2020), the peak response is after about ten weeks or 50 trading days. While the coefficients are strongly statistically significant for the two-year maturity, they are insignificant for the ten-year maturity. The latter finding is in contrast to those in Brooks et al. (2020) and likely owes to the fact that we control for more lags of the dependent variable. Importantly, the positive estimated coefficients β^h imply that tightening shocks lead to a persistent hump-shaped *increase*, while easing shocks lead to a persistent hump-shaped *decline* of Treasury yields in the first ten weeks after the policy announcement.

Prior research has documented that U.S. monetary policy shocks exert asymmetric effects on the U.S. (Debortoli et al. (2020)) and on global economies (Degasperi et al. (2020)). Since

4 Moreover, purging monetary policy shocks from the central bank's information set by using Greenbook data would reduce our sample drastically since these data are only available with a delay of five years.

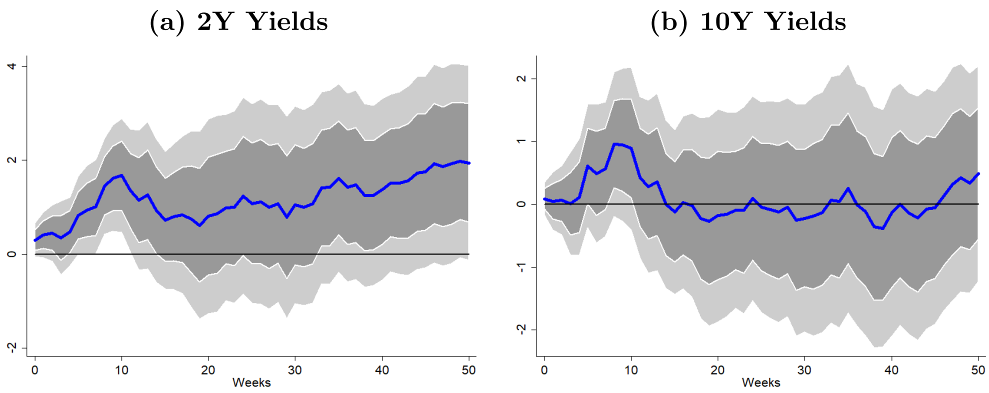


Figure 1
U.S. yield responses to U.S. monetary policy surprises
The figure shows impulse response functions of U.S. sovereign bond yields to Kuttner U.S. monetary policy surprises with target rate changes obtained from local projections specified in equation (1), controlling for two previous monetary policy surprises and five lags of the dependent variable. The sample period is June 1989 until November 2007. We use Newey-West standard errors and show confidence bands at the 68% and 90% level.

the term structure of interest rates is the key transmission link for monetary policy to the real economy, a natural question is whether U.S. monetary policy shocks also affect Treasury yields asymmetrically.

To explore this question, we run local projections similar to the ones above, but allowing for different coefficients for easing- and tightening surprises. Specifically, we run the following regressions:

$$\Delta_h^{(n)} y_t = \beta^h_{tight} \mathbb{1}_{\{MP_t>0\}} MP_t + \beta^h_{eas} \mathbb{1}_{\{MP_t<0\}} MP_t + \text{controls} + \varepsilon^h_t \tag{2}$$

where $\Delta_h^{(n)} y_t = y^{(n)}_{t+h} - y^{(n)}_{t-1}$ again denotes the cumulative yield change of a n-year bond from $t-1$ to $t+h$ and where $\mathbb{1}_{\{MP_t>0\}}$ ($\mathbb{1}_{\{MP_t<0\}}$) indicates the set of tightening (easing) U.S. monetary policy surprises and where *controls* captures the same set of controls as before.

If the impulse responses were symmetric across easing and tightening monetary policy surprises, we would obtain the same coefficients for β^h_{tight} and β^h_{eas}.

The responses are clearly asymmetric (Figure 2). While the coefficients are positive for tightening surprises, implying a persistent *increase* of Treasury yields, the coefficients summarizing the response to easing shocks are negative or insignificant. Hence, over the sample period from 1989 through 2007, Treasury yields did not decline after easing shocks, but rather rose or remained unchanged. Our findings thus imply that the persistent hump-shaped response of Treasury yields to target rate surprises documented by Brooks et al. (2020) is largely driven by Federal Reserve tightening moves.

Short rate expectations or term premiums? In the absence of default-risk, sovereign yields have two main components: expectations about the future path of policy rates and term premiums. The latter reflect compensation investors seek for holding long-term- rather

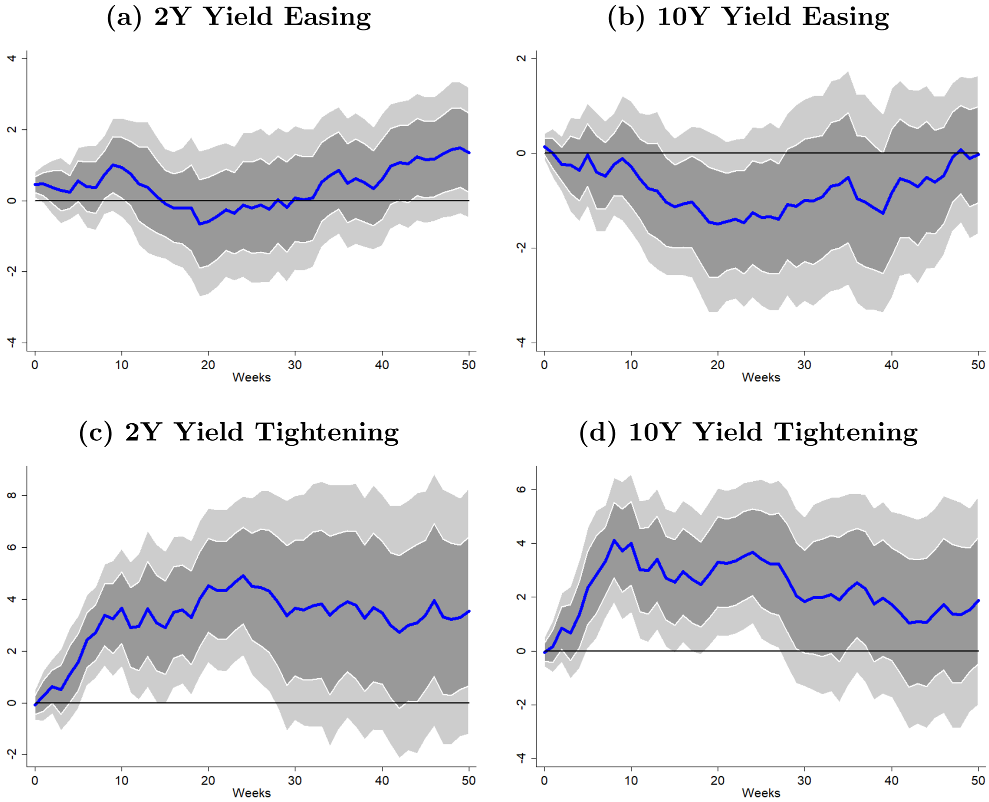


Figure 2
Asymmetric responses of 2Y and 10Y Treasury yields to Fed target rate surprises 1989-2007

The figure shows impulse response functions of ten-year Treasury yields to Kuttner (2001) Fed target rate surprises. These impulse responses are obtained from local projections specified in equation (2), controlling for two previous monetary policy surprises and five lags of the dependent variable. The sample period is June 1989 until November 2007. We use Newey-West standard errors and show confidence bands at the 68% and 90% level.

than rolling over short-term bonds. Both components of Treasury yields might be affected by Federal Reserve policy. First, Fed easing or tightening moves likely alter market participants' expectations about future policy changes. Second, in line with the risk-taking channel of monetary policy (e.g. Borio and Zhu (2012), Adrian and Shin (2010)), term premiums are also likely affected by Fed easing and tightening surprises.

To assess the differential response of the yield components to easing- and tightening surprises, we run the same regressions as in Equation (2), but now use as dependent variables the expected short rate- and term premium components of U.S. Treasuries. These are obtained from Adrian et al. (2019) based on the model and estimation approach in Adrian et al. (2013).

Figure 3 provides the results. The top row shows the responses of the expected short rate and term premium components of the ten-year Treasury yield to easing shocks. The coefficients on the expected rate component are positive for most horizons, in line with easing surprises lowering the path of expected future short rates. Surprisingly, however, the opposite

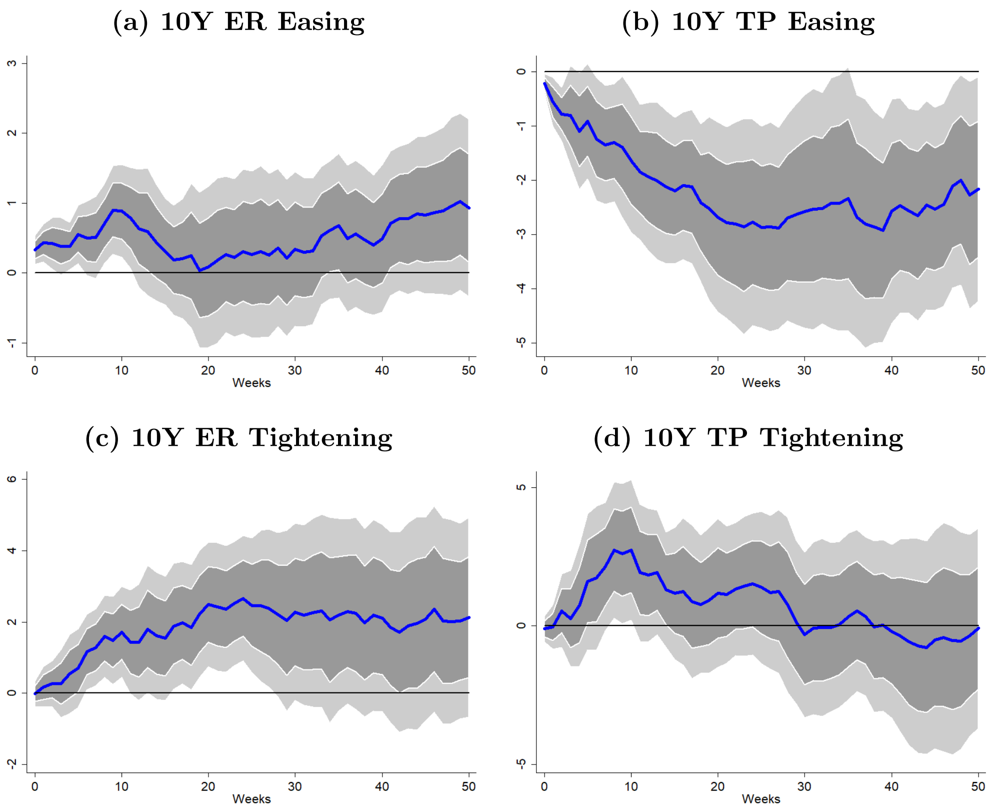


Figure 3

Asymmetric responses of the expected rate (ER) and term premium (TP) components of 10Y Treasury yields to Fed target rate surprises 1989-2007

The figure shows impulse response functions of the expected short rate (ER) and term premium (TP) components of ten-year Treasury yields to Kuttner (2001) Fed target rate surprises. These impulse responses are obtained from local projections specified in equation (2), controlling for two previous monetary policy surprises and five lags of the dependent variable. The sample period is June 1989 until November 2007. We use Newey-West standard errors and show confidence bands at the 68% and 90% level.

is true for the coefficients capturing the term premium response to easing shocks, shown in the top-right panel. They are strongly statistically significant and negative across horizons. Hence, surprise easing moves by the Federal Reserve have contributed to a persistent *inrease* of term premiums in the sample from 1989 to 2007.

Table 1 summarizes these findings for a range of horizons. They highlight that surprise easing decisions by the Federal Reserve were associated with strong and offsetting effects of the expected rate and term premium components of two-year and ten-year Treasury yields. Tightening surprises, on the other hand, led to a more consistent positive response of expected rate and term premium components.

Combined, these results suggest that, prior to the GFC, the persistent response of longer-dated Treasury yields to Federal Reserve target rate surprises was mainly driven by tightening shocks. Easing shocks, in contrast, have contributed to persistently *higher* term premiums, which partially offset the negative effect on expected short rates and lead to a muted response of Treasuries to easing surprises.

Table 1
Responses of U.S. Treasury yields and their expected short rate (ER) and term premium (TP) components to Federal Reserve target rate surprises

	Y24				Y120			
$h =$	0	10	20	50	0	10	20	50
Kuttner Easing shocks								
Yields	0.45*	0.93	-0.59	1.35	0.14	-0.29	-1.49	-0.03
	(0.23)	(0.85)	(1.25)	(1.12)	(0.18)	(0.85)	(1.13)	(1.02)
ER	0.53***	1.54***	0.44	1.47	0.33**	0.89**	0.09	0.93
	(0.19)	(0.55)	(1.07)	(1.28)	(0.13)	(0.41)	(0.71)	(0.77)
TP	-0.06	-0.51*	-0.89**	-0.63	-0.22*	-1.64**	-2.68**	-2.16*
	(0.04)	(0.28)	(0.36)	(0.41)	(0.11)	(0.81)	(1.07)	(1.26)
Kuttner Tightening shocks								
Yields	-0.08	3.67***	4.53**	3.53	-0.05	4.01**	3.32**	1.87
	(0.36)	(1.39)	(1.82)	(2.89)	(0.34)	(1.57)	(1.68)	(2.36)
ER	-0.00	2.03*	3.42**	2.93	-0.01	1.72**	2.49**	2.13
	(0.33)	(1.14)	(1.60)	(2.50)	(0.22)	(0.78)	(1.07)	(1.70)
TP	-0.04	1.01*	0.51	0.02	-0.10	2.74*	1.18	-0.08
	(0.10)	(0.53)	(0.55)	(0.74)	(0.29)	(1.55)	(1.64)	(2.21)

The table shows the regression results for horizons h obtained from local projections specified in equation (2). The dependent variables are changes in two- and ten-year U.S. Treasury yields and their expected rate (ER) and term premium (TP) components between week $t-1$ and $t+h$. Monetary policy shocks are measured using Kuttner (2001) target rate surprises. Control variables are two previous monetary policy surprises and five lags of the dependent variable. The sample period is June 1989 until November 2007. Newey-West standard errors are shown in parentheses.

2.4. Extending the sample beyond the GFC

In this subsection, we explore whether the findings of persistence and asymmetry extend to a longer sample, beyond the GFC. Since Federal Reserve policy was constrained by the zero lower bound between 2008 and 2015, we use the monetary policy surprise series by Nakamura and Steinsson (2018), updated by Acosta (2022), for this analysis. Their series is the first principal component of a range of federal funds and Eurodollar futures contracts with maturities up to one year ahead and thus serves as a measure of policy surprises beyond the immediate target rate decision.[5] Since the Nakamura and Steinsson (2018) surprise measure is only available starting in 1995, this analysis covers the sample period from January 1995 through November 2021.

While the overall patterns of responses remain qualitatively unchanged, the strong and persistent response of the term premium to easing shocks documented above is even more

5 Note that the series of monetary policy surprises ends before the monetary policy meeting in October 2022. To base the responses at all horizons on the same sample of surprises, we end our sample in November 2021, 50 weeks before October 2022.

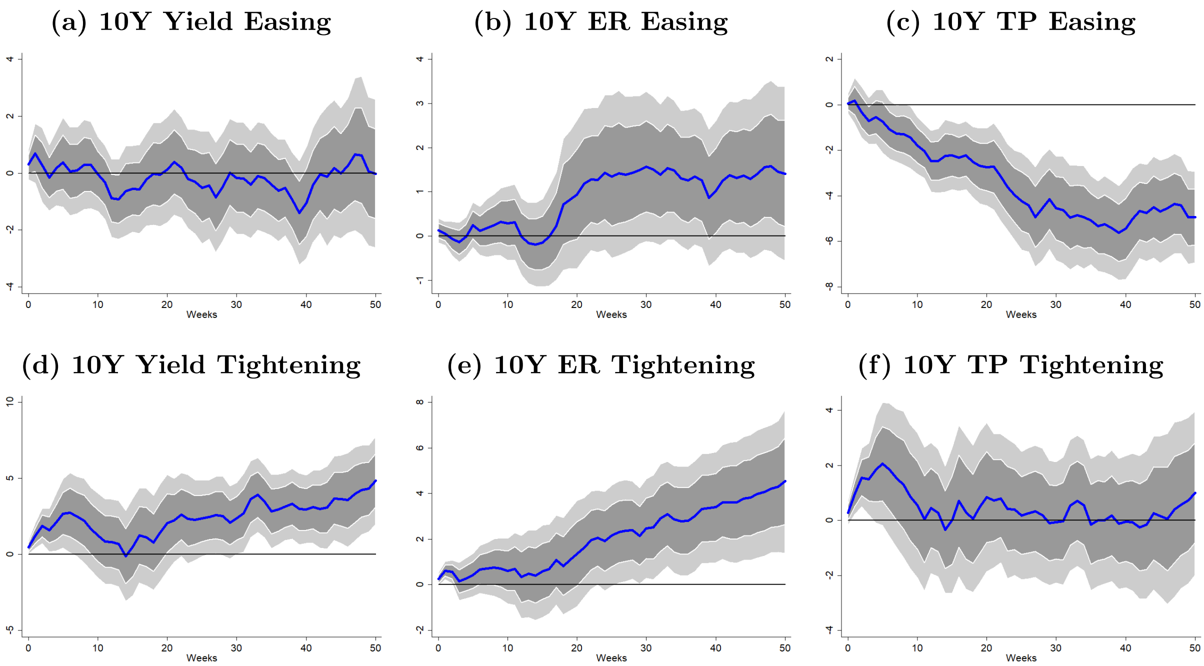


Figure 4

Asymmetric responses of U.S. 10Y yields and their expected rate (ER) and term premium (TP) components to U.S. monetary policy surprises 1995-2021

The figure shows impulse response functions of U.S. 10Y sovereign bond yields and their expected rate (ER) and term premium (TP) components to NS U.S. monetary policy surprises obtained from local projections specified in equation (2), controlling for two previous monetary policy surprises and five lags of the dependent variable. The sample period is January 1995 until November 2021. We use Newey-West standard errors and show confidence bands at the 68% and 90% level.

pronounced in this extended sample (Figure 4). A surprise cut leading to a 25 basis points on-impact decline of the one-year Treasury is associated with a staggering 1.25 percentage points increase of the ten-year term premium after around 40 weeks. In contrast, tightening surprises exert only a relatively short-lived and more muted response of the term premium. That said, the expected short rate component responds more strongly to tightening surprises in the longer sample.

In a related recent paper, Tillmann (2020) uses the two-day change of the two-year Treasury as a measure of Federal Reserve policy surprises. He finds that U.S. Treasury yields increase significantly and persistently after a policy tightening while term premia fall over the sample period from 1994 through 2015. Interacting the policy shock with different measures of uncertainty about monetary policy, he further documents that the positive yield response to a policy tightening is significantly reduced if uncertainty is high at the time the shock. Consistent with our results for the pre-GFC period, he further finds that easing shocks lead to a persistent increase of term premiums which offsets the negative effect of a surprise easing on expected future policy rates.

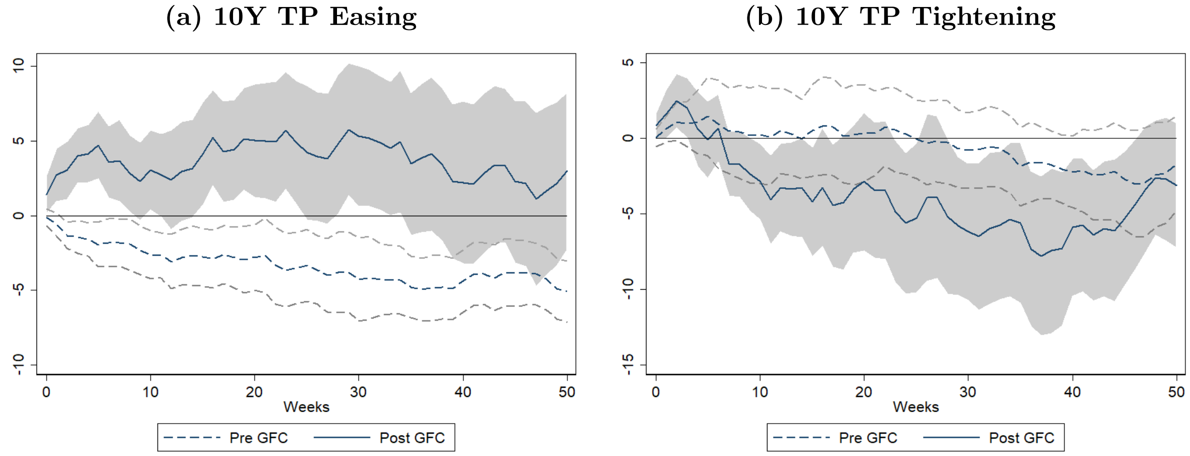


Figure 5
Asymmetric responses of U.S. 10Y term premium (TP) components to U.S. monetary policy surprises pre versus post-GFC
The figure shows impulse response functions of the ten-year U.S. Treasury term premium (TP) components to NS U.S. monetary policy surprises obtained from local projections specified in Equation ((2)), controlling for two previous monetary policy surprises and five lags of the dependent variable. The pre-GFC period is from January 1995 until November 2007 and the post-GFC period is from January 2010 until November 2021. We use Newey-West standard errors and show confidence bands at the 68% and 90% level.

2.5. Treasury Yield Responses Before- vs. After the GFC

The previous results suggest that the transmission of U.S. monetary policy surprises to the Treasury yield curve may have changed around the GFC. To investigate this hypothesis, we split the period from 1995 through 2021 into a pre- and a post-GFC period. The differences documented before were mainly accounted for by the term premium response to easing shocks. Accordingly, Figure 21 contrasts the responses of the ten-year Treasury term premium to easing (left panel) and tightening (right panel) surprises. To highlight the differences across subsamples, we superimpose the corresponding coefficients for the pre-GFC (dashed line) and the post-GFC (solid line) period. To avoid capturing the particular effects of policy surprises on yields during the height of the GFC, we split the sample into the pre-GFC period from January 1995 until November 2007 and the post-GFC period from January 2010 until November 2021, with each subsample thus capturing about 12 years of weekly data. g

Figure 21 confirms that the coefficients on easing shocks have opposite signs in the pre- and the post-GFC sample. Easing shocks are associated with statistically significant negative coefficients and thus *increasing* term premiums before the GFC, but feature significant negative coefficients and thus *decreasing* term premiums after the GFC. Tightening surprises, in turn, are associated with a persistent decline in both subsamples, although considerably more strongly in the post-GFC period.

The behavior of term premiums in response to post-GFC easing shocks is not driven by quantitative easing (QE). They qualitative results remain unaltered when either excluding

QE shocks in our series or using the Swanson (2021) monetary surprises excluding LSAP shocks.

2.6. Federal Reserve Communication about the Path of Policy Rates or the State of the Economy

In addition to adjusting the policy rate, the Federal Reserve regularly uses the FOMC statement and subsequent press conferences by the Fed chair as well as speeches and interviews to communicate to market participants about the state of the economy and the likely path of policy rates. These communications have been argued to have important effects on financial markets and the economy (see, e.g., Jarociński and Karadi (2020), Nakamura and Steinsson (2018)).

Fed communication about the policy rate path There are at least two ways in which Fed communication could affect the response of Treasury and global sovereign bond yields to measured monetary policy surprises. First, if monetary policy changes were well signaled in advance, the policy surprises measured using high-frequency yield changes around FOMC announcements would be small even when the actual subsequent tightening or easing were large. Yet, yields would likely co-move strongly with the expected component of monetary policy, as communicated by the Fed. The impulse responses using measured policy surprises could therefore be biased upwards. Such a situation could also give rise to potential asymmetries, for example if tightening shocks were communicated more precisely than easing shocks.

To adjust for potential serial correlation, in a robustness exercise (see Appendix B.1), we control for monetary policy surprises that occur between t and $t+h$. To also control for potential effects of Federal Reserve communication about the policy path, we now check if our results are susceptible to including the actual change in the effective federal funds rate between $t-1$ and $t+h$.

The results controlling for future policy actions are essentially identical to our baseline results22 . In the full sample from 1995 until 2021, Fed easing surprises led to persistently higher Treasury yields, driven primarily by an increase of term premiums (as indicated by negative β^h coefficients in panel (c) of Figure 22). At the same time, tightening surprises have also been associated with a persistent increase in expected rates and term premiums. The estimated coefficients are of the same magnitudes as those in Figure 4. Hence, our results are not driven by a subsequent realization of well telegraphed and thus little surprising policy changes. In other words, even small surprises about Fed policy have large, persistent, and asymmetric effects on Treasury yields (as well as global sovereign bond yields as we will document below).

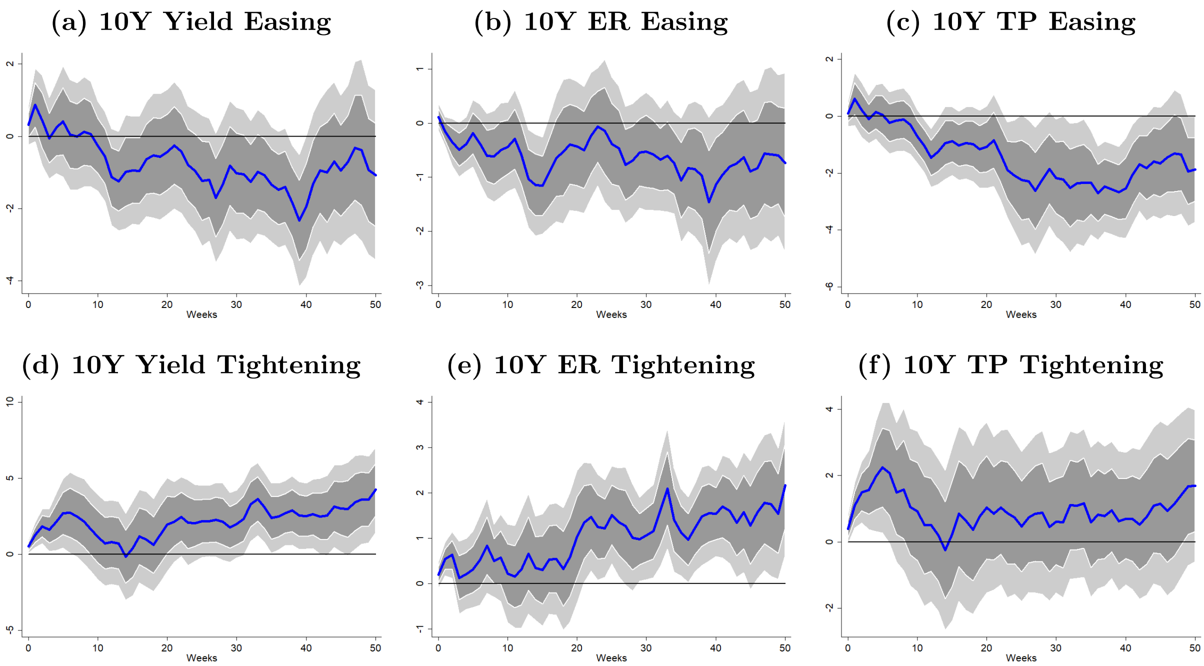


Figure 6

Impulse responses of ten-year U.S. Treasury yields and their expected rate (ER) and term premium (TP) components to U.S. monetary policy surprises, controlling for actual changes in the Fed Funds Rate: 1995-2021

The figure shows impulse response functions of ten-year U.S. Treasury yields and their expected short rate (ER) and term premium (TP) components to U.S. monetary policy surprises obtained from local projections as specified in equation (2), controlling for two previous monetary policy surprises and five lags of the dependent variable. Additionally, we control for changes in the effective federal funds rate between $t-1$ and h. The sample period is January 1995 until November 2021. We use Newey-West standard errors and show confidence bands at the 68% and 90% level.

2.7. Monetary Policy versus Information Shocks

Several authors have recently suggested that monetary policy surprises measured using changes of short-term interest rates in tight windows around U.S. monetary policy announcements capture not only genuine monetary policy shocks, but also the market's response to information about the economy conveyed with the FOMC statement. Importantly, such a response to information provided by the Fed requires an informational advantage of the central bank relative to market participants.

Jarociński and Karadi (2020) propose to disentangle monetary policy shocks from central bank information shocks by studying the differential reaction of stock and bond markets on FOMC announcement days. More precisely, they interpret a shock as a monetary policy shock if stock prices and bond yields have opposite-signed responses, and as a central bank information shocks when stock prices and bond yields move in the same direction. According to their identification assumptions, a typical surprise monetary policy tightening would lead to lower Treasury prices and thus higher yields (primarily through an increase in expected future policy rates), and at the same time to a reduction of equity prices. The latter is consistent with both a discount-rate- and a cash-flow channel of monetary policy. A positive central bank information shock, in turn, would lead to *higher* equity prices if the market learned from the surprise tightening that the economy is doing better than previously anticipated.

An alternative interpretation of these so-called central bank information shocks has recently been put forth by Bauer and Swanson (2023a). That study provides evidence that the response to information shocks is consistent with the notion that inter-meeting economic news may cause the Fed to change monetary policy and the private sector to revise its forecasts. Independently of the precise channel through which central bank information shocks affect bond markets, they might give rise to the asymmetric response to easing versus tightening shocks that we have documented.

To check if FOMC information about the state of the economy can explain our findings, we use as the monetary policy surprise the series from Bauer and Swanson (2023b), which is orthogonalized to six macro and financial variables pre-dating the respective monetary policy announcements. Specifically, the authors compute the first principal component of the changes in current quarter and one- to three quarters-ahead Eurodollar futures contracts and scale it so that the impact on the three-quarter-ahead Eurodollar futures contracts equals one. Then they purge this measure from inter-meeting macro news by computing the residual from a regression on several macro and financial variables. Their series is available from January 1995 through January 2019.

The results are provided in Figure 23. They are again qualitatively similar to the ones in Figure 4: Fed easing surprises have been followed by large and persistent increases in Treasury term premiums and by extension Treasury yields since the mid 1990s. Controlling for changes in the Fed's response to news when computing monetary policy surprises as in Bauer and Swanson (2023b) does not alter this result. That said, the results for Fed tightening surprises are somewhat weaker when purging monetary policy surprises from inter-meeting macro news. While yields still rise persistently following tightening surprises, mainly driven by a persistent increase in term premiums, the impulse responses corresponding to the expected short rate component of Treasuries are muted relative to those reported in Figure 4.

In sum, the results in this section paint a surprising picture. Over the past three decades, Federal Reserve policy surprises have had large and persistent effects on U.S. Treasury yields, consistent with the evidence in Brooks et al. (2020). However, these effects have been highly asymmetric. Before the GFC, tightening surprises have led to a persistent increase in Treasury yields, while easing surprises have had only transitory effects. The reason is that term premiums have experienced a strong and highly persistent increase subsequent to easing shocks in the pre-GFC sample, offsetting the response of expected short rates. In contrast, easing shocks have been associated with a persistent *decline* of term premiums after the GFC, contributing to an overall compression of Treasury yields.

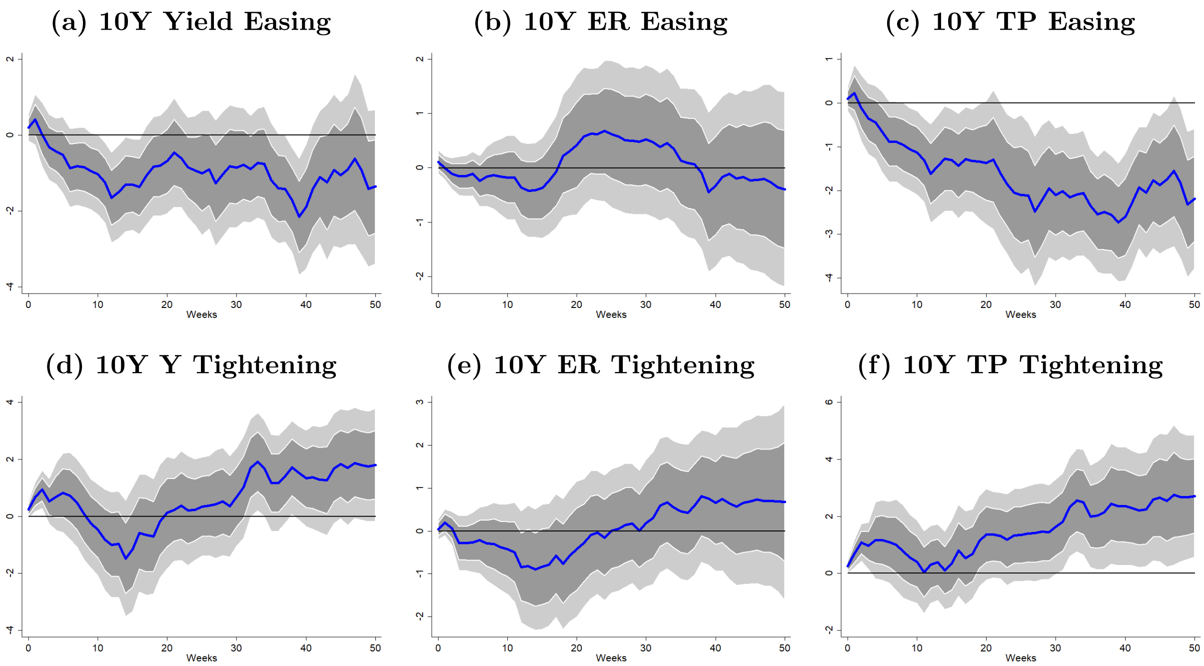


Figure 7
Asymmetric responses of U.S. 10Y yields and their expected rate (ER) and term premium (TP) components to Bauer and Swanson (2023b) U.S. monetary policy surprises 1995-2019

The figure shows impulse response functions of ten-year U.S. Treasury yields and their expected rate (ER) and term premium (TP) components to Bauer and Swanson (2023b) U.S. monetary policy surprises obtained from local projections specified in equation (2), controlling for two previous monetary policy surprises and five lags of the dependent variable. The sample period is January 1995 until January 2019. We use Newey-West standard errors and show confidence bands at the 68% and 90% level.

3. U.S. Monetary Policy and Global Bond Yields

Federal Reserve policy has previously been documented to affect international bond markets. However, the prior literature has largely focused on short term spillovers materializing over horizons of at most a few days, see the literature review above. Given our findings that U.S. monetary policy has large, persistent and asymmetric effects on U.S. Treasury yields, we next investigate the persistence and potential asymmetry of Federal Reserve policy surprises on global sovereign bond markets.

3.1. Methodology and Data

We study the impulse responses of sovereign bond yields of a broad set of advanced (AE) and emerging market (EM) economies to U.S. monetary policy surprises by estimating panel local projections following Jordà (2005).[6] Specifically, we run the following regressions separately for the set of AE and EM economies and for each horizon h:

$$\Delta_h y_{t,i}^{(n)} = \alpha_i^h + \beta^h MP_t + \delta_{-1}^h MP_{-1} + \delta_{-2}^h MP_{-2} + \gamma^h X_{t,i} + \varepsilon_{t,i}^h, \tag{3}$$

where the dependent variables $\Delta_h y_{t,i}^{(n)} = y_{t+h,i}^{(n)} - y_{t-1,i}^{(n)}$ measure cumulative changes of the yield of maturity n in country i between weeks $t-1$ and $t+h$, respectively. MP_t is the U.S. monetary policy surprise in week t. The coefficients of interest are again the β^h. To account for potential serial correlation in the monetary policy surprise series, we control for the two previous monetary policy surprises, MP_{-1} and MP_{-2}.[7] The vector of country-specific controls, $X_{t,i}$ includes the current exchange rate of country i vis-à-vis the U.S. Dollar and five lags of the dependent variable. α_i are country fixed effects. We compute standard errors following Driscoll and Kraay (1998), which are robust to serial correlation, heteroskedasticity, and cross-sectional dependencies.

We use data on local currency zero-coupon government bond yields for 18 advanced economies (AE) excluding the U.S., and 15 emerging market (EM) economies obtained from Bloomberg. We also obtain exchange rates vis-à-vis the USD from Bloomberg. We compute weekly averages of exchange rates, government bond yields, and their components for weeks running from Thursday to Wednesday to align the timing to the weekly data on mutual fund flows, which we use for subsequent analyses below.

In light of the prominent role of term premiums in the persistent and asymmetric transmission of U.S. monetary policy shocks to Treasury yields, we consider a similar decomposition for global sovereign bond yields. Both components of global sovereign debt might be affected by U.S. monetary policy. First, Fed easing or tightening moves might give rise to expectations about future policy changes also by other central banks. Second, in line with evidence of a global financial cycle that is driven by U.S. monetary policy (e.g. Rey, 2015; Miranda-Agrippino and Rey, 2020), global term premiums are also likely to be affected by surprise changes of Fed policy.

We rely on a decomposition of local currency yields into expected short rate and term premium components as provided by Adrian et al. (2019). Their estimation follows Adrian et al. (2013) but uses four instead of five principal components of yields as pricing factors.

3.2. U.S. Monetary Policy and Advanced Economy Yields

Consistent with the evidence in Section 2, sovereign yields in advanced economies feature a strongly persistent but asymmetric response to U.S. monetary policy surprises. Figure 8

6 The sets of countries which we consider given the available data is provided in Appendix C.2.

7 In Appendix B.1, we show that our results are robust to controlling for the monetary policy surprises that occur between period t and $t+h$.

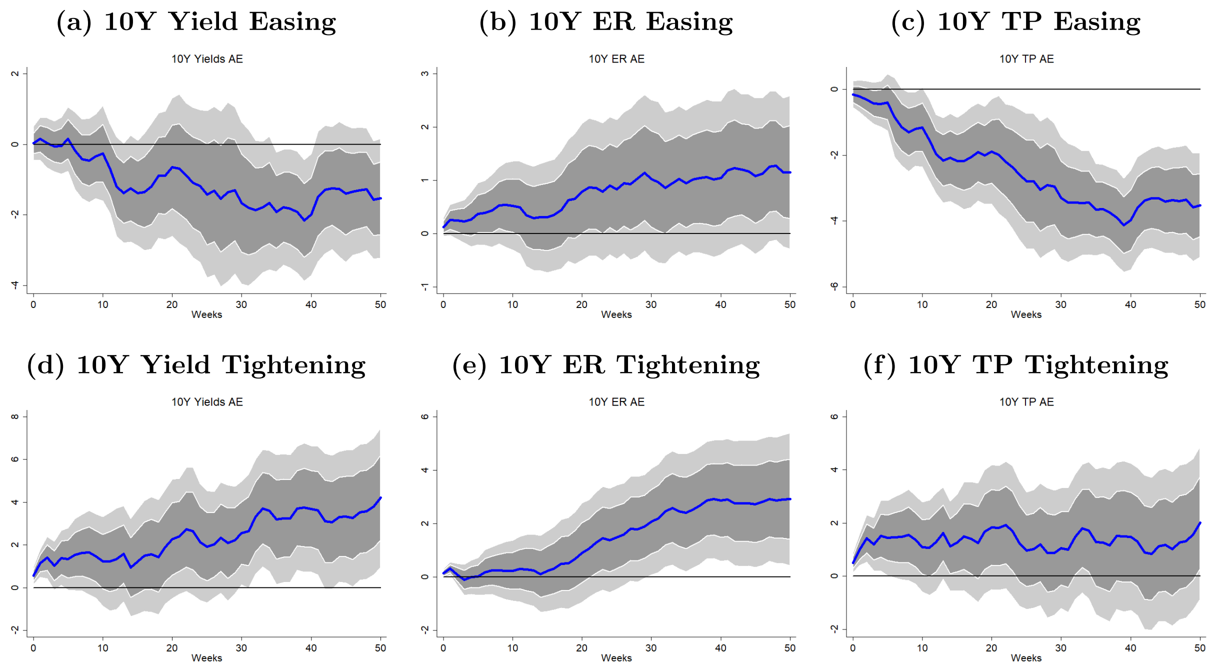


Figure 8

Response of AE yields and their components to Fed surprises: 1995-2021

The figure shows impulse response functions of ten-year sovereign yields of AEs and their expected short rate (ER) and term premium (TP) components to U.S. monetary policy surprises. The coefficients are obtained from panel local projections specified in Equation (2), controlling for two previous monetary policy surprises, the current exchange rate of each country with respect to the U.S.$, five lags of the dependent variable, and country fixed effects. The sample period is January 1995 until November 2021 and the set of countries is listed in Appendix C.2. We use Driscoll-Kraay standard errors and show confidence bands at the 68% and 90% level.

plots the coefficients from panel local projections of the ten-year yields and their components for the 18 advanced economies on the Nakamura and Steinsson (2018) U.S. monetary policy surprises from the same week until 50 weeks after the policy announcement.[8] The top panel provides results for easing, the bottom panel for tightening surprises. The coefficients on easing surprises are increasingly negative across horizons and level out after 30 to 50 weeks. Quantitatively, they imply that a Federal Reserve surprise associated with an on-impact 25 bps negative response of the one-year Treasury yield is associated with a 50 bps increase in advanced economy ten-year sovereign yields one year later. This persistent increase is primarily driven by the response of term premiums, as shown in the last column of Figure 8. The same 25 basis points U.S. policy surprise leads to a one percentage point increase of global ten-year term premiums one year after the Federal Reserve's decision.

The coefficients on tightening surprises, shown in the bottom panel of Figure 8, paint a different picture. Surprise Federal Reserve tightening decisions are associated with persistently higher advanced economy bond yields. This response is driven by both yield components,

8 In Appendix B.2, we also show the impulse response functions to monetary policy shocks following Bauer and Swanson (2023b). The results are qualitatively the same, both for the set of advanced and emerging market economies.

(a) 10Y TP Easing (b) 10Y TP Tightening

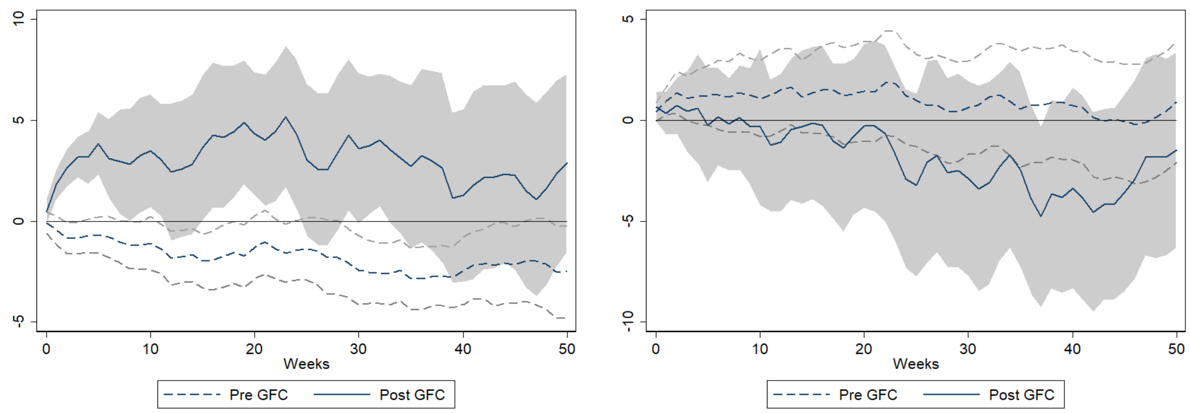


Figure 9

Response of AE Term Premiums to Fed surprises: pre-GFC vs. post-GFC

The figure shows impulse response functions of ten-year term premiums in AEs to U.S. monetary policy surprises obtained from local projections specified in Equation (2), controlling for two previous monetary policy surprises, the current exchange rate of each country with respect to the U.S. Dollar, and five lags of the dependent variable. The pre-GFC period is from January 1995 until November 2007 and the post-GFC period from January 2010 until November 2021 and the set of countries is listed in Appendix C.2. We use Driscoll-Kraay standard errors and show confidence bands at the 68% and 90% level.

expected short rates and term premiums, albeit with important differences with respect to the timing. While expected short rates in AEs initially do not react to Federal Reserve tightening surprises, they significantly increase after around three to four months. This suggests that monetary policy in these countries is expected to follow the Federal Reserve's decisions with some lag. Term premiums in advanced economies, on the other hand, rise immediately after a U.S. policy tightening, and then slowly decay. This response is consistent with a temporary impact on global risk premiums.

We had documented in Section 2 that the response of the U.S. Treasury term premium to Federal Reserve easing surprises had flipped signs around the GFC. As shown in Figure 9, this effect is also present for AE term premiums. As before, the left panel plots the coefficients for easing shocks before and after the GFC. While Federal Reserve easing shocks have been associated with persistent negative coefficients and thus an increase of AE term premiums before the GFC, post-GFC the opposite is true: U.S. easing surprises have been followed by declining term premiums. The responses to tightening shocks, shown in the right column, are not as clear-cut. Before the GFC, surprise tightenings were associated with briefly increasing, but subsequently receding term premiums. Since the GFC, however, U.S. tightening shocks have been associated with an initial increase followed by a protracted decline of AE term premiums. Figures 15 and 16 in the Appendix show the impulse responses of AE yields and their components to Federal Reserve easing and tightening surprises for the 1995-2007 and the 2010-2021 subsamples, respectively. Contrasting the charts highlights the switching sign in the impulse responses to easing- versus tightening shocks around the GFC.

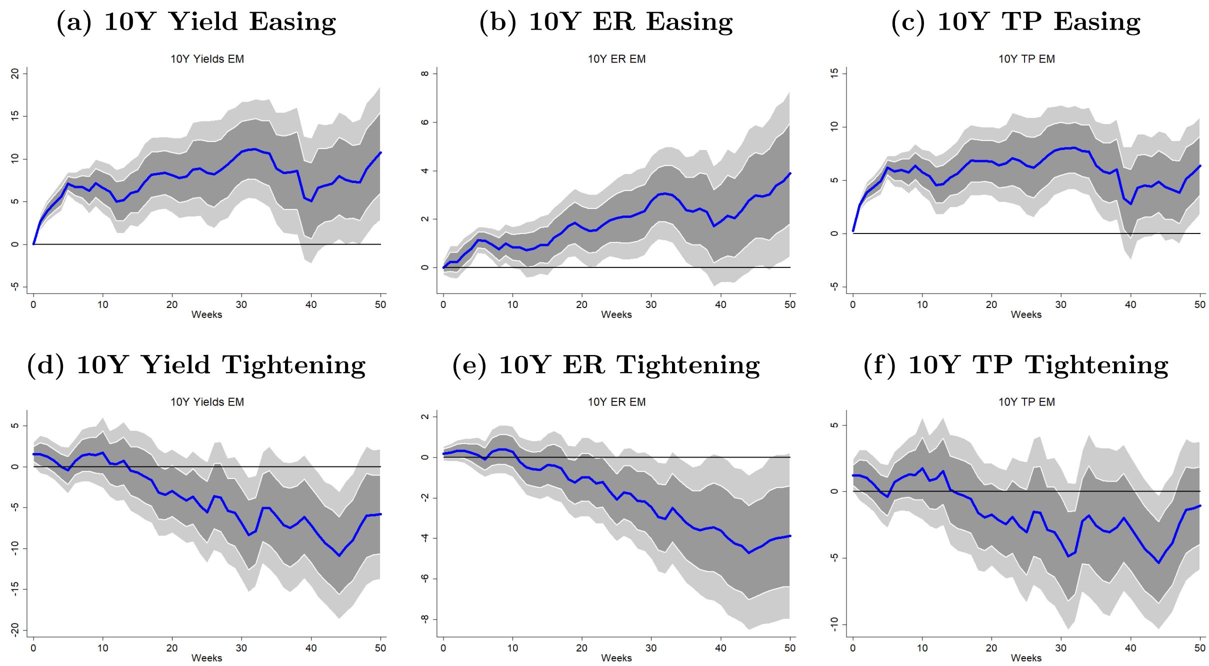


Figure 10

Response of EM yields and their components to Fed surprises: 2010-2021

The figure shows impulse response functions of ten-year EME sovereign yields and their expected short rate (ER) and term premium (TP) components to U.S. monetary policy surprises obtained, controlling for two previous monetary policy surprises, the current exchange rate of each country with respect to the U.S.$, five lags of the dependent variable, and country fixed effects. The sample period is January 2010 until November 2021 and the set of countries is listed in Appendix C.2. We use Driscoll-Kraay standard errors and show confidence bands at the 68% and 90% level.

3.3. U.S. Monetary Policy and Emerging Market Economy Yields

What is the effect of U.S. Federal Reserve policy on emerging market sovereign debt? Unfortunately, due to data availability, we can only answer this question for the post-GFC sample. Figure 10 provides the results for our group of 15 EMEs. The top panel plots the coefficients of ten-year EM yields as well as their expected short rate- and term premium components to Federal Reserve easing shocks. While they are small on impact, they quickly and persistently rise over time. The response of yields, expected short rates and term premiums peaks about thirty weeks after the surprise and then declines. The responses of EM yields to Fed easing surprises are not only highly statistically significant, but also economically large. A surprise cut equivalent to an immediate 25 bps decline of the one-year U.S. Treasury yield is associated with an approximately tenfold 2.5 percentage points drop of ten-year EME yields after thirty weeks. These dynamics are driven by both components of EME yields, with term premiums declining even more strongly in response to Fed easing decisions.

The bottom panel of Figure 10 provides the corresponding results for tightening surprises. While the coefficients show a small positive initial response, they quickly drop after a few weeks and remain in negative territory up to one year after the Fed decision. The negative coefficients for EME yields and both their components imply that surprise tightening decisions of the Federal Reserve have been associated with falling short rate expectations and term premiums in EMEs in the post-GFC sample.

In sum, the results in this section show that spillovers from U.S. monetary policy to international bond markets are large, highly persistent and asymmetric across easing and tightening shocks. Having studied mostly short-term spillovers, the previous literature appears to have underestimated the effects of U.S. monetary policy on global bond markets.

4. Potential Explanations

In this section, we explore a few potential explanations for our results. First, we study the role of intermediaries' portfolio duration in the transmission of monetary policy shocks to the yield curve along the lines of recent work by Kekre et al. (2022). Second, we analyze the role of mutual fund flows in explaining the transmission of U.S. monetary policy to global sovereign bond markets.

4.1. Intermediaries and Monetary Policy Transmission to the Yield Curve

In Sections 2 and 3, we have documented that Federal Reserve easing shocks have led to an increase of term premiums before the GFC, but a compression of term premiums in the U.S. and in global bond markets after the GFC.

In recent work, Kekre et al. (2022) argue that the transmission of monetary policy shocks to the yield curve may depend on the balance sheet capacity of intermediaries who arbitrage the demands of preferred habitat investors. Their model is an extension of Vayanos and Vila (2021) with arbitrageur equity wealth being an additional state variable. In the model of Kekre et al. (2022), monetary policy easing shocks have three distinct and potentially offsetting effects on bond yields. First, an easing shock lowers the expected path of policy rates and thus compresses bond yields across the maturity spectrum, with smaller effects on longer maturities. This is the classical expectations hypothesis channel. Second, an easing shock leads to increased demand of habitat investors for longer-term bonds and thus raises the term premium, all else equal. This is the Vayanos-Vila preferred habitat channel. Third, if the bond portfolio of arbitrageurs has positive duration, an easing surprise raises their wealth and thus their intermediation capacity, leading to a decline of the term premium potentially offsetting the increase due to the second channel. This is the additional channel highlighted by Kekre et al. 2022. In their model, the response of the term premium to monetary policy surprises thus crucially depends on the duration of arbitrageurs' bond portfolios. The authors provide a calibration of their model to the duration of Federal Reserve primary dealers' balance sheets and show that it matches the response of longer-term (real) forward rates to monetary policy surprises in the period from 2004-2016.

Primary dealers play a crucial role in the U.S. Treasury market as they are authorized by the Federal Reserve to participate directly in government bond auctions. They underwrite and distribute new Treasury securities on behalf of the U.S. government and make markets by buying and selling these securities. Primary dealers are thus key for ensuring a smooth functioning of the Treasury market and for the transmission of policy shocks to the yield curve.

In a recent paper, Du et al. (2022) document that the balance sheet composition of primary dealers has shifted from net short coupon-bearing Treasury securities before the GFC to net long in recent years. According to the model in Kekre et al. 2022, this shift could explain the structural break in the relationship between monetary policy surprises and term premiums that we have documented around the GFC. To further explore this explanation, we follow Born et al. (2020) and extend equation (2) by a smooth regime transition mechanism in the following way:

$$\begin{aligned}\Delta_h^{(n)} y_{t,i} = {} & \beta_{tight}^{h,H} \mathbb{1}_{\{MP_t>0\}} F(PD_t) MP_t + \beta_{tight}^{h,L} \mathbb{1}_{\{MP_t>0\}} [1 - F(PD_t)] MP_t \\ & + \beta_{eas}^{h,H} \mathbb{1}_{\{MP_t<0\}} F(PD_t) MP_t + \beta_{eas}^{h,L} \mathbb{1}_{\{MP_t<0\}} [1 - F(PD_t)] MP_t + \text{controls} + \varepsilon_{t,i}^h, \quad (4)\end{aligned}$$

where β_h^H (β_h^L) measures the response of the dependent variable to a monetary policy shock in a state of high (low) primary dealer duration. The function $0 \leq F(PD_t) \leq 1$ thus maps the portfolio duration at time t into a probability of being in a high or low duration regime. The exact shape of the probability function $F(PD_t)$ follows the empirical cumulative density function of the observations of the weighted average portfolio duration. Hence, $F(PD_t)$ is equal to one if duration is at its sample maximum, and zero if it is at its minimum. We measure primary dealer balance sheet duration using data on their net positions by maturity bucket, provided by the Federal Reserve Bank of New York in its FR2004 primary dealer statistics. Specifically, we compute the value-weighted duration by compounding their net positions in Treasury bills and coupon bonds with an average time to maturity for each maturity bucket. Figure 11 shows the corresponding series. Consistent with Du et al. (2022), our measure of dealers' Treasury portfolio duration has switched from net short to net long around the GFC.

Combining the local projections with a smooth regime-switching mechanism for dealers' net Treasury duration results in four different impulse response functions—one for periods of high duration and one for periods of low duration for both easing and tightening surprises, respectively. These are shown in Figure 12. They highlight a strong dependence of the response of Treasury yields to U.S. monetary policy shocks on dealers' net duration. In states of low dealer balance sheet duration, easing shocks are associated with strongly statistically

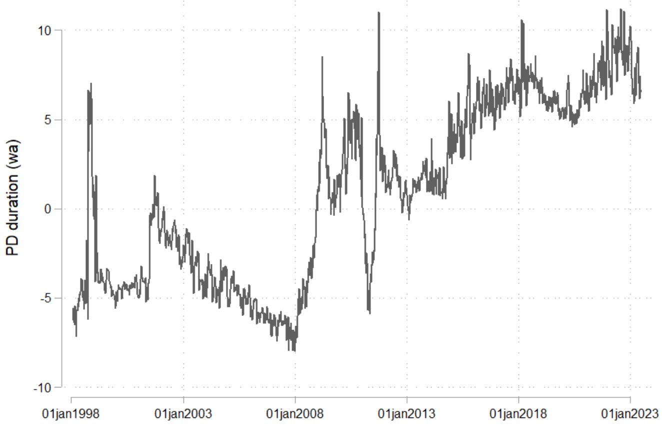


Figure 11
Primary dealers' government bond portfolio duration

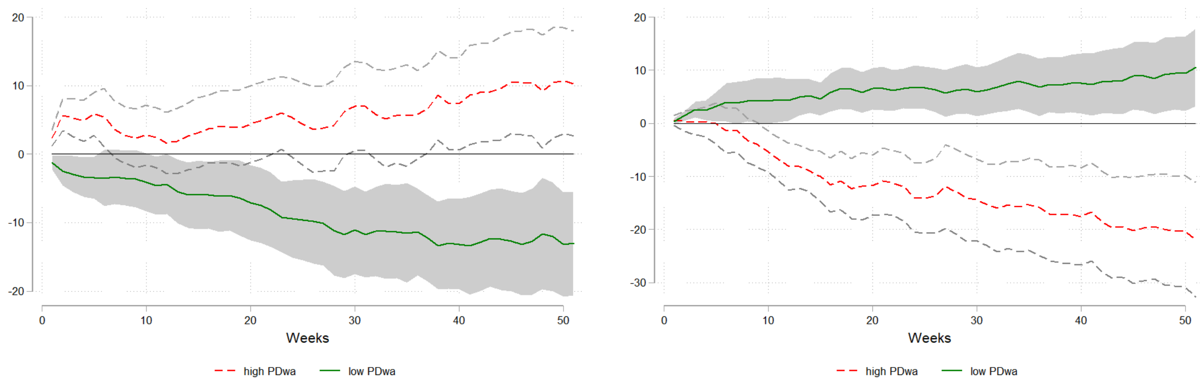
significant negative coefficients $\beta_{eas}^{h,H}$, and thus lead to an *increase* of the term premium. Conversely, in times of high dealer net duration, the coefficients are statistically significantly positive, and thus imply a negative response of the term premium to easing shocks.

These impulse responses associated with monetary easing surprises are qualitatively consistent with Kekre et al. (2022): when arbitrageurs have positive balance sheet duration, easing shocks increase their net worth and thus their arbitrage capacity. This lowers term premiums which compensate dealers for providing arbitrage capital. Conversely, when dealers have negative balance sheet duration, easing shocks lower their net worth and raise term premiums. The left panel of Figure 12 is thus consistent with our previous findings in light of the channel highlighted by Kekre et al. 2022. Before the GFC, when primary dealers had on average negative duration, Federal Reserve easing surprises were associated with strongly increasing term premiums (see the upper right panel in Figure 2).

That said, the response to tightening surprises, shown in the right panel of Figure 12, are inconsistent with the implications of the model in Kekre et al. (2022). According to their model, tightening shocks should raise term premiums if arbitrageurs have positive duration and compress term premiums if dealers have negative duration. The reason is that a policy tightening leads to a decline of longer-term bond prices and thus to a reduction of intermediation capacity if dealers' balance sheets have positive net duration. Yet, our results suggest the opposite: tightening shocks are associated with a strongly *negative* response of term premiums in states of high dealer balance sheet duration and a *positive* response in times of low net duration.

In sum, while the net duration of dealer balance sheets clearly appears to be informative about the response of term premiums to monetary policy shocks, the model in Kekre et al. (2022) can only explain the switch in the sign of the term premium to easing shocks around the GFC, but not the asymmetry of the responses to easing and tightening surprises that we document. One important caveat around this line of arguments is that the model in

Kekre et al. 2022 is a real model and therefore does not give rise to predictions about the response of *nominal* term premiums to policy shocks which we study here. Nominal term premiums embed a combination of real term premiums and inflation risk premiums, see e.g. Abrahams et al. (2016). Potentially, the response of inflation risk premiums to monetary policy shocks could be asymmetric due to the existence of a zero lower bound. As a result, the nominal term premium response to easing and tightening surprises could well reflect state dependencies such as the ones documented above.



(a) Easing **(b) Tightening**

Figure 12

Response of Treasury Term Premium to Fed Surprises depending on PD Duration

The figure shows impulse response functions of the ten-year U.S. Treasury term premium to U.S. monetary policy surprises, interacted with primary dealers' (PD) average government bond duration. We control for two previous monetary policy surprises, and five lags of the dependent variable. The sample period is January 1998 until November 2021. We use Newey-West standard errors and show confidence bands at the 68% and 90% level.

4.2. Persistent and asymmetric response of fund flows

One important dimension of our empirical results in the previous sections are the persistent and asymmetric spillovers of U.S. monetary policy surprises to global sovereign bond markets. In this section, we examine whether mutual fund flows into and out of local currency bonds in response to U.S. monetary policy shocks are consistent with the observed dynamics of yields and their components. For the U.S., Brooks, Katz and Lustig (2020) have documented that mutual fund flows into Treasury bonds respond sluggishly and persistently to Federal Reserve policy surprises. They argue that combined with a slow updating of investor's expectations of the short rate path, these flows can explain the protracted response of yields to policy shocks.

To explore whether mutual fund flows are consistent with our previous results, we again rely on panel local projections as outlined in equation (1). We now use cumulative changes in mutual fund flows as dependent variables. We again distinguish between countries classified as AEs and EMEs. We use data on mutual fund flows from the Emerging Portfolio Fund Research (EPFR) data base. The flows measure the change in total assets of all mutual funds in the data base investing mainly in local currency sovereign bonds of a specific country, corrected by asset valuations and exchange rate dynamics. Since the number of funds that are covered by EPFR is increasing over time, we standardize the flows by the number of funds covered at any given point in time. We use weekly data on fund flows, where a week runs from Thursday to Wednesday. The list of countries is provided in Tables 2 and 3 in the Appendix. For data availability reasons the sample is restricted to the post-GFC period from January 2010 until September 2022.[9]

The impulse responses of cumulative mutual fund flows to U.S. monetary policy surprises are reported in Figure 27 for advanced economies (left column) and emerging markets (right column). The top panel shows the responses to all policy shocks combined. While there is no significant response in the first few weeks after FOMC meetings, the coefficients for funds invested both in advanced and emerging market sovereign debt start to decline persistently thereafter. The increasingly negative coefficients are consistent with outflows in response to Fed tightening shocks (which have a positive sign) and inflows in response to easing shocks (which have a negative sign).

We explore potential asymmetries in the response of flows to easing and tightening shocks in the lower two panels of Figure 27. The middle panel reports the response of fund flows to easing shocks. The charts clearly show that a surprise easing of U.S. monetary policy results in persistent inflows into both advanced and emerging markets' sovereign debt funds. These inflows initially are of the same order of magnitude for advanced and emerging market economies. But while inflows into EME's debt stabilize after about 15 weeks, AE funds continue to experience substantial inflows thereafter.

In contrast, we see essentially no response of mutual fund flows to surprise tightenings of U.S. monetary policy, shown in the bottom panel. Funds invested in advanced economies do not show significant in- or outflows. While emerging market funds experience short-lived inflows, these are quickly reversed in subsequent weeks and turn into highly persistent significant outflows.

These mutual fund flows in response to U.S. monetary policy shocks are broadly consistent with the yield responses we have documented above. In the post-GFC sample, Federal Reserve easing surprises have been associated with persistently lower Treasury yields, driven by both expectations of lower future short rates and lower term premiums. At the same time, we observe substantial and highly persistent inflows into mutual funds invested in advanced and emerging market economies' sovereign debt. Concurrently, global bond yields show a persistent decline in response to these easing shocks. A plausible explanation is thus that lower Treasury yields have led to fund flows from Treasuries into non-U.S. sovereign debt, creating price pressure in these markets and thus pushing down yields persistently. In sharp contrast, over the same sample period U.S. tightening shocks did not have strong effects on

9 For some countries, the flow data are only available at a later point in time (see Appendix C.2).

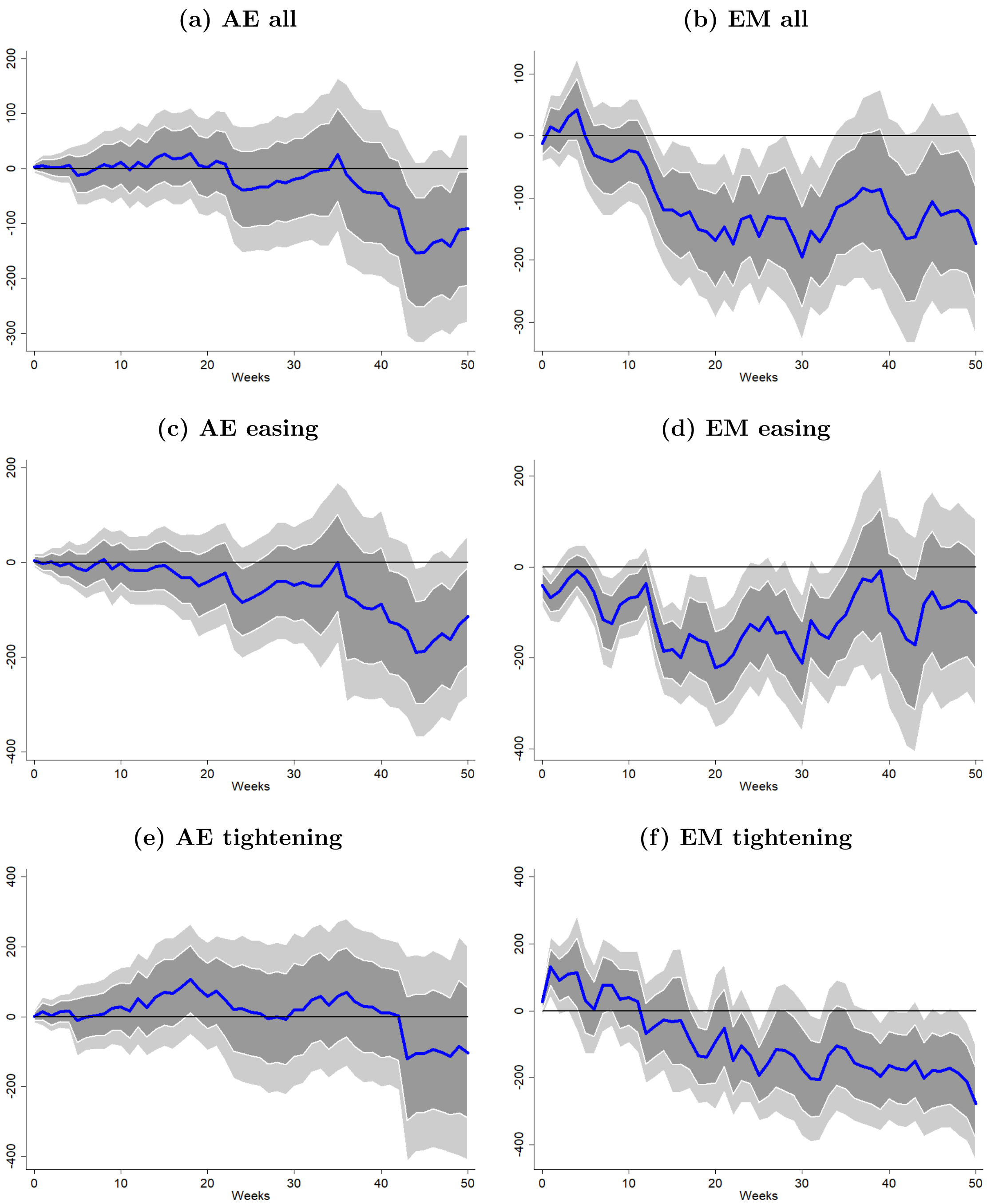


Figure 13

Cumulative mutual fund flow responses of AE and EM countries to U.S. monetary policy surprises

The figure shows impulse response functions of cumulative mutual fund flow responses of AE and EM countries to all (upper panel), easing (middle panel), and tightening (lower panel) NS U.S. monetary policy surprises obtained from panel local projections specified in equations (1) and (2), controlling for two previous monetary policy surprises, the current exchange rate of each country with respect to the U.S. Dollar, five lags of the dependent variable, a linear time trend, and country fixed effects. We measure flows in Million USD and divide by the number of funds covered at any given point in time. Hence, flows are reported in in Million USD per fund. The sample period is January 2010 until November 2021 and the set of countries is listed in Appendix C.2. We use Driscoll-Kraay standard errors and show confidence bands at the 68% and 90% level.

Treasury yields, and thus did not result in strong fund flows or a strong response of non-U.S. sovereign yields.

How can the persistent flow- and return pattern be rationalized? The slow response of capital to investment opportunities has been repeatedly observed and discussed in the literature (see, e.g., Duffie, 2010), and the persistence of flows in- and out of mutual funds in particular has been subject to much research (see, e.g., Choi, Kahraman and Mukherjee, 2016). Proposed explanations include institutional constraints and behavioral explanations such as inattention. Brooks et al. (2020) propose a model in which mutual fund investors slowly adjust their extrapolative expectations of future short rates after a target change. But if fund flows are predictable, why don't returns adjust immediately? Vayanos and Woolley (2013) rationalize this apparent disconnect based on a bird-in-hand effect. In their setup, assets held by mutual funds that experience a price drop are expected to underperform due to price pressures stemming from outflows. "Smart" investors could step in and buy these assets after they see the outflows occurring. This, however, exposes them to the risk that the future outflows may in fact occur, and hence the profit opportunity is not fully exploited.

5. Conclusion

In this paper, we have documented several new results on to the effects of U.S. monetary policy shocks on global sovereign debt markets. Most importantly, the effects of Federal Reserve surprises on U.S. Treasury and international bond markets are highly asymmetric across easings and tightenings, and feature a clear break around the GFC. Key to these patterns is the behavior of term premiums. Prior to the GFC, term premiums tended to rise strongly and persistently following accommodative policy news by the Federal Reserve, more than offsetting the decline of short-rate expectations. After the GFC, term premiums rise briefly in response to tightening shocks, before falling in a protracted manner; in response to easings shocks, term premiums fall persistently. The effects on international bond markets essentially mimic those of the U.S. Treasury market.

While we entertain several potential explanations for our findings, none of them fully explains these patterns. We confirm that the net duration of U.S. primary dealer balance sheets has switched sign around the GFC and that this duration is highly informative about the sign of the term premium response to monetary policy surprises. Consistent with Kekre et al. (2022), the changing Treasury duration of primary dealers' can rationalize the switching sign in the response of term premiums to easing shocks around the GFC. However, it fails to capture the time-varying response to tightening shocks. Hence, future research should aim at uncovering mechanisms that give rise to an asymmetry in term premium responses to policy shocks. Importantly, we find similar patterns of asymmetry and persistence as in yields in the mutual fund flow responses to U.S. monetary policy shocks, which also deserve further exploration.

Our findings appear relevant for central bankers trying to gauge the international spillovers of U.S. monetary policy. This is particularly important at the current juncture where the U.S. Federal Reserve has pushed up policy rates sharply higher at an unprecedented pace. Our results based on data since the GFC suggest that global term premiums and international sovereign bond yields, including those of emerging market economies, might not be affected as strongly as sometimes feared. So far, this has been borne out by the (out-of-sample) evidence.

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A. Additional Figures

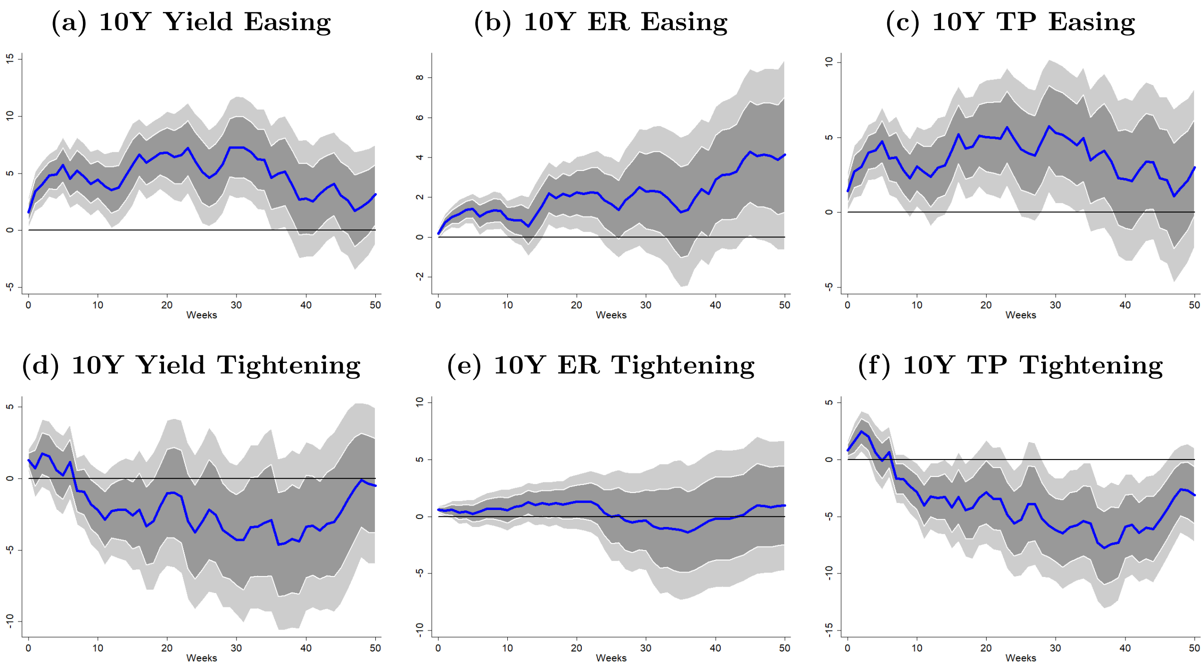
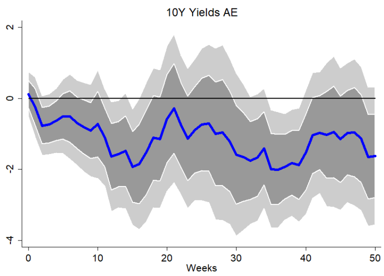


Figure 14

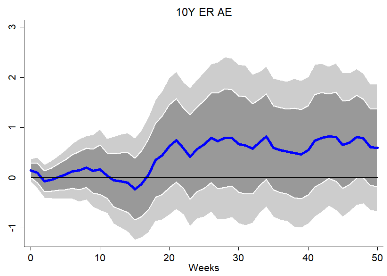
Asymmetric responses of U.S. 10Y yields and their expected rate (ER) and term premium (TP) components to U.S. monetary policy surprises 2010-2021

The figure shows impulse response functions of U.S. 10Y sovereign bond yields and their expected rate (ER) and term premium (TP) components to NS U.S. monetary policy surprises obtained from local projections specified in equation (2), controlling for two previous monetary policy surprises and five lags of the dependent variable. The sample period is January 2010 until November 2021. We use Newey-West standard errors and show confidence bands at the 68% and 90% level.

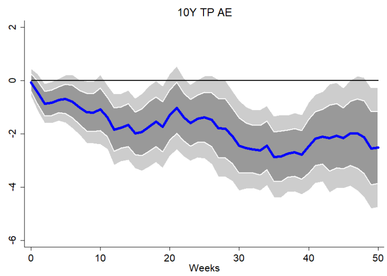
(a) 10Y Yield Easing



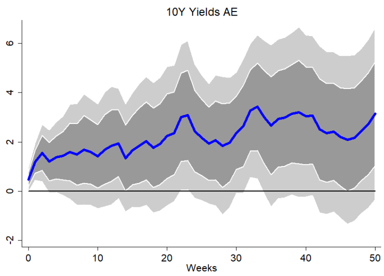
(b) 10Y ER Easing



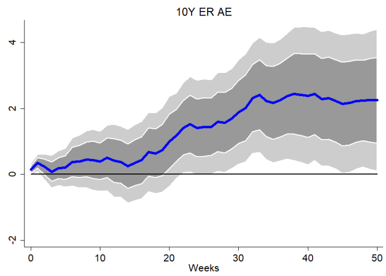
(c) 10Y TP Easing



(d) 10Y Yield Tightening



(e) 10Y ER Tightening



(f) 10Y TP Tightening

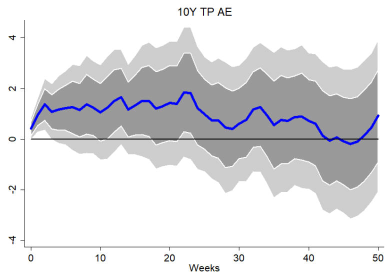


Figure 15

Asymmetric responses of 10Y yields of AE countries and their expected rate (ER) and term premium (TP) components to U.S. monetary policy surprises - 1995-2007

The figure shows impulse response functions of 10Y sovereign bond yields of AE countries and their expected rate (ER) and term premium (TP) components to NS U.S. monetary policy surprises obtained from panel local projections specified in equation (2), controlling for two previous monetary policy surprises, the current exchange rate of each country with respect to the U.S.$, five lags of the dependent variable, and country fixed effects. The sample period is January 1995 until November 2007 and the set of countries is listed in Appendix C.2. We use Driscoll-Kraay standard errors and show confidence bands at the 68% and 90% level.

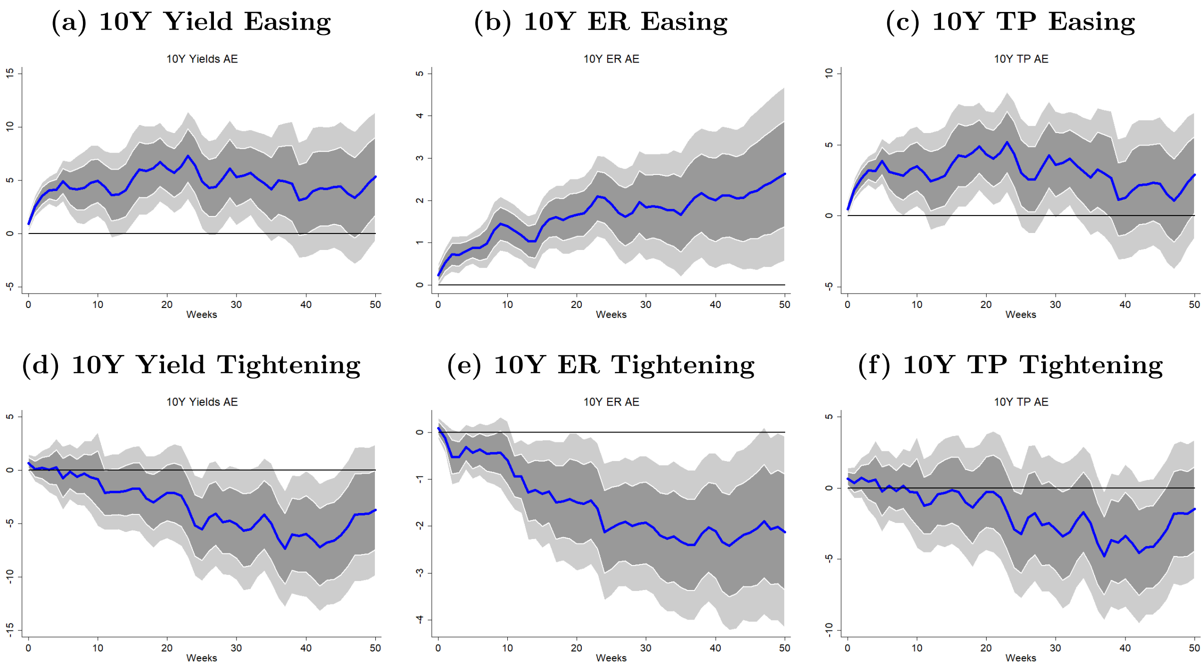


Figure 16

Asymmetric responses of 10Y yields of AE countries and their expected rate (ER) and term premium (TP) components to U.S. monetary policy surprises - 2010-2021

The figure shows impulse response functions of 10Y sovereign bond yields of AE countries and their expected rate (ER) and term premium (TP) components to NS U.S. monetary policy surprises obtained from panel local projections specified in equation (2), controlling for two previous monetary policy surprises, the current exchange rate of each country with respect to the U.S.$, five lags of the dependent variable, and country fixed effects. The sample period is January 2010 until November 2021 and the set of countries is listed in Appendix C.2. We use Driscoll-Kraay standard errors and show confidence bands at the 68% and 90% level.

B. Robustness

B.1. Controlling for future monetary policy surprises

(a) 2Y Yields (b) 10Y Yields

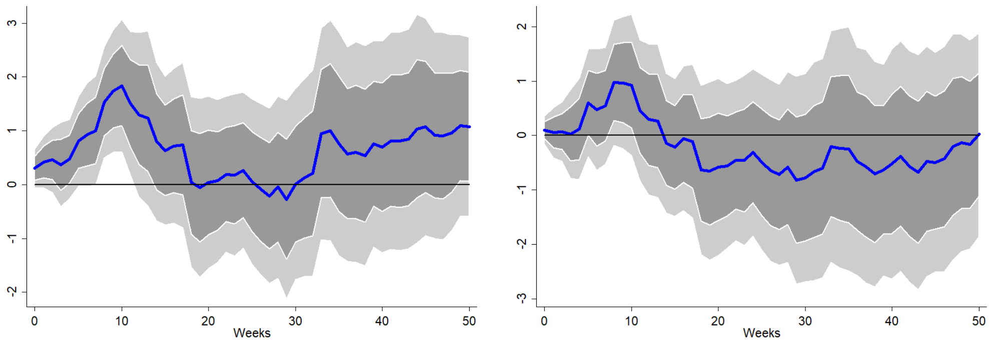


Figure 17

U.S. yield responses to U.S. monetary policy surprises

The figure shows impulse response functions of U.S. sovereign bond yields to Kuttner U.S. monetary policy surprises with target rate changes obtained from local projections specified in equation (1), controlling for two previous and all future monetary policy surprises up to horizon h, and five lags of the dependent variable. The sample period is June 1989 until November 2007. We use Newey-West standard errors and show confidence bands at the 68% and 90% level.

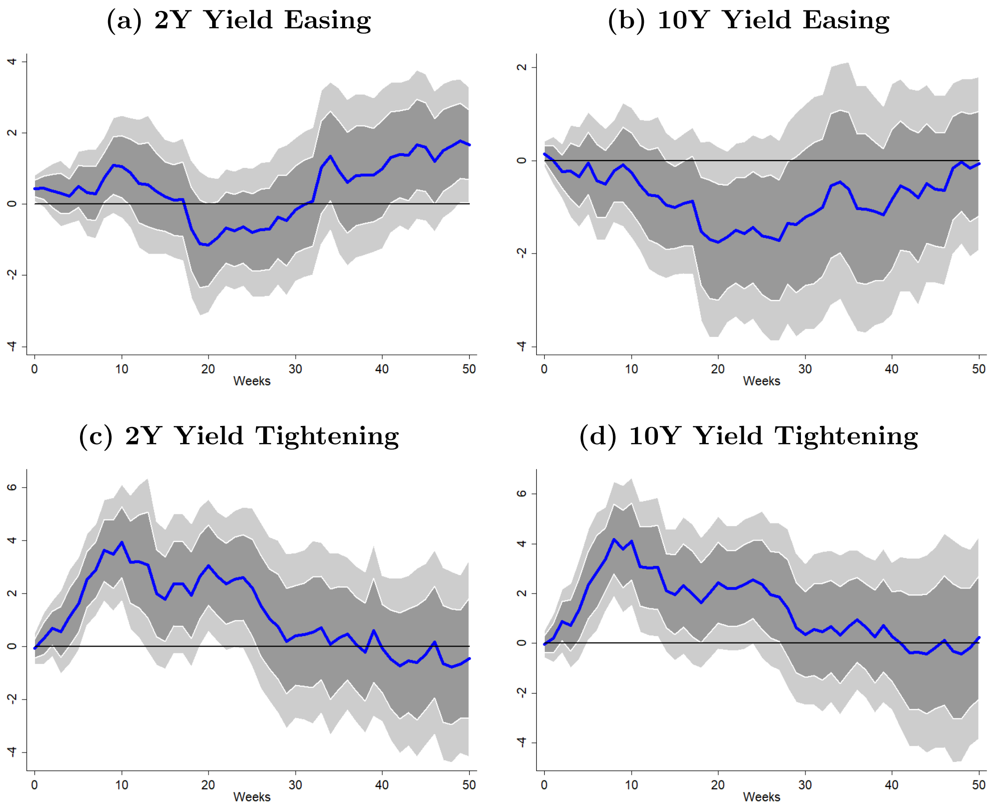


Figure 18

Asymmetric responses of 2Y and 10Y Treasury yields to Fed target rate surprises 1989-2007

The figure shows impulse response functions of ten-year Treasury yields to Kuttner (2001) Fed target rate surprises. These impulse responses are obtained from local projections specified in equation (2), controlling for two previous and all future monetary policy surprises up to horizon h, and five lags of the dependent variable. The sample period is June 1989 until November 2007. We use Newey-West standard errors and show confidence bands at the 68% and 90% level.

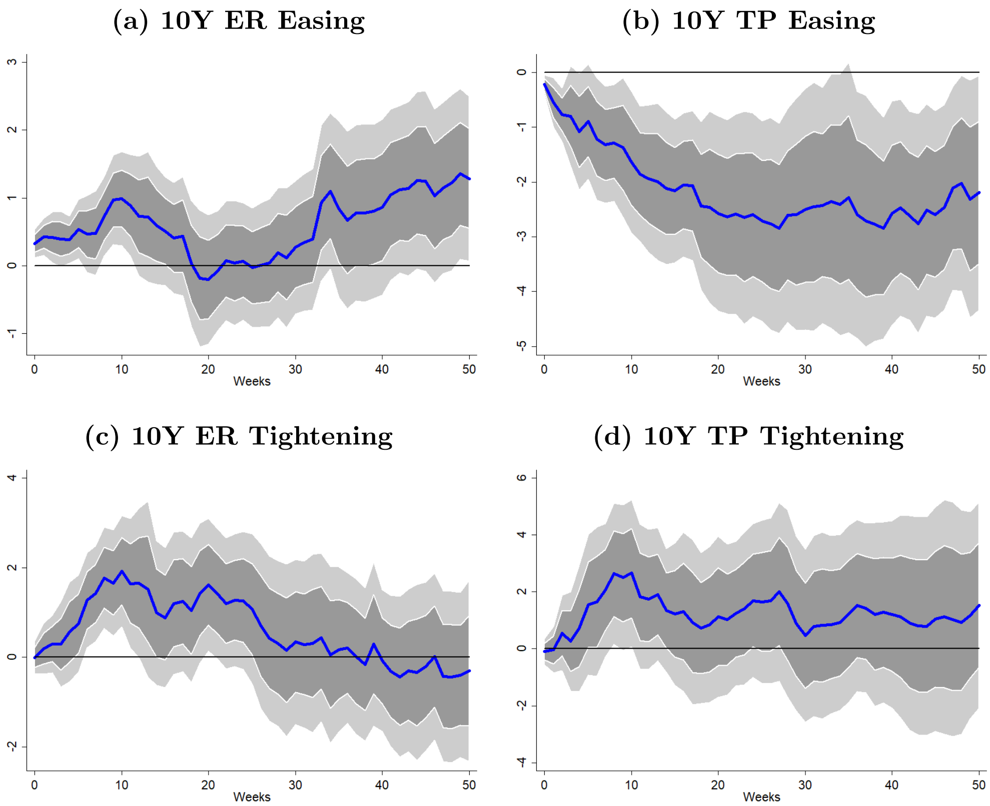


Figure 19

Asymmetric responses and the expected rate (ER) and term premium (TP) components of 10Y Treasury yields to Fed target rate surprises 1989-2008

The figure shows impulse response functions of the expected short rate (ER) and term premium (TP) components of ten-year Treasury yields to Kuttner (2001) Fed target rate surprises. These impulse responses are obtained from local projections specified in equation (2), controlling for two previous and all future monetary policy surprises up to horizon h, and five lags of the dependent variable. The sample period is June 1989 until November 2007. We use Newey-West standard errors and show confidence bands at the 68% and 90% level.

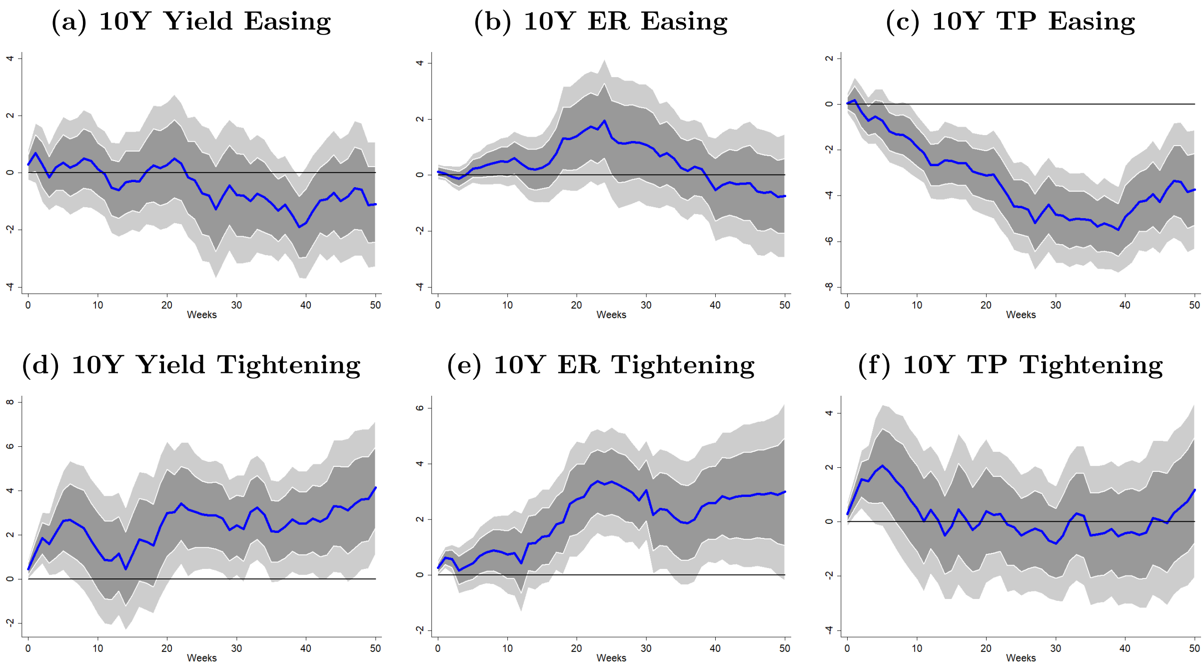


Figure 20

Asymmetric responses of U.S. 10Y yields and their expected rate (ER) and term premium (TP) components to U.S. monetary policy surprises 1995-2021

The figure shows impulse response functions of U.S. 10Y sovereign bond yields and their expected rate (ER) and term premium (TP) components to NS U.S. monetary policy surprises obtained from local projections specified in equation (2), controlling for two previous and all future monetary policy surprises up to horizon h, and five lags of the dependent variable. The sample period is January 1995 until November 2021. We use Newey-West standard errors and show confidence bands at the 68% and 90% level.

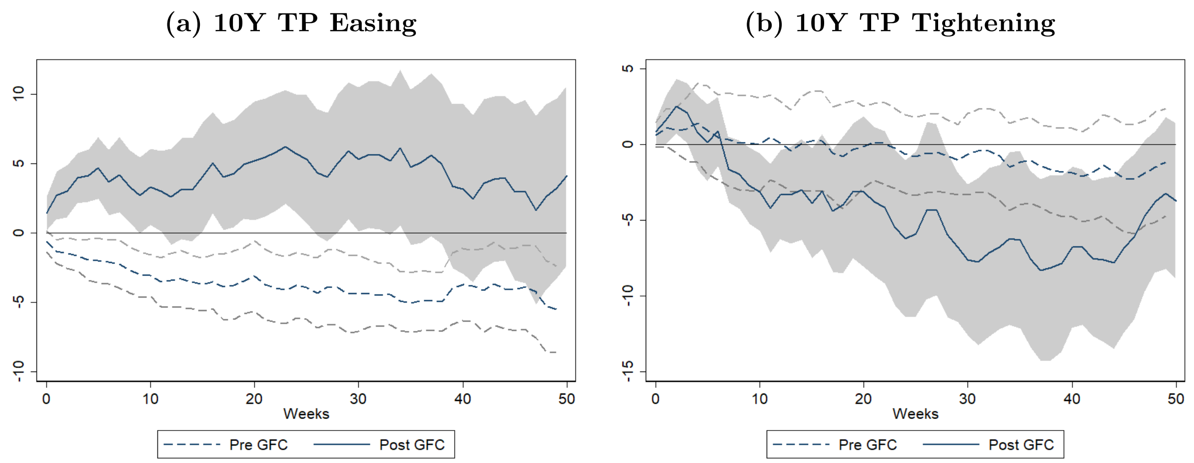


Figure 21

Asymmetric responses of U.S. 10Y term premium (TP) components to U.S. monetary policy surprises pre versus post-GFC

The figure shows impulse response functions of the ten-year U.S. Treasury term premium (TP) components to NS U.S. monetary policy surprises obtained from local projections specified in Equation ((2)), controlling for two previous and all future monetary policy surprises up to horizon h, and five lags of the dependent variable. The pre-GFC period is from January 1995 until November 2007 and the post-GFC period is from January 2010 until November 2021. We use Newey-West standard errors and show confidence bands at the 68% and 90% level.

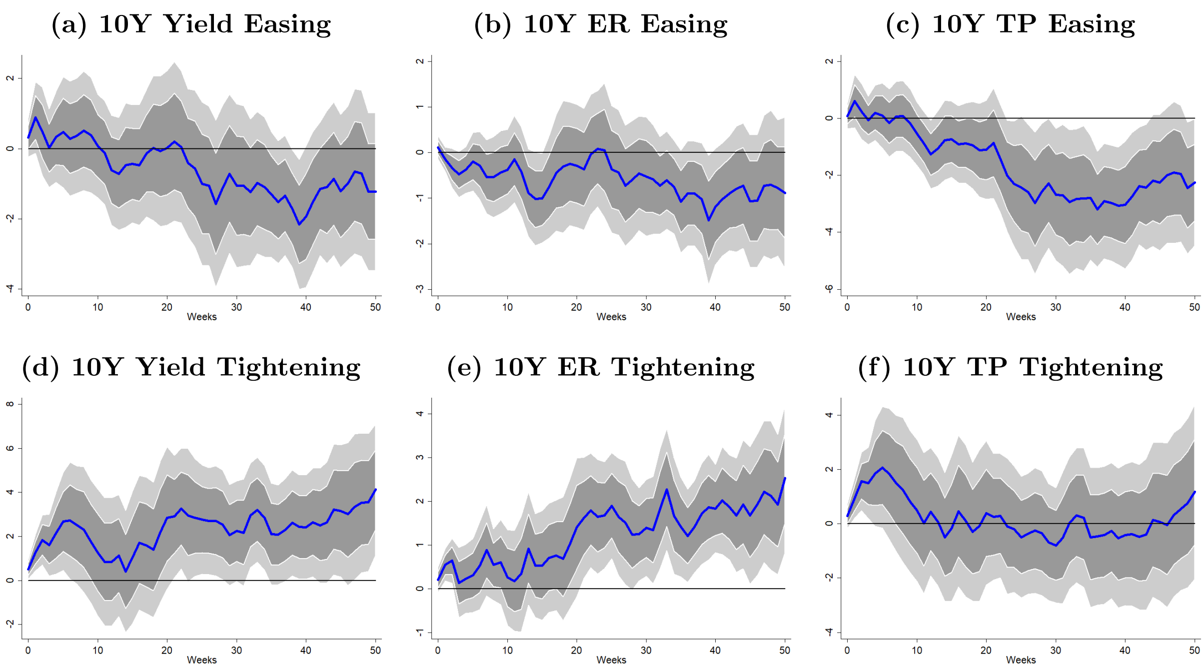


Figure 22

Impulse responses of ten-year U.S. Treasury yields and their expected rate (ER) and term premium (TP) components to U.S. monetary policy surprises, controlling for actual changes in the Fed Funds Rate: 1995-2021

The figure shows impulse response functions of ten-year U.S. Treasury yields and their expected rate (ER) and term premium (TP) components to U.S. monetary policy surprises obtained from local projections as specified in equation (2), controlling for two previous and all future monetary policy surprises up to horizon h, five lags of the dependent variable. Additionally, we control for changes in the effective federal funds rate between $t-1$ and h. The sample period is January 1995 until November 2021. We use Newey-West standard errors and show confidence bands at the 68% and 90% level.

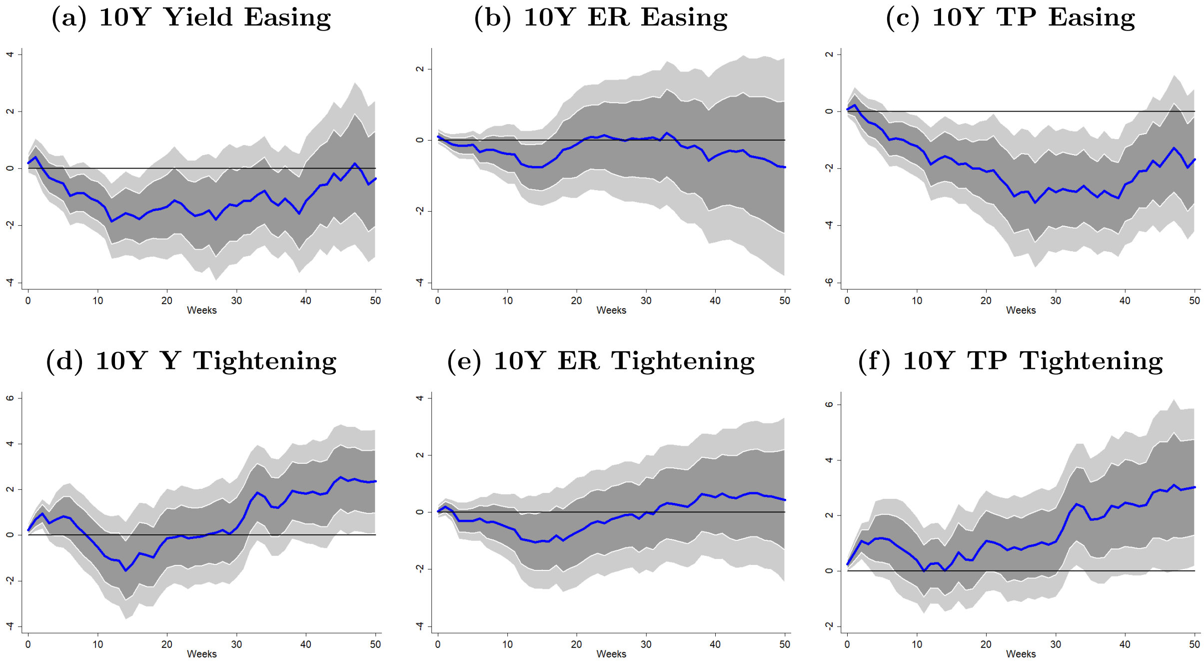


Figure 23

Asymmetric responses of U.S. 10Y yields and their expected rate (ER) and term premium (TP) components to U.S. monetary policy surprises 1995-2019

The figure shows impulse response functions of ten-year U.S. Treasury yields and their expected rate (ER) and term premium (TP) components to Bauer and Swanson (2023b) U.S. monetary policy surprises obtained from local projections specified in equation (2), controlling for two previous and all future monetary policy surprises up to horizon h, and five lags of the dependent variable. The sample period is January 1995 until January 2019. We use Newey-West standard errors and show confidence bands at the 68% and 90% level.

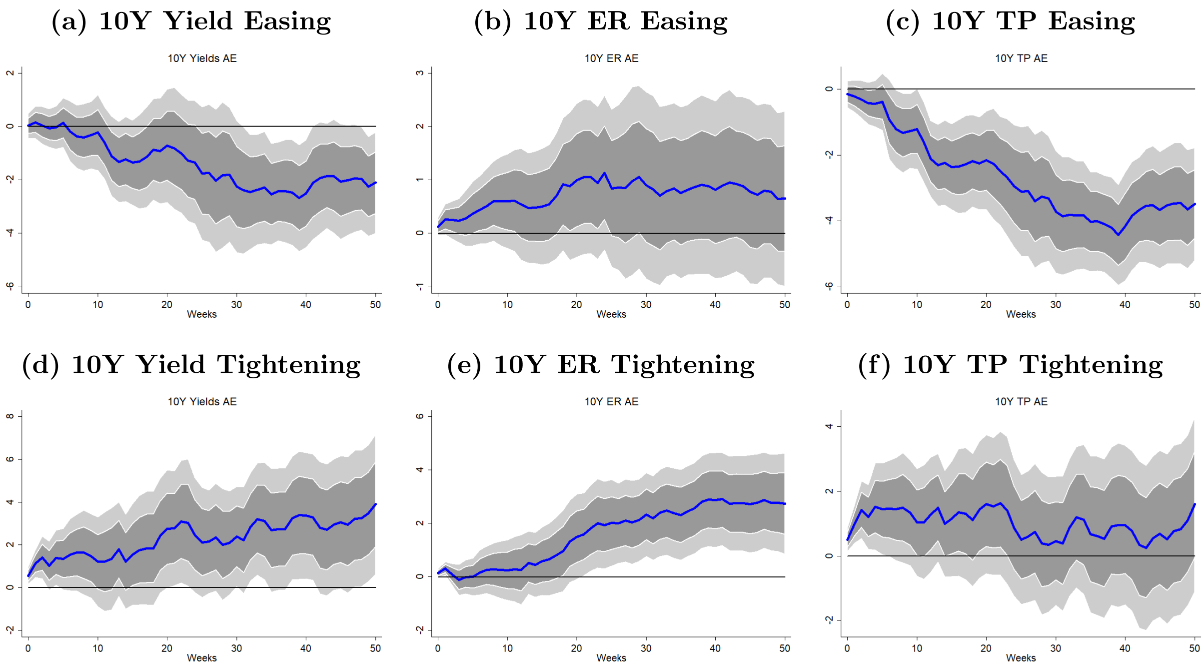
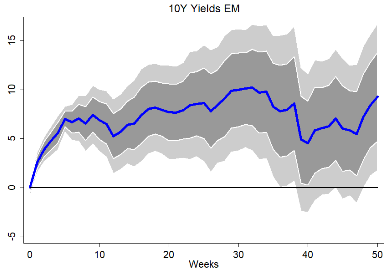


Figure 24

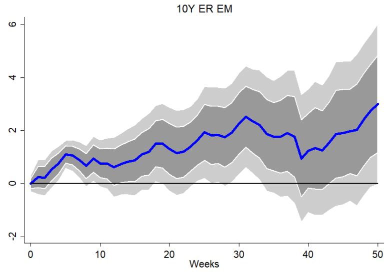
Response of AE yields and their components to Fed surprises: 1995-2021

The figure shows impulse response functions of ten-year sovereign yields of AEs and their expected short rate (ER) and term premium (TP) components to U.S. monetary policy surprises. The coefficients are obtained from panel local projections specified in Equation (2), controlling for two previous and all future monetary policy surprises up to horizon h, the current exchange rate of each country with respect to the U.S.$, five lags of the dependent variable, and country fixed effects. The sample period is January 1995 until November 2021 and the set of countries is listed in Appendix C.2. We use Driscoll-Kraay standard errors and show confidence bands at the 68% and 90% level.

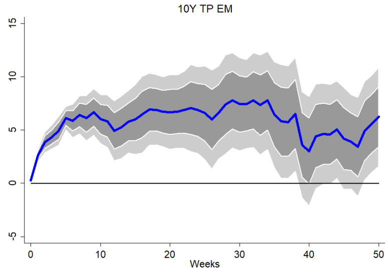
(a) 10Y Yield Easing



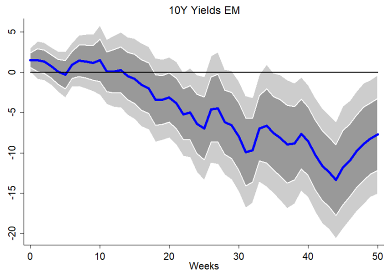
(b) 10Y ER Easing



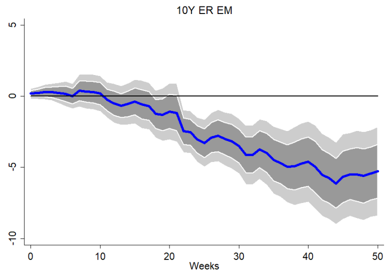
(c) 10Y TP Easing



(d) 10Y Yield Tightening



(e) 10Y ER Tightening



(f) 10Y TP Tightening

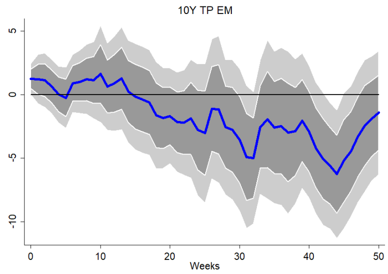
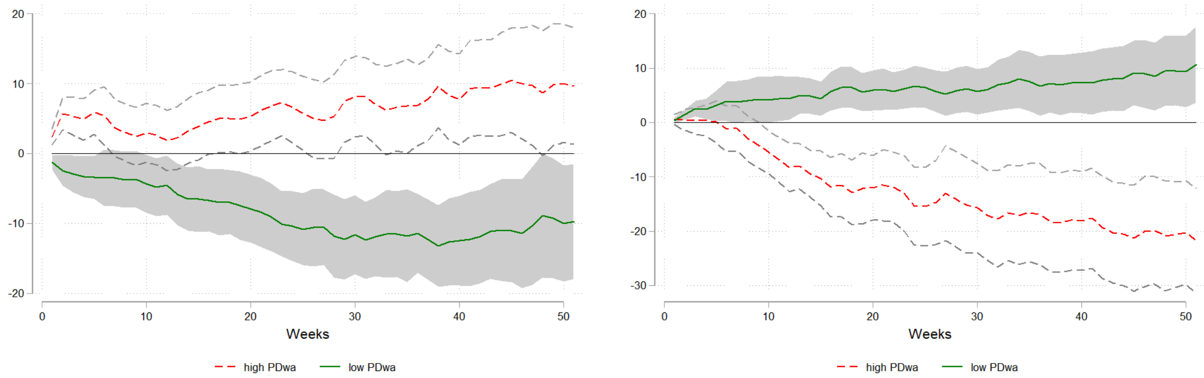


Figure 25

Response of EM yields and their components to Fed surprises: 2010-2021

The figure shows impulse response functions of ten-year EME sovereign yields and their expected short rate (ER) and term premium (TP) components to U.S. monetary policy surprises obtained, controlling for two previous and all future monetary policy surprises up to horizon h, the current exchange rate of each country with respect to the U.S.$, five lags of the dependent variable, and country fixed effects. The sample period is January 2010 until November 2021 and the set of countries is listed in Appendix C.2. We use Driscoll-Kraay standard errors and show confidence bands at the 68% and 90% level.



(a) Easing (b) Tightening

Figure 26

Response of Treasury Term Premium to Fed Surprises interacted with PD Duration

The figure shows impulse response functions of the ten-year U.S. Treasury term premium to U.S. monetary policy surprises, interacted with primary dealers' (PD) average government bond duration. We control for two previous and all future monetary policy surprises up to horizon h, and five lags of the dependent variable. The sample period is January 1998 until November 2021. We use Newey-West standard errors and show confidence bands at the 68% and 90% level.

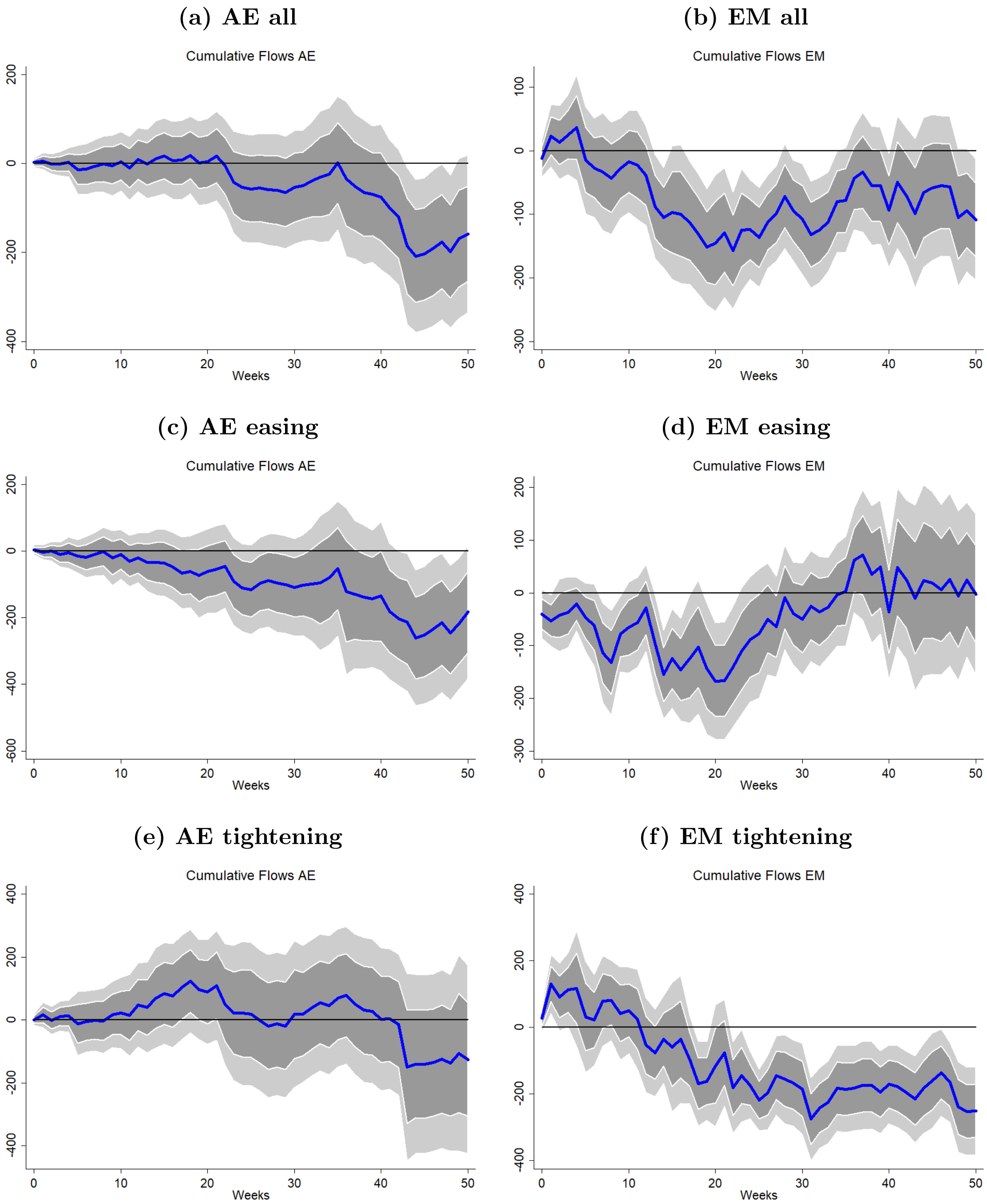


Figure 27

Cumulative mutual fund flow responses of AE and EM countries to U.S. monetary policy surprises

The figure shows impulse response functions of cumulative mutual fund flow responses of AE and EM countries to all (upper panel), easing (middle panel), and tightening (lower panel) NS U.S. monetary policy surprises obtained from panel local projections specified in equations (1) and (2), controlling for two previous and all future monetary policy surprises up to horizon h, the current exchange rate of each country with respect to the U.S.\$, five lags of the dependent variable, a linear time trend, and country fixed effects. The sample period is January 2010 until November 2021 and the set of countries is listed in Appendix C.2. We use Driscoll-Kraay standard errors and show confidence bands at the 68% and 90% level.

B.2. Using monetary policy shocks from Bauer and Swanson (2023b)

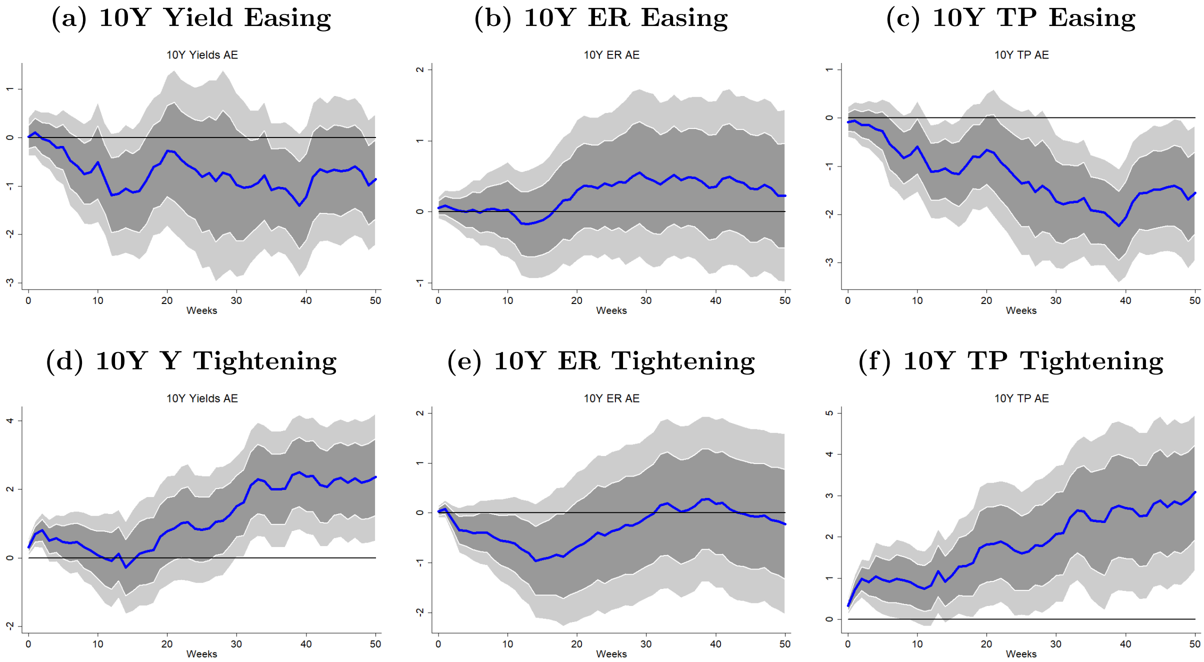


Figure 28

Response of AE yields and their components to Bauer and Swanson (2023b) Fed surprises: 1995-2019

The figure shows impulse response functions of ten-year sovereign yields of AEs and their expected short rate (ER) and term premium (TP) components to Bauer and Swanson (2023b) U.S. monetary policy surprises. The coefficients are obtained from panel local projections specified in Equation (2), controlling for two previous monetary policy surprises, the current exchange rate of each country with respect to the U.S.$, five lags of the dependent variable, and country fixed effects. The sample period is January 1995 until January 2019 and the set of countries is listed in Appendix C.2. We use Driscoll-Kraay standard errors and show confidence bands at the 68% and 90% level.

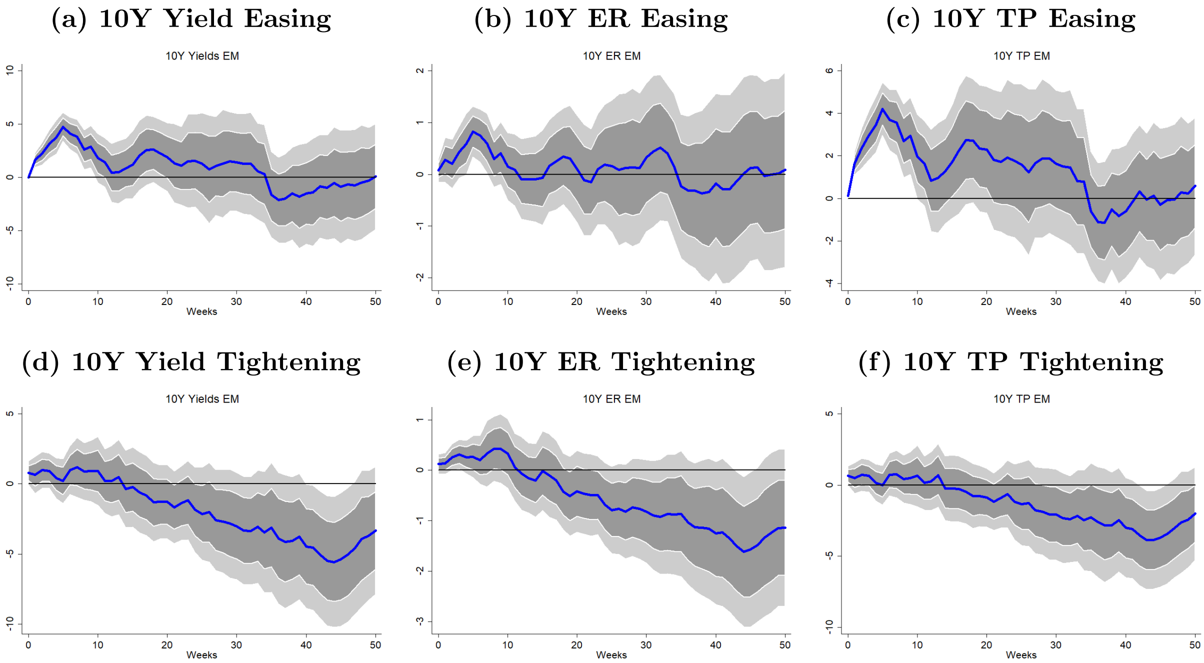


Figure 29

Response of EM yields and their components to Bauer and Swanson (2023b) Fed surprises: 2010-2019

The figure shows impulse response functions of ten-year EME sovereign yields and their expected short rate (ER) and term premium (TP) components to Bauer and Swanson (2023b) U.S. monetary policy surprises obtained, controlling for two previous monetary policy surprises, the current exchange rate of each country with respect to the U.S.$, five lags of the dependent variable, and country fixed effects. The sample period is January 2010 until November 2021 and the set of countries is listed in Appendix C.2. We use Driscoll-Kraay standard errors and show confidence bands at the 68% and 90% level.

C. Data overview

C.1. U.S. monetary policy surprises

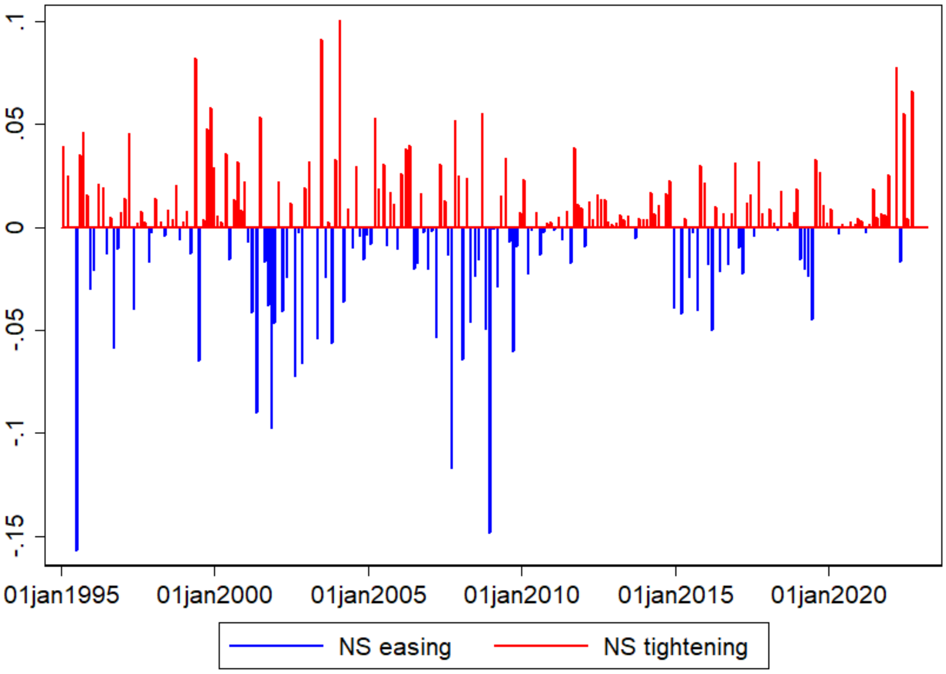


Figure 30
Monetary policy surprises from Nakamura and Steinsson (2018), updated by Acosta and Saia (2020)

C.2. List of countries in our sample

Table 2
Data availability of AE countries

Country (AE)	Yields	Flows
Australia	1995	2011
Belgium	1995	2010
Canada	1995	2009
Switzerland	1995	2009
Germany	1995	2009
Denmark	1995	2010
Spain	1995	2012
Finland	1995	2012
France	1995	2010
United Kingdom	1995	2004
Ireland	1995	2014
Italy	1995	2012
Netherlands	1995	2012
Norway	1995	2010
New Zealand	1995	2020
Sweden	1995	2010

Table 3
Data availability of EM countries

Country (EM)	Yields	Flows
Brazil	2007	2016
Chile	2005	2018
China	2004	2013
Colombia	2006	2013
Czech republic	2000	2004
Hungary	2001	2012
Indonesia	2003	2013
Israel	2005	2015
Malaysia	2001	2009
Mexico	2003	2009
Peru	2006	-
Poland	2000	2012
Portugal	1995	-
Russia	2005	2013
South Africa	1995	2012

D. Additional Tables

Table 4
Responses of U.S. yields and their expected rate (ER) and term premium (TP) components to U.S. monetary policy surprises: 1995-2021

	Y24				Y120			
$h =$	0	10	20	50	0	10	20	50
Easing NS shocks								
Yields	0.19	0.19	1.33	2.19	0.30	-0.04	0.12	-0.02
	(0.35)	(0.89)	(1.78)	(1.98)	(0.33)	(0.80)	(1.13)	(1.59)
ER	0.17	0.45	1.44	2.03	0.13	0.29	0.94	1.42
	(0.24)	(0.75)	(1.52)	(1.83)	(0.17)	(0.51)	(1.02)	(1.20)
TP	0.03	-0.56**	-0.83**	-1.43***	0.05	-1.78**	-2.74***	-4.94***
	(0.10)	(0.26)	(0.34)	(0.41)	(0.27)	(0.77)	(1.04)	(1.22)
Tightening NS shocks								
Yields	0.54*	1.07	2.78	7.38**	0.47*	1.24	2.05	4.85***
	(0.31)	(1.65)	(2.43)	(3.01)	(0.28)	(1.71)	(1.93)	(1.77)
ER	0.32	0.80	1.96	7.01**	0.25	0.61	1.36	4.54**
	(0.28)	(1.26)	(2.08)	(2.95)	(0.18)	(0.88)	(1.42)	(1.92)
TP	0.11	0.25	0.40	0.62	0.28	0.55	0.84	1.00
	(0.09)	(0.55)	(0.56)	(0.57)	(0.28)	(1.61)	(1.65)	(1.82)

The table shows the regression results for horizons h obtained from local projections specified in equation (2). The dependent variables are changes in U.S. 2Y and 10Y sovereign bond yields and their expected rate (ER) and term premium (TP) components between week $t + h$ and $t - 1$. As monetary policy shocks, we use the NS shocks. Control variables are two previous monetary policy surprises, and five lags of the dependent variable. The sample period is January 1995 until November 2021. Newey-West standard errors are shown in parentheses.

Table 5

Responses of U.S. yields and their expected rate (ER) and term premium (TP) components to U.S. monetary policy surprises: 2010-2021

	Y24				Y120			
$h =$	0	10	20	50	0	10	20	50
Easing NS shocks								
Yields	0.64*	2.71**	4.96**	6.80	1.58*	4.44***	6.78***	3.15
	(0.36)	(1.16)	(2.00)	(4.58)	(0.83)	(1.64)	(2.22)	(2.65)
ER	0.14	0.60	1.95	4.96	0.18	0.93*	2.24**	4.14
	(0.28)	(0.84)	(1.63)	(4.48)	(0.19)	(0.56)	(1.10)	(2.91)
TP	0.49*	1.02*	1.68**	0.89	1.42*	3.06*	5.01**	3.01
	(0.27)	(0.55)	(0.78)	(1.06)	(0.79)	(1.63)	(2.32)	(3.21)
Tightening NS shocks								
Yields	1.31***	1.05	3.02	2.94	1.27***	-2.23	-1.04	-0.51
	(0.43)	(2.02)	(2.86)	(6.05)	(0.48)	(1.76)	(3.10)	(3.30)
ER	0.77***	1.32	1.94	1.71	0.60***	0.55	1.30	0.99
	(0.26)	(1.57)	(2.08)	(4.90)	(0.19)	(1.11)	(1.47)	(3.47)
TP	0.28	-0.96*	-0.92	-0.88	0.84	-2.86*	-2.86	-3.12
	(0.18)	(0.52)	(0.96)	(0.86)	(0.52)	(1.55)	(2.79)	(2.52)

The table shows the regression results for horizons h obtained from local projections specified in equation (2). The dependent variables are changes in U.S. 2Y and 10Y sovereign bond yields and their expected rate (ER) and term premium (TP) components between week $t+h$ and $t-1$. As monetary policy shocks, we use the NS shocks. Control variables are two previous monetary policy surprises and five lags of the dependent variable. The sample period is January 2010 until November 2021. Newey-West standard errors are shown in parentheses.

Table 6
Responses of yields and their expected rate (ER) and term premium (TP) components of AE countries to U.S. monetary policy surprises: 1995-2021

	Y24				Y120			
$h =$	0	10	20	50	0	10	20	50
Easing NS shocks								
Yields	0.27	0.78	1.05	1.38	0.03	-0.25	-0.64	-1.53
	(0.27)	(1.09)	(1.69)	(1.72)	(0.29)	(0.83)	(1.19)	(1.03)
ER	0.24	0.98	1.42	2.07	0.13	0.53	0.78	1.15
	(0.17)	(0.88)	(1.36)	(1.61)	(0.11)	(0.51)	(0.78)	(0.88)
TP	-0.03	-0.37	-0.58*	-1.10***	-0.16	-1.16	-1.89*	-3.52***
	(0.08)	(0.27)	(0.34)	(0.33)	(0.25)	(0.74)	(0.97)	(0.96)
Tightening NS shocks								
Yields	0.31	1.08	2.54	6.26**	0.56**	1.22	2.28	4.21**
	(0.24)	(1.49)	(2.28)	(2.91)	(0.25)	(1.28)	(1.70)	(1.99)
ER	0.18	0.50	1.62	5.29*	0.14	0.23	0.91	2.91*
	(0.17)	(1.15)	(1.95)	(2.72)	(0.10)	(0.69)	(1.13)	(1.51)
TP	0.17**	0.56	0.74	1.08*	0.51**	1.09	1.84	2.02
	(0.08)	(0.42)	(0.50)	(0.59)	(0.23)	(1.03)	(1.43)	(1.75)

The table shows the regression results for horizons h obtained from local projections specified in equation (2). The dependent variables are changes in 2Y and 10Y sovereign bond yields and their expected rate (ER) and term premium (TP) components of AE countries between week $t+h$ and $t-1$. As monetary policy shocks, we use the NS shocks. Control variables are two previous monetary policy surprises, five lags of the dependent variable, the current exchange rate of each country with respect to the U.S.$ and country fixed effects. The sample period is January 1995 until November 2021. Driscoll-Kraay standard errors are shown in parentheses.

Table 7

Responses of yields and their expected rate (ER) and term premium (TP) components of AE countries to U.S. monetary policy surprises: 1995-2007

	Y24				Y120			
$h =$	0	10	20	50	0	10	20	50
Easing NS shocks								
Yields	0.25	-0.03	0.78	0.63	0.11	-0.73	-0.57	-1.62
	(0.37)	(1.06)	(1.77)	(1.41)	(0.39)	(0.93)	(1.24)	(1.18)
ER	0.25	0.33	1.05	1.06	0.15	0.16	0.63	0.60
	(0.22)	(0.75)	(1.37)	(1.40)	(0.14)	(0.49)	(0.83)	(0.77)
TP	-0.01	-0.34	-0.36	-0.65*	-0.07	-1.09	-1.29	-2.51*
	(0.11)	(0.26)	(0.34)	(0.39)	(0.32)	(0.80)	(0.94)	(1.36)
Tightening NS shocks								
Yields	0.31	1.10	2.45	4.64*	0.48	1.41	2.23	3.15
	(0.26)	(1.30)	(1.85)	(2.61)	(0.30)	(1.30)	(1.72)	(2.13)
ER	0.21	0.70	1.74	3.91*	0.16	0.40	1.00	2.25*
	(0.19)	(0.87)	(1.37)	(2.31)	(0.12)	(0.56)	(0.83)	(1.31)
TP	0.12	0.41	0.61	0.56	0.42	1.06	1.42	0.92
	(0.09)	(0.39)	(0.51)	(0.57)	(0.27)	(1.14)	(1.50)	(1.83)

The table shows the regression results for horizons h obtained from local projections specified in equation (2). The dependent variables are changes in 2Y and 10Y sovereign bond yields and their expected rate (ER) and term premium (TP) components of AE countries between week $t+h$ and $t-1$. As monetary policy shocks, we use the NS shocks. Control variables are two previous monetary policy surprises, five lags of the dependent variable, the current exchange rate of each country with respect to the U.S.$ and country fixed effects. The sample period is January 1995 until November 2007. Driscoll-Kraay standard errors are shown in parentheses.

Table 8

Responses of yields and their expected rate (ER) and term premium (TP) components of AE countries to U.S. monetary policy surprises: 2010-2021

	Y24				Y120			
$h =$	0	10	20	50	0	10	20	50
Easing NS shocks								
Yields	0.71	3.52***	3.99***	5.55*	0.94*	4.96**	6.11***	5.37
	(0.53)	(1.04)	(1.34)	(3.32)	(0.51)	(2.04)	(2.18)	(3.68)
ER	0.27	2.02***	2.14**	4.18**	0.23	1.39***	1.66***	2.64**
	(0.28)	(0.58)	(0.86)	(2.04)	(0.17)	(0.38)	(0.52)	(1.26)
TP	0.20	1.56***	1.86***	1.40	0.47	3.48**	4.33**	2.89
	(0.20)	(0.58)	(0.67)	(1.42)	(0.43)	(1.72)	(1.88)	(2.70)
Tightening NS shocks								
Yields	0.31	-0.64	-3.45*	-5.27*	0.68	-0.85	-2.14	-3.72
	(0.37)	(2.36)	(1.93)	(3.08)	(0.50)	(2.68)	(2.62)	(3.74)
ER	0.06	-0.65	-2.68*	-3.56*	0.09	-0.60	-1.49*	-2.13*
	(0.24)	(1.03)	(1.48)	(2.00)	(0.14)	(0.51)	(0.89)	(1.25)
TP	0.23	0.05	-0.96	-1.72	0.66	-0.30	-0.29	-1.47
	(0.16)	(1.35)	(0.94)	(1.38)	(0.46)	(2.38)	(2.49)	(2.97)

The table shows the regression results for horizons h obtained from local projections specified in equation (2). The dependent variables are changes in 2Y and 10Y sovereign bond yields and their expected rate (ER) and term premium (TP) components of AE countries between week $t+h$ and $t-1$. As monetary policy shocks, we use the NS shocks. Control variables are two previous monetary policy surprises, five lags of the dependent variable, the current exchange rate of each country with respect to the U.S.$ and country fixed effects. The sample period is January 2010 until November 2021. Driscoll-Kraay standard errors are shown in parentheses.

Table 9
Responses of yields and their expected rate (ER) and term premium (TP) components of EM countries to U.S. monetary policy surprises: 2010-2021

	Y24				Y120			
$h =$	0	10	20	50	0	10	20	50
Easing NS shocks								
Yields	-0.22	3.16**	5.50**	11.24**	0.04	6.64***	8.11***	10.76**
	(0.60)	(1.43)	(2.22)	(5.70)	(0.52)	(1.86)	(2.68)	(4.79)
ER	-0.11	1.57	3.30*	7.73*	0.00	0.83	1.65*	3.89*
	(0.40)	(1.06)	(1.69)	(3.95)	(0.19)	(0.53)	(0.88)	(2.10)
TP	-0.18	1.61***	2.31***	3.09*	0.28	5.73***	6.77***	6.39**
	(0.31)	(0.55)	(0.84)	(1.86)	(0.37)	(1.34)	(2.00)	(2.79)
Tightening NS shocks								
Yields	1.14	2.41	-1.38	-11.67*	1.54*	1.73	-2.98	-5.81
	(0.74)	(2.65)	(3.35)	(6.59)	(0.90)	(2.66)	(3.12)	(4.85)
ER	0.22	0.98	-1.72	-7.61	0.19	0.27	-0.98	-3.88
	(0.41)	(1.46)	(2.09)	(4.84)	(0.22)	(0.76)	(1.18)	(2.50)
TP	0.54	1.08	-0.30	-3.10	1.23	1.75	-1.72	-1.04
	(0.38)	(1.46)	(1.61)	(1.99)	(0.75)	(2.34)	(2.35)	(2.92)

The table shows the regression results for horizons h obtained from local projections specified in equation (2). The dependent variables are changes in 2Y and 10Y sovereign bond yields and their expected rate (ER) and term premium (TP) components of AE countries between week $t+h$ and $t-1$. As monetary policy shocks, we use the NS shocks.Control variables are two previous monetary policy surprises, five lags of the dependent variable, the current exchange rate of each country with respect to the U.S.$ and country fixed effects. The sample period is January 2010 until November 2021. Driscoll-Kraay standard errors are shown in parentheses.

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