Do Central Bank Words Matter in Emerging Markets? Evidence from Mexico [†]

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Abstract

This paper analyzes the price and quantity effects of monetary policy statements in an emerging market economy. Surprises in monetary policy are identified using intraday data on asset prices around monetary policy announcements in Mexico. I find that asset prices and the portfolio flows of domestic and foreign investors respond strongly and persistently to both news about the policy rate and guidance about its future path communicated via statements. The ability to manage expectations about future policy via statements is thus not exclusive to central banks in advanced economies and does not require the zero lower bound to be binding.

Keywords: Monetary policy surprises, exchange rate, yield curve, portfolio flows, emerging markets, high-frequency data.

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1 Introduction

Monetary policy in emerging markets is generally viewed in terms of interest rate policies. For advanced economies, however, it is also associated with forward guidance and asset purchases. Are central banks in emerging markets limited to interest rate policies? On the one hand, committing to a future policy seems unnecessary when the policy rate is unconstrained by the zero lower bound, as is generally the case for emerging markets. On the other hand, an inflation targeting regime and well-anchored inflation expectations allow them to pursue more forward-looking policies so as to reduce policy uncertainty.

This paper studies whether monetary policy in an emerging market economy is conducted exclusively through adjustments in the level of the policy rate or by also communicating additional information via statements. To address this question, I first construct a new dataset of intraday changes in swap rates around regular monetary policy announcements in Mexico from 2011 to 2023,[1] and use it to identify monetary policy surprises following the methodology proposed by Gürkaynak et al. (2005);[2] I then characterize the price and quantity effects of those surprises by analyzing the response of the exchange rate, bond yields and the portfolio flows of domestic and foreign investors.

Mexico offers an ideal setting to study this question. It is a small open economy with a credible inflation targeting regime (De Pooter et al. 2014, Beauregard et al. 2021), a market-based exchange rate (Ilzetzki et al. 2019), and relatively liquid financial markets[3]. Several emerging markets share similar characteristics (Ruch 2021, Ilzetzki et al. 2019, OECD 2020), so the analysis in this paper can serve as a benchmark for understanding the effects of monetary policy statements in those countries. In addition, the Mexican central bank collects a unique dataset of daily holdings for all Mexican government bonds disaggregated by type of investor that allows me to better understand the transmission

[1] The swaps reference an interbank interest rate that closely follows the policy rate.

[2] Their methodology identifies surprises directly from asset prices, it does not involve textual analysis.

[3] In particular, the sovereign local currency bond market has a diversified (domestic and foreign) investor base, a highly liquid repo market, effective systems for market making, settlement and clearing, and bonds included in global benchmark indices (OECD 2016). Although foreign investors are an important driver of the liquidity premium in Mexican fixed-rate bonds (Christensen et al. 2021), the market is not dependent on them, as is the case for other emerging markets (see Table A B.20 in OECD 2023).

mechanisms of its monetary policy.[4]

I find that Banxico, the Mexican central bank, conducts its monetary policy by communicating two types of information via statements: news about the policy rate and guidance about its future path. Unexpected changes in them are henceforth referred to as target and path surprises, respectively.[5] I show that path surprises are closely related to information in the statements. The fact that Banxico actually uses path surprises suggests that central banks in emerging markets do have the ability to manage expectations about future policy via statements, even if the zero lower bound is not binding.[6] The multidimensionality of monetary policy (Gürkaynak et al. 2005, Altavilla et al. 2019, Swanson 2021) is thus not exclusive to central banks in advanced economies.

Banxico's target and path surprises influence asset prices and portfolio flows. The analysis relies on a high-frequency event study and local projections to quantify the contemporaneous and persistent effects of target and path surprises on the exchange rate, bond yields and portfolio flows. High-frequency event studies overcome endogeneity concerns by isolating the surprise component of monetary policy decisions (Nakamura and Steinsson 2018), while local projections are more robust to model misspecification than vector autoregressions (Jordà 2005).

Target and path tightening surprises appreciate the local currency, in line with standard open economy models. A 25 basis point target or path tightening surprise appreciates the currency by about 0.6% and 0.3%, respectively, over the sample. However, the role of both surprises shifted at the end of 2014, a period of declining oil prices and uncertainty about the end of the zero lower bound era in the U.S. The exchange rate response is stronger and persistent to path surprises before the end of 2014, and to target surprises afterwards. A 25 basis point target (post-2014) or path (pre-2014) tightening surprise would appreciate the currency by 1.3%. Both surprises occured more frequently

[4]Cross-border capital flows (including portfolio flows, foreign direct investment, and banking flows) are reported quarterly, although some sources report portfolio flows monthly and at most weekly.

[5]Path surprises by emerging market central banks could also be considered as communication surprises or as a subtle form of forward guidance. Kuttner (2018) notes that although there is no consensus in the literature of what constitutes forward guidance, the likely trajectory of the policy rate communicated near the zero lower bound is more explicit than under a conventional regime.

[6]Central banks in advanced economies also communicated information about future policy before the global financial crisis, when the zero lower bound was not binding (Gürkaynak et al. 2005).

post-2014, which suggests that investors in the forex market may give more weight to information about the *future* stance of monetary policy in periods of relative stability, but more weight to the *current* monetary policy stance when they are frequently surprised by the central bank. In any case, both type of surprises play an important role in the transmission of monetary policy to the exchange rate, a vital channel for open economies.

Target and path tightening surprises also flatten the yield curve. Medium- and long-term yields tend to react more to path than to target surprises on-impact, consistent with the evidence for the U.S. when its policy rate was not constrained by the zero lower bound (Gürkaynak et al. 2005, Swanson 2021). Both surprises have persistent effects on the yield curve days after an announcement, but their role shifted at the end of 2016, around the time of the U.S. presidential election. Bond yields' response is stronger to target surprises before the end of 2016, and to path surprises afterwards. Although the timing of the change is not the same, it suggests that bond investors weight target and path surprises differently than forex investors. Regardless, both surprises improve the implementation of monetary policy in Mexico by affecting medium- and long-term yields to the extent they influence the spending decisions of households and firms.

Domestic and foreign investors rebalance their debt portfolios in response to target and path surprises. This rebalancing effect occurs between domestic and foreign investors as well as across different types of domestic investors. For instance, the evidence suggests that after a tightening of the monetary stance, some domestic investors (firms and households) position themselves in the short end of the yield curve; while foreign investors prefer exposure to the long end. Foreign investors thus participate in the transmission of the local monetary policy.[7] Finally, investors take time to rebalance their portfolios. This sluggish response by investors supports the evidence of a delayed response by the exchange rate and bond yields just mentioned, and is consistent with the literature on slow-moving capital in asset pricing (Duffie 2010).

Banxico therefore does not conduct monetary policy exclusively using target surprises. Path surprises have an equally important role in the transmission of monetary

[7]Nevertheless, domestic investors increase their positions when foreigners retreat from certain markets.

policy. Moreover, the relative influence of each policy can change over time depending on macroeconomic circumstances and institutional arrangements.

This paper contributes to the literature in three respects. First, it assesses the role of high-frequency identified path surprises in an emerging market economy. The literature on the multidimensionality of monetary policy has hitherto concentrated on advanced economies,[8] and intraday data is rarely used for emerging markets. Second, the effects of target and path surprises are not only analyzed on asset prices but on daily portfolio flows to better understand the transmission mechanisms of monetary policy. The literature for advanced economies generally considers only the effects on prices (not quantities), while for emerging markets, it mostly focuses on target (not path) surprises (Kohlscheen 2014, Solís 2023). Third, this paper takes the perspective of the host country when analyzing the effects of its monetary policy on incoming portfolio flows. Traditionally, the literature on monetary policy spillovers takes the perspective of the home country.[9] As far as I know, this is the first paper to show evidence on the portfolio rebalancing effect of monetary policy using daily flow data and on how foreign investors respond to the monetary policy of an emerging market.

The rest of the paper is structured as follows. Section 2 describes how monetary policy surprises are identified. Section 3 shows that Banxico uses two types of monetary policy surprises. Sections 4 and 5 respectively characterize the response of asset prices and portfolio flows to both types of surprises. The last section concludes.

2 Identification of Monetary Policy Surprises

This section summarizes the relevant institutional details for the identification of the monetary policy surprises. It also describes the asset prices used in the analysis.

[8] Blinder et al. (2008) review the literature on the influence of central bank communications on financial markets but mainly for advanced economies. Some evidence exists for emerging markets using content analysis to classify communications (Su et al. 2019), yet the approach is prone to subjectivity.

[9] The literature using a home-country perspective documents significant flows into financial assets in emerging markets after the global financial crisis (Fratzscher et al. 2018). Hausman and Wongswan (2011) show that stock prices respond more to U.S. target surprises, that exchange rates and long-term yields respond more to U.S. path surprises, and that short-term yields respond to both types of surprises. Bowman et al. (2015) and Fischer (2020) show that the effect of U.S. monetary policy surprises is particularly relevant for local currency sovereign yields.

The Bank of Mexico, also known as Banxico, is an independent central bank that follows an inflation targeting regime since 2001. Its inflation target is 3% with a range of ± 1%, and its monetary policy instrument is the overnight interbank interest rate. A Governing Board comprising a governor and four deputy governors meets on average eight times a year to discuss monetary policy; the announcements of its decisions are made via statements released at 1 p.m. local time on dates (usually Thursdays) that are published ahead of time.[10] Solís (2023) provides the dates and times of the announcements.

This paper uses swap rates to measure surprises in monetary policy decisions. The swaps market in Mexico references the 28-day interbank interest rate (TIIE28D), an interbank interest rate denominated in local currency that serves as a benchmark for banking loans in the country and that closely follows the policy rate.[11] Banxico reports the TIIE28D once a day based on quotes submitted by commercial banks. The 3-month swap of the TIIE28D is the main local derivative. Solís (2023) uses this swap to capture surprises in the policy rate. This paper extends his analysis by considering a broader sense of monetary policy surprises given that the adoption of inflation targeting and well-anchored inflation expectations arguably allowed Banxico to pursue more forward-looking policies.

I consider swaps with maturities up to one year. Like other central banks, Banxico communicates information about its monetary policy outlook via statements. This information might influence market expectations about future policy actions. Unlike in several countries after the global financial crisis and the Covid-19 pandemic, the policy rate in Mexico has not been constrained by the zero lower bound. As a consequence, Banxico's monetary policy statements include information about future policy actions within a year out at most, it does not need to commit to a predetermined policy path for longer periods. Moreover, using maturities up to one year is consistent with the approach of Gürkaynak et al. (2005) for the U.S. before the global financial crisis.[12]

[10]Previously, Banxico conducted monetary policy by setting a quantitative target for reserves and by expressing monetary conditions in basis points (before 2008), the Governing Board met more frequently (before 2011), and the announcements were made at 9 a.m. local time (before 2015), see Solís (2023).

[11]The average difference between the TIIE28D and the policy rate is around 30 basis points. Since this spread exhibits small variation, it essentially cancels out when computing changes in swap rates.

[12]Swanson (2021) argues for including maturities of more than one year out if the policy rate is

Asset price changes are calculated on intraday windows containing regular monetary policy announcements. The monetary policy surprises use intraday differences from 10 minutes before to 20 minutes after each announcement for swaps with maturities of 3, 6, 9 and 12 months.[13] To measure the effects of the surprises, intraday differences over the same windows are also calculated for assets that are closely related to monetary policy; namely, the Mexican peso (MXN) per U.S. dollar (USD) exchange rate and the yields of fixed-rate bonds issued by the Mexican government with maturities of 2, 5, 10 and 30 years.[14] For yields, the change is calculated directly using quotes before and after the announcements; for the exchange rate, 100 times log differences are used to approximate the percentage change (or return) over the window.[15]

All the asset price information comes from Bloomberg. The data to calculate the intraday differences for the swap rates and the exchange rate are available since 2011, and since 2013 for bond yields other than the 5-year yield for which the sample starts in December 2014. The dataset covers up to the June 2023 announcement. Between January 2011 and June 2023, there were 99 regularly-scheduled monetary policy announcements.[16] Table 1 summarizes the asset price intraday changes and the surprises discussed in the next section.

3 Monetary Policy Dimensions

This section shows that two factors in monetary policy announcements move asset prices in Mexico. The first factor is associated with surprises about the current policy rate and the other factor, with surprises about its future path communicated via policy statements.

constrained by the zero lower bound and the central bank uses unconventional monetary policy tools.

[13] When no information is available at any of those times, the next available quote is used instead. If they are still not available using wider windows for the day, the open and close quotes are used instead. Those cases are rare, they only happen on a few days for some swaps.

[14] The Mexican government issued 10- 20- and 30-year fixed-rate local-currency bonds for the first time in 2001, 2003 and 2006, respectively, following the implementation of a debt management strategy to develop its debt market that started in 2000 (Jeanneau and Tovar 2008, Banxico 2014).

[15] All the results discussed below using tight 30-minute windows remain using wider 50-minute windows, starting 20 minutes before and ending 30 minutes after each monetary policy announcement.

[16] Banxico held three unscheduled monetary policy meetings during that period, one in 2016 and two in 2020 due to the Covid-19 pandemic. They are excluded from the sample because the decisions in all three cases were accompanied by additional non-monetary measures (see Appendix B in Solís (2023)).

Table 1. Summary Statistics of Intraday Asset Price Changes

	Mean	Std. Dev.	Min.	Max.	Obs
Δ 3-Month Swap	0.1	7.5	-45.8	19.5	99
Δ 6-Month Swap	0.2	8.8	-46.0	25.5	99
Δ 9-Month Swap	0.1	9.3	-49.0	26.5	99
Δ 12-Month Swap	0.3	9.4	-44.0	36.5	99
FX Returns	-9.2	34.4	-165.4	55.3	99
Δ 2-Year Yield	-0.2	6.8	-37.7	23.9	83
Δ 5-Year Yield	0.1	4.6	-15.4	19.1	64
Δ 10-Year Yield	-0.5	4.9	-25.8	11.9	83
Δ 30-Year Yield	-0.7	4.1	-19.8	8.2	83
Target Surprises	-0.0	7.4	-44.8	18.2	99
Path Surprises	-0.0	3.9	-14.9	11.8	99

Notes: This table reports summary statistics of intraday changes in swap rates and bond yields, as well as exchange rate (FX) returns around monetary policy announcements. The changes are calculated from 10 minutes before to 20 minutes after an announcement. All values are expressed in basis points. The sample includes all regular monetary policy announcements from January 2011 to June 2023; for bond yields the sample starts on January 2013, except for the 5-year yield for which the sample period covers from December 2014 to December 2022.

Subsequent sections analyze how asset prices and portfolio flows respond to these factors.

3.1 Assessing the Number of Factors

As in Gürkaynak et al. (2005), the number of factors influencing asset prices is assessed using the matrix rank test developed by Cragg and Donald (1997). Let X be a $T \times n$ matrix of asset price changes around monetary policy announcements with T observations and n asset prices, and with a factor structure given by:

$$X = F\Lambda + \zeta, \tag{1}$$

in which F is a $T \times k$ matrix with k unobserved factors, Λ is a $k \times n$ matrix of factor loadings and ζ is white noise. For a given number of variables n, the Cragg–Donald test assesses the null hypothesis that k_0 factors ($k_0 < n$) explain most of the variability observed in the data. The test minimizes the distance between the covariance matrix of the observed data and that obtained from all the possible models with k_0 factors. The test is a Wald statistic with an asymptotic χ^2 distribution and $(n - k_0)(n - k_0 + 1)/2 - n$

degrees of freedom.

The test is performed for the exchange rate and bond yields ($n = 5$) to assess the number of factors they react to, and for swaps with maturities up to one year ($n = 4$) to give a structural interpretation to the estimated factors. Inference based on the Cragg–Donald test requires to satisfy the condition $(n - k_0)(n - k_0 + 1)/2 > n$,[17] therfore k_0 can be at most 2 for the exchange rate and the yields, and 1 for the swaps. To check robustness to the frequency of the data and to the sample period, the test is also performed using daily changes in asset prices around the announcements. Daily changes for all assets are calculated since 2004, except for the 30-year yield with data since October 2006.

Table 2 shows that two factors characterize the responses of asset prices to monetary policy in Mexico. The null hypothesis of no factors ($k_0 = 0$) is strongly rejected in all cases, so asset prices in Mexico respond at least to one factor; Solís (2023) indeed shows that they respond to unanticipated changes in the current policy rate. The most interesting null hypotheses therefore involve one and two factors. The null hypothesis of one factor ($k_0 = 1$) is rejected for the exchange rate and bond yields, as well as for the swaps, regardless of the data frequency and the sample period, so asset prices respond at least to two factors. A third factor is not supported by the data since the null of two factors ($k_0 = 2$) cannot be rejected, even at the 10% significance level. Therefore, two factors drive the response of asset prices to monetary policy announcements, which implies that the multidimensionality of monetary policy (Gürkaynak et al. 2005, Altavilla et al. 2019, Swanson 2021) is not exclusive to advanced economies.

Notice that two monetary policy factors in Mexico is not a recent phenomenon. The test using daily data since 2004 shows that asset prices have responded to two factors even before Banxico adopted its current policy rate in 2008.[18]

In sum, asset prices in Mexico react to information provided by Banxico other than news about the policy rate. The next two subsections explain how to estimate and interpret the two factors.

[17] See Cragg and Donald (1997) and the appendix in Gürkaynak et al. (2005) for further details.

[18] The daily data sample can start in 2004 because the swaps reference the TIIE28D, not the policy rate.

Table 2. Tests of the Number of Factors in Monetary Policy Surprises

	Frequency	$H_0 : k = k_0$	Wald Statistic	Degrees of Freedom	p-value	Observations
Exchange Rate & Yield Curve	Intraday	0	26.25	10	0.003	64
		1	11.94	5	0.036	64
		2	1.23	1	0.267	64
	Daily	0	47.84	10	0.000	145
		1	22.60	5	0.000	145
		2	0.05	1	0.828	145
Swaps	Intraday	0	30.43	6	0.000	99
		1	6.57	2	0.037	99
	Daily	0	37.29	6	0.000	202
		1	9.93	2	0.007	202

Notes: This table reports the results from the Cragg–Donald test. H_0 is the null hypothesis of $k = k_0$ factors against the alternative of $k > k_0$ factors, where $k_0 = 0, 1, 2$. The sample includes all regular monetary policy announcements up to June 2023, the starting date varies based on data availability: for the exchange rate and the yield curve, it is December 2014 (due to the 5-year yield) with intraday data and October 2006 (due to the 30-year yield) with daily data; for swaps, it is January 2011 with intraday data and January 2004 with daily data. The yield curve includes 2-, 5-, 10- and 30-year bonds. Swaps have maturities of 3, 6, 9 and 12 months.

3.2 Estimating the Factors

The factors F, as well as their loadings Λ, in equation (1) are estimated by applying principal components to the matrix of asset price changes X. The first two principal components of X will be the two factors implied by the Cragg–Donald test. These two factors are orthogonal to each other and are linear combinations of the variables included in X, but they do not have a practical interpretation. Section 3.3 addresses this issue.

The two factors, F_1 and F_2, are estimated from X, comprising only the swaps for interpretation purposes. They are then normalized to have unit standard deviation and rotated to give them a structural interpretation.

Let U be a 2×2 rotation matrix for F such that

$$Z = F\,U, \tag{2}$$

in which Z denotes the rotated factors, Z_1 and Z_2. Four restrictions help to uniquely identify U in order to interpret the factors. The first three restrictions require the rotated factors to be orthogonal to each other and to have unit variance. The final restriction is set so that only Z_1 mirrors the changes in the 3-month swap, what Solís (2023) calls the policy rate surprises; its loading on the changes in Z_2 is thus zero.[19]

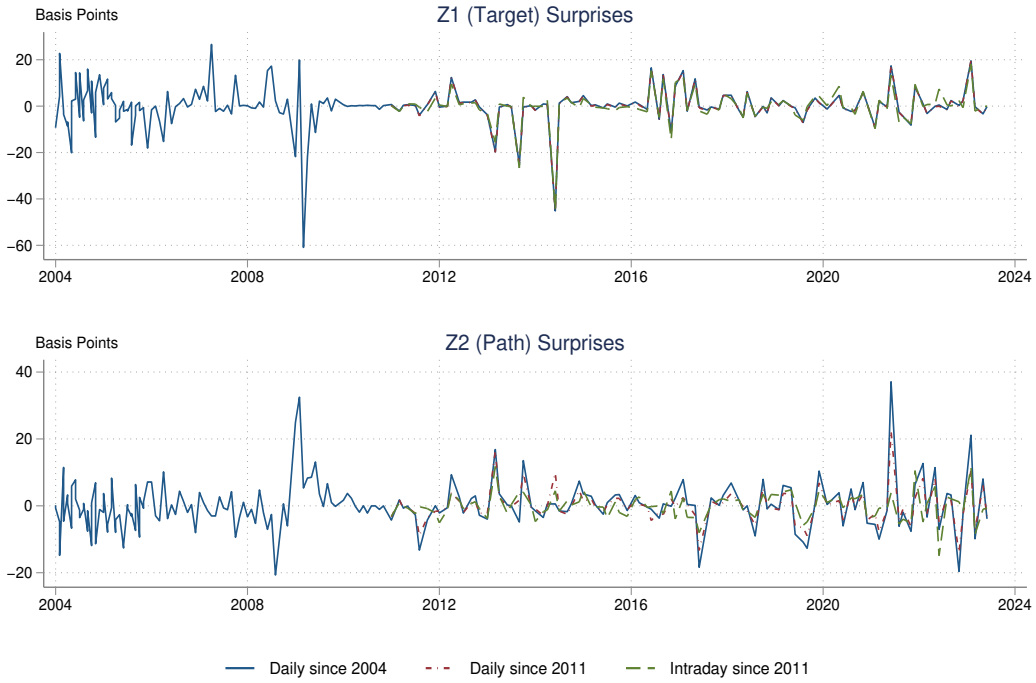
To further ease the interpretation and to be able to compare the magnitudes of the factors, they are rescaled so that Z_1 moves one-to-one with changes in the 3-month swap rate and Z_2 affects the 12-month swap rate in the same magnitude as Z_1 does. The base for rescaling is 2013, when intraday data for bond yields become available.[20]

Figure 1 displays the estimated factors using different sample periods and data frequency. The figure compares the time series of Z_1 (top panel) and Z_2 (bottom panel) obtained with intraday and daily data since 2011 as well as with daily data since 2004. Notice that Z_1 is less sensitive to changes in the sample period and the data frequency. Table 1 above shows that the standard deviation of Z_2 is close to half that of Z_1. Intu-

[19] The loadings on Z_1 and Z_2 for all four swaps can be expressed in terms of the parameters in U and the factor loadings Λ. To see this, substitute F from equation (2) into (1). The last restriction, however, only uses the two loadings in Λ for the 3-month swap. See the appendix in Gürkaynak et al. (2005).

[20] The rescaling does not affect the starting date of the factors.

Figure 1. Monetary Policy Surprises in Mexico: Intraday vs. Daily Data



Notes: This figure compares the evolution of the Z_1 (target) and Z_2 (path) factors or surprises obtained with daily data since 2004 (solid line) and 2011 (dash-dotted line), and with intraday data since 2011 (dashed line). The sample includes all regular monetary policy announcements up to June 2023.

itively, it is unlikely for the policy rate to reach the zero lower bound in Mexico, so the need of Banxico to rely on path surprises is relatively lower (hence the smaller variation).

The figure confirms that two monetary policy factors in Mexico is not a recent phenomenon, in line with table 2. Nevertheless, even though daily data yields longer time series, they have relatively less explanatory power and precision during the estimation (Kearns and Manners 2006, Solís 2023), so the rest of the analysis uses the factors identified with intraday data.

3.3 Interpreting the Factors

The factors Z_1 and Z_2 are henceforth referred to as the target and path factors or surprises. By definition, Z_1 moves one-to-one with changes in the 3-month swap. Thus, Z_1 can be related to surprises in the *current* policy rate, since changes in the 3-month swap adequately capture the monetary stance in the short run (Solís 2023). On the other

hand, Z_2 is aligned with movements in the 12-month swap that are unrelated to changes in the 3-month swap, so the second factor could in principle just capture movements in long-term yields.[21] The evidence in figure 2 and table 3 below, however, supports its association with surprises about the *future* path of the policy rate.[22] More broadly, path surprises by emerging market central banks could be considered as communication surprises or as a subtle form of forward guidance.

Figure 2 plots the estimated target and path surprises for relevant dates over the sample period. Target surprises are in the horizontal axis, and path surprises are in the vertical axis; the units are basis points. The figure is obtained by leaving out the points inside an arbitrary radius.[23] A positive value in any of the two surprises represents a tightening in Banxico's monetary stance, and a negative value represents an easing.

Banxico has used all four possible combinations of target and path surprises. The first quadrant shows announcements with target and path tightening surprises, while the third quadrant shows dates in which both surprises eased. In the second and fourth quadrants, one surprise tightened and the other eased.

3.3.1 Statements and Path Surprises

Central banks can use statements to convey information intended to influence expectations about future monetary policy decisions and to reduce policy uncertainty. This part shows that Banxico communicates information about the future path of its policy rate via statements.

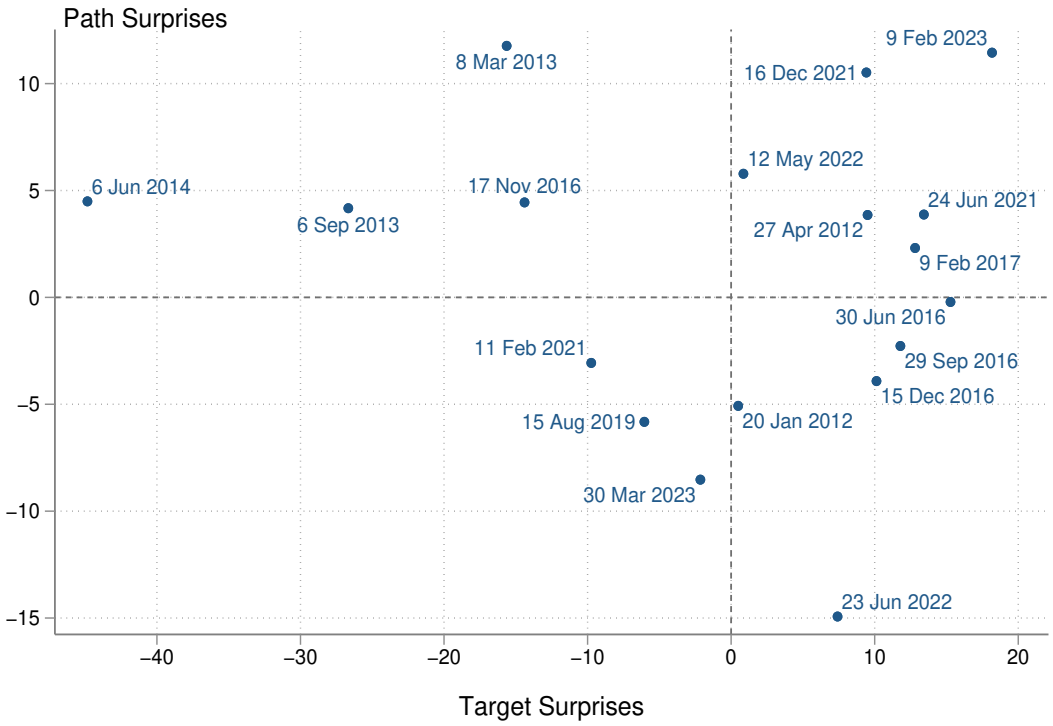
Table 3 shows that path surprises are closely related to information in the statements. It contains excerpts of statements for days in which path surprises are large in absolute value (most of them plotted in figure 2). All the excerpts contain clear references to the monetary stance outlook, and several of them make explicit reference to the future

[21] By construction, Z_1 is essentially the same as the policy rate surprises in Solís (2023), the correlation between the two measures is 0.99. Meanwhile, the correlation between Z_2 and the residual of a regression of the change in the 12-month swap on the change in the 3-month swap is 0.98.

[22] Gürkaynak et al. (2005) and Swanson (2021) show that the first and second factors in the U.S. also relate to surprises about the policy rate and its future path communicated via statements, respectively.

[23] Target and path surprises are orthogonal to each other by construction, so no correlation is to be expected between the dots in the figure.

Figure 2. Monetary Policy Dimensions



Notes: This figure plots the largest estimated target and path surprises (expressed in basis points) obtained from daily data, as explained in the main text. The sample includes all regular monetary policy announcements from January 2004 to June 2023.

path of the policy rate.[24] Notice that the text and the signs of the path surprises are consistent with each other, which is noteworthy since no textual analysis is involved in the identification of the surprises.

The tightening cycle that started in mid-2016 further exemplifies the link between path surprises and statements. The 2016 U.S. presidential election generated uncertainty about the bilateral relation of the two countries. Between early-November 2016 and mid-January 2017, the peso depreciated by more than 14%. In addition, the Mexican government raised the minimum wage and ended gasoline subsidies in early-2017. By mid-2017, inflation had risen for 10 consecutive months. In that context, Banxico raised its policy rate by 50 basis points on June and September 2016, more than the market

[24]See the excerpts for March 2013, June 2017, May and June 2022, February and March 2023. The link between statements and path surprises predates the start of the intraday sample in 2011. For instance, the largest path tightening surprise pre-2011 (using daily data) occured on June 2009 along with a statement indicating that 'the Board considers that its easing cycle is close to an end'.

Table 3. Summary of Statements in Selected Dates

Date	Target	Path	Description
Jun 23, 2022	7.41	−14.93	Statement notes that the Board 'will assess to act with the same forcefulness if required,' after increasing the policy rate by 75 basis points for the first time ever.
Mar 8, 2013	−15.64	11.77	Statement makes clear that the 50 basis point cut in the policy rate 'does not represent the beginning of an easing cycle.'
Feb 9, 2023	18.17	11.45	Statement indicates that 'the next increase in the policy rate may be of a smaller magnitude,' after 14 consecutive increases amounting to 7%.
Dec 16, 2021	9.42	10.52	Statement highlights that the forecasts for headline and core inflation were revised upwards 'again, especially those for 2022,' and that the balance of risks for inflation 'has deteriorated again.'
Mar 30, 2023	−2.14	−8.53	Statement notes that inflation 'has fallen more than expected,' and removes 'the next increase in the policy rate may be of a smaller magnitude' from the previous statement.
Jun 22, 2017	−2.07	−8.03	Statement drops reference to do 'the necessary tightenings ahead' from the previous statement.
Aug 15, 2019	−6.05	−5.82	Statement notes that 'inflation decreased as expected,' while 'the negative output gap widened more than expected.'
May 12, 2022	0.85	5.78	Statement highlights that inflation reached 'its highest level since January 2001,' so the Board 'will consider to act more forcefully,' following four increases of 25 and four of 50 basis points.
Aug 12, 2021	−6.94	−5.45	Statement notes that although the expected path of inflation increased, inflation is 'expected to decrease, especially for horizons longer than one year.'
Nov 11, 2021	−7.61	−5.24	Statement indicates that the shocks to inflation are considered to be 'mainly' transitory.

expected according to surveys, followed by six more consecutive tightenings (three of 50 and three of 25 basis points) to contain the rising inflation risks. In the statement for the last hike on June 22, 2017, Banxico dropped the reference to do 'the necessary tightenings ahead' from the previous statement. The hike was largely anticipated by the market (i.e., a small target surprise), but the wording of the statement suggested the end of the tightening cycle, delivering a large path easing surprise.

Statements have also been used to mitigate path surprises. Contrary to survey expectations of no change in the policy rate, on June 6, 2014, Banxico cut the rate by 50 basis points, but in the statement indicated that 'no further reductions in the policy rate are expected in the foreseeable future.' Therefore, the policy rate was cut unexpectedly, but the statement portrayed the decision as a one-off cut.

In sum, target and path surprises respectively capture unanticipated changes in the policy rate and news about its future path communicated via statements.

4 The Effects of Monetary Policy on Asset Prices

The previous section shows that target and path surprises capture news about the policy rate and its future path. This section quantifies how the exchange rate and the yield curve respond to the surprises. The next section studies the response of portfolio flows.

4.1 Contemporaneous Effects

The following event-study regression measures the on-impact effects of the two types of monetary policy surprises on the exchange rate and the yield curve:

$$\Delta y_t = \beta_0 + \beta_1 Target_t + \beta_2 Path_t + \varepsilon_t, \tag{3}$$

in which Δy_t denotes the intraday exchange rate returns or the intraday changes in bond yields, $Target_t$ and $Path_t$ are the intraday surprises in the policy rate and its future path, and ε_t is the error term. All the variables are expressed in basis points. The standard errors are computed using 10,000 bootstrap simulations given that $Target_t$ and $Path_t$

are generated regressors (see Swanson 2021, Appendix B).[25]

The parameters of interest are β_1 and β_2, they measure the response of the exchange rate and bond yields to the two types of surprises. A tightening of the monetary policy in Mexico should appreciate the peso, according to standard open economy models, and increase bond yields at different maturities, due to increases in interest rate expectations and term premiums. In this sense, β_1 and β_2 are expected to be negative for the exchange rate (since it is expressed in pesos per dollar) and positve for bond yields.

Table 4 reports the results of the estimation. The first column for each dependent variable shows the coefficient estimates when the regression only includes target surprises as the independent variable, and the second column adds path surprises as a regressor. The first columns show that a target tightening surprise appreciates the currency and flattens the yield curve, similar to a policy rate tightening surprise (Solís 2023).

4.1.1 The Response of the Exchange Rate

The exchange rate responds to both target and path surprises. The coefficient on the target surprise is highly significant and indicates that a 25 basis point (bp) target tightening surprise would appreciate the currency by more than 0.6%, on average. The coefficient on the path surprise is also negative and significant, but with almost half of the effect of target surprises. A 25 bp path tightening surprise would appreciate the currency by more than 0.3%, on average. These results are in line with the evidence for the currencies of advanced economies before the global financial crisis (Rosa 2011).

Section 4.2 explains that there is a structural change in the response of the exchange rate in November 2014, a period of declining oil prices and uncertainty about the end of the zero lower bound era in the U.S. Table 5 reports the results of estimating equation (3) before and after that date. The explanatory power of the surprises (in terms of R^2) in both subsamples increases considerably relative to the whole sample. Also notice that the relative importance of the surprises shifted.[26]

[25]The statistical significance of the results is essentially the same whether bootstrapped or asymptotic standard errors are used.

[26]These results are robust to using an M-estimator that reduces the impact of outliers.

Table 4. The Response of Asset Prices to Target and Path Surprises

	FX Returns		Δ 2Y Yield		Δ 5Y Yield		Δ 10Y Yield		Δ 30Y Yield	
Target	-2.54***	-2.54***	0.74***	0.74***	0.54***	0.47***	0.46***	0.46***	0.31***	0.31***
	(0.39)	(0.39)	(0.05)	(0.04)	(0.06)	(0.05)	(0.05)	(0.04)	(0.05)	(0.04)
Path		-1.36*		0.43***		0.57***		0.44***		0.41***
		(0.75)		(0.09)		(0.1)		(0.08)		(0.08)
Obs.	99	99	83	83	64	64	83	83	83	83
R^2	0.3	0.31	0.75	0.81	0.4	0.62	0.56	0.7	0.37	0.54

Notes: The first column for each dependent variable shows the coefficient estimates in regressions of intraday yield changes or exchange rate (FX) returns on target surprises; the second column adds path surprises as a regressor. Target and path surprises are obtained from intraday data, as explained in the main text. Intraday changes are calculated starting 10 minutes before to 20 minutes after a monetary policy announcement. The sample includes all regular monetary policy announcements starting on January 2011 for the exchange rate, on January 2013 for 2- 10- and 30-year yields, and on December 2014 for 5-year yields; the sample ends on June 2023 in all cases. Figures are expressed in basis points. All regressions include a constant. Bootstrapped standard errors in parentheses. *, **, *** asterisks respectively indicate significance at the 10%, 5% and 1% level.

Table 5. The Response of Asset Prices to Target and Path Surprises Before and After Break Dates

	FX Returns		Δ 2Y Yield		Δ 5Y Yield		Δ 10Y Yield		Δ 30Y Yield	
Target	-1.59***	-5.36***	0.79***	0.69***	0.17*	0.57***	0.51***	0.40***	0.39***	0.23***
	(0.39)	(0.77)	(0.096)	(0.085)	(0.089)	(0.11)	(0.10)	(0.056)	(0.098)	(0.063)
Path	-5.21***	1.23	0.55***	0.43***	0.89**	0.52***	0.60***	0.44***	0.63***	0.41***
	(1.51)	(0.92)	(0.19)	(0.10)	(0.35)	(0.11)	(0.17)	(0.090)	(0.14)	(0.097)
Obs.	31	68	30	53	15	49	30	53	30	53
R^2	0.47	0.61	0.89	0.75	0.52	0.69	0.76	0.66	0.66	0.49

Notes: The first column for each dependent variable shows the coefficient estimates in regressions of intraday yield changes or exchange rate (FX) returns on target and path surprises *before* the respective break date; the second column reports the coefficient estimates *after* the break date. Target and path surprises are obtained from intraday data, as explained in the main text. Intraday changes are calculated starting 10 minutes before to 20 minutes after a monetary policy announcement. The sample includes all regular monetary policy announcements starting on January 2011 for the exchange rate, on January 2013 for 2- 10- and 30-year yields, and on December 2014 for 5-year yields; the sample ends on June 2023 in all cases. The break date for the exchange rate is November 18, 2014 and for bond yields is November , 2016. Figures are expressed in basis points. All regressions include a constant. Bootstrapped standard errors in parentheses. *, **, *** asterisks respectively indicate significance at the 10%, 5% and 1% level.

The exchange rate response is stronger to path surprises before the end of 2014, and to target surprises afterwards. Before the end of 2014, the effect of path surprises increased almost four times relative to the whole sample, and the effect of target surprises decreased. After end-2014, the effect of a target surprise more than doubles relative to the effect over the whole sample. Accordingly, a 25 bp target (post-2014) or path (pre-2014) tightening surprise would appreciate the currency by 1.3%. The currencies of advanced economies also respond stronger after the global financial crisis (Ferrari et al. 2021).

The frequency of target and path surprises increased post-2014 (see figure 1). Before end-2014, the market largely anticipated most policy changes by Banxico ahead of the announcement.[27] After end-2014, Banxico has dealt with two inflationary cycles, one after the 2016 U.S. presidential election and some local reforms (see section 3.3.1), and the other after the global post-pandemic recovery, during which the market has been frequently surprised by Banxico's policy decisions. Thus, the change in the response of the exchange rate suggests that investors in the forex market may give more weight to information about the *future* stance of monetary policy in periods of relative stability, but more weight to the *current* monetary policy stance when they are frequently surprised by the central bank. In any case, target and path surprises play an important role in the transmission of monetary policy to the exchange rate, a vital channel for open economies.

4.1.2 The Response of the Yield Curve

The yield curve also responds to both surprises in table 4. A tightening in either surprise flattens the yield curve. Importantly, path surprises tend to have a stronger effect on medium- and long-term yields and explain a large share of their variability, consistent with the evidence for the U.S. when its policy rate was not constrained by the zero lower bound (Gürkaynak et al. 2005, Swanson 2021). In this sense, path surprises improve the implementation of monetary policy in Mexico, to the extent that medium- and long-term yields influence the spending decisions of households and firms.

Moreover, the influence of Banxico's monetary policy surprises on the yield curve in

[27] With a few exceptions, both surprises tended to be relatively small (within ± 5 bp).

Mexico seems to be larger relative to the effect that U.S. surprises have on the U.S. yield curve.[28] This result reflects two non-mutually-exclusive channels according to the expectations hypothesis.[29] First, it is likely that long-term inflation expectations in Mexico are *less* firmly anchored than in the U.S. (Andreasen et al. 2021, fig. 12, Beauregard et al. 2021, fig. 10). Second, monetary policy surprises in Mexico may have a larger effect on the term premium.[30] Future research can provide more evidence on both channels.

Section 4.2 explains, as for the exchange rate, that there is a structural change in the response of the yield curve in November 2016, at the time of the 2016 U.S. presidential election. The results before and after that date are also reported in table 5. The effects of both surprises remain highly statistically significant, except for the 5-year yield for which the sample size decreases considerably before the break date.[31] The explanatory power of the surprises in both subsamples is similar to that for the whole period, although slightly larger before the break date. Also, the on-impact effect of both surprises tends to be slightly stronger before the break date.

4.2 Persistence

Monetary policymakers are not only interested in the initial reaction to the surprises but on how persistent they are. This subsection assesses that persistance using local projections following Jordà (2005). Specifically, I run the following regressions:

$$y_{t+h} = \alpha_h^1 + \alpha_h^2 \, y_{t-1} + \beta_h^1 \, Target_t + \beta_h^2 \, Path_t + \eta_h^{'} z_{t-1} + u_{t+h}, \tag{4}$$

in which h indicates the horizon in days with $h = 0, 1, \ldots, 30$, y_{t+h} is a bond yield or the log of the exchange rate at the close of day $t + h$, $Target_t$ and $Path_t$ are equal to the intraday surprises on announcement days t and zero otherwise,[32] z_{t-1} is a vector of one-day lagged variables to control for potential drivers of the given assets, and u_{t+h} is

[28] Comparing the estimates in table 4 against those in Gürkaynak et al. (2005), on average, a 25 bp target tightening surprise in Mexico vs the U.S. raises the 2- 5- and 10-year yields by 19 vs 12, 12 vs 7, 12 vs 3 bp; while a 10 bp path tightening surprise raises them by 4 vs 4, 6 vs 4, 4 vs 3 bp, respectively.

[29] Since prices are flexible in the long run, long-term expected real interest rates would not be affected.

[30] This channel could be explained by reach-for-yield investors who, for instance, switch to long-term bonds in search of higher returns after a target easing, lowering their yields (Hanson and Stein 2015).

[31] The results are robust to using an M-estimator, except for the 5-year yield before the break date.

[32] Although the factors are uncorrelated by construction, including them together increases efficiency.

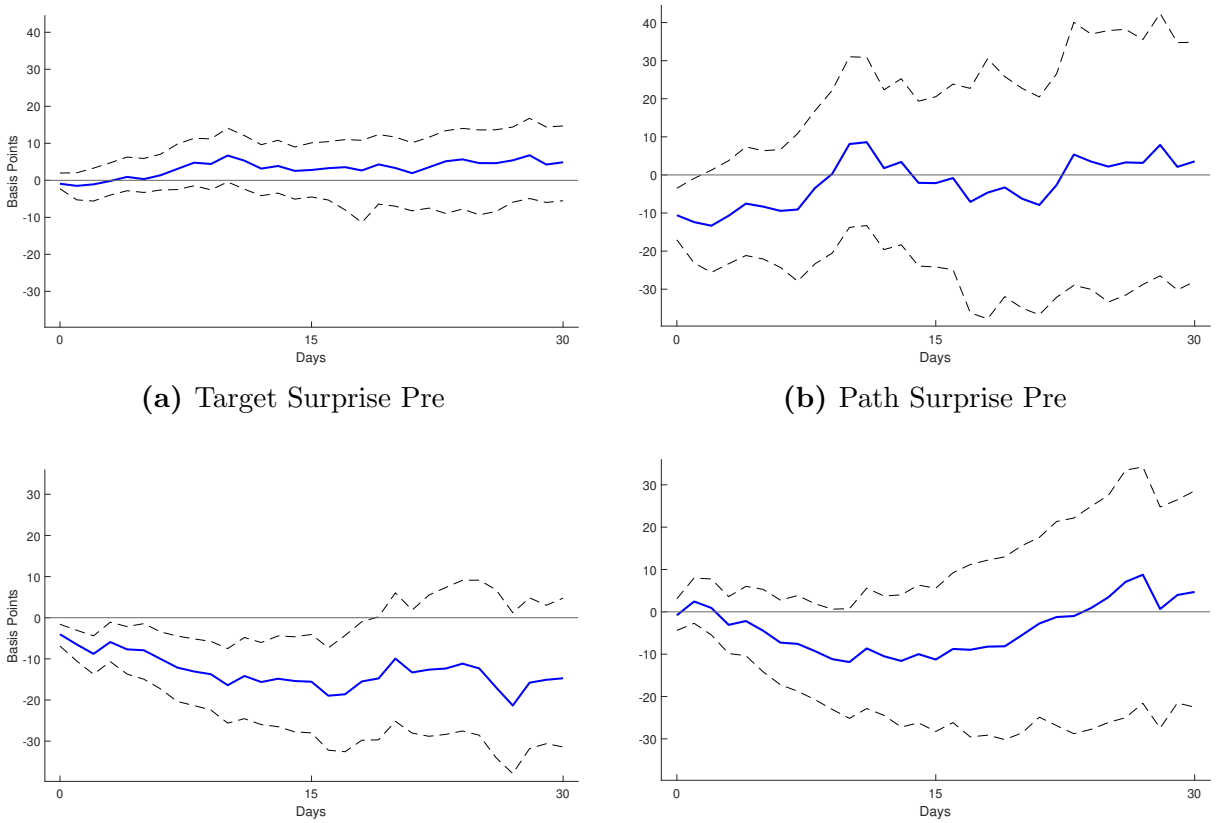
the error term. Since the factors are indeed surprises, no controls are needed,[33] but they are considered here for comparison with the analysis of portfolio flows in section 5 for which it might be more reasonable to include controls. All responses are assessed relative to a one basis point tightening of the respective surprise. The parameters of interest are β_h^1 and β_h^2, they measure the average response of the yields to the surprises at horizon h. The 95% confidence bands are computed using 10,000 bootstrap simulations.

The controls comprise the exchange rate (for the bond yields), the daily returns of the Mexican stock exchange as a measure of local financial conditions, the 10-year U.S. Treasury yield from the Federal Reserve's H.15 dataset to account for global financial conditions, the Cboe's volatility index (VIX) as a measure of risk aversion and economic uncertainty, the J.P. Morgan Emerging Market Bond Index (EMBI) to capture developments in emerging market sovereign bonds, the West Texas Intermediate (WTI) crude oil price as it can influence the exchange rate and bond issuances since Mexico is an oil exporter country, the 5-year credit default swap (CDS) for Mexico to account for sovereign default risk, the TED spread as an indicator of credit risk in the global financial sector and its local version calculated as the difference between the one-month interbank rate (TIIE28D) and the one-month Mexican Treasury bill rate. Christensen et al. (2021) use similar controls in their study of the liquidity premium in the Mexican bond market.

To analyze whether the sensisitivity of the exchange rate and bond yields to monetary policy surprises changed over the sample period, I test for a strcutural break in equation (4) using a supremum likelihood ratio test (Andrews 1993). This structural break test will also be useful for the analysis of portfolio flows in section 5.2. For the exchange rate, the test identifies a break on November 18, 2014, a period of declining oil prices and uncertainty about the end of the zero lower bound era in the U.S. For bond yields, the test identifies breaks between July 2015 and October 2016. To simplify the analysis, a single date is used for all bond yields. Upon visual inspection, the estimated date closer to a joint change in bond yields is the one closer to the 2016 U.S. presidential election. The break date is thus November 8, 2016; all the yields clearly jumped on that day.

[33] In fact, all the results are essentially the same when no controls are included.

Figure 3. Exchange Rate Response to Target and Path Surprises



(a) Target Surprise Pre

(b) Path Surprise Pre

(c) Target Surprise Post

(d) Path Surprise Post

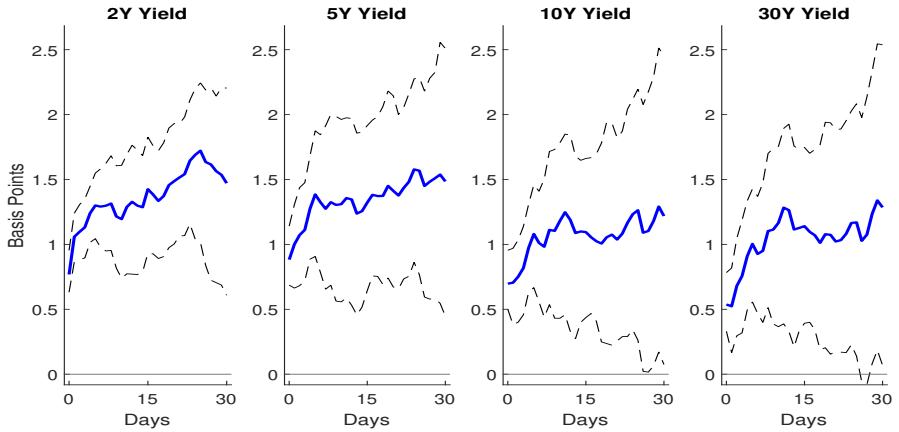
Notes: Coefficient estimates for the response of the exchange rate to a 1 basis point target and path tightening surprises from day $t-1$ to day $t+h$, where t is a day with a monetary policy announcement and $h = 0, 1, \ldots, 30$. Dashed lines show 95% bootstrapped confidence bands. The sample includes all regular monetary policy announcements from January 2011 to June 2023. The top row shows the responses before November 18, 2014, and the bottom row the responses afterwards.

Figure 3 shows the persistence of the exchange rate response to target and path surprises before and after the break date. The relative importance of the surprises shifted, consistent with the results in table 5. Before the break date, path surprises have a persistent effect on the exchange rate for a few days after an announcement, while target surprises have no effect at all.[34] After the break date, the exchange rate only responds to target surprises with an increasing effect, reaching almost 20 bp two weeks after an announcement. The intuition for the switch in the response is explained in section 4.1.1.

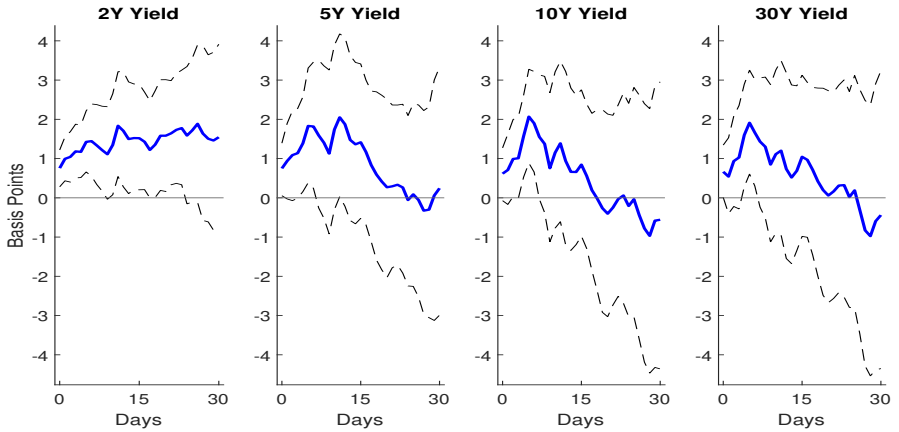
Figure 4 shows the persistence of the yield curve response to target and path surprises

[34]This is consistent with what Solís (2023) shows for policy rate surprises.

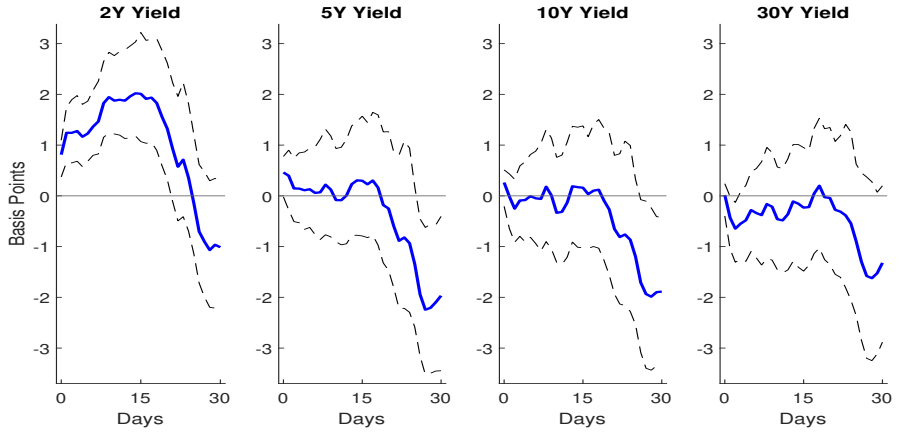
Figure 4. Yield Curve Response to Target and Path Surprises



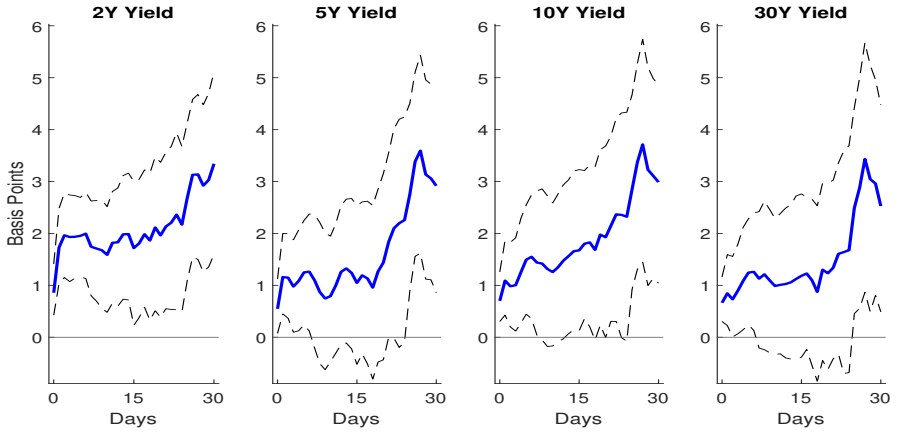
(a) Target Surprise Pre



(b) Path Surprise Pre



(c) Target Surprise Post



(d) Path Surprise Post

Notes: Coefficient estimates for the response of bond yields to a 1 basis point target and path tightening surprises from day $t-1$ to day $t+h$, where t is a day with a monetary policy announcement and $h = 0, 1, \ldots, 30$. Dashed lines show 95% bootstrapped confidence bands. The sample includes all regular monetary policy announcements from January 2011 to June 2023. The top row shows the responses before November 8, 2016, and the bottom row the responses afterwards.

before and after the break date. The nature of the response to the surprises shifted as with the exchange rate. Before the break date, the response to target surprises increases over time (although decreases with maturity), while the response to path surprises is stronger but much less persistent. After the break date, the response to target surprises is stronger than before the break and persistent only for the 2-year yield, while the response to path surprises increases significantly over time for all the yields. Unlike investors in the forex market, bond investors seem to give more weight to the future monetary policy stance when Banxico's policy decisions are less predictable (see figure 1).

Overall, monetary policy has persistent effects on asset prices that last days after an announcement. This delayed response aligns with a slow-moving capital explanation (Duffie 2010), in which big players like pension funds and foreign investors take time to respond to the surprises. The evidence in the next section supports this interpretation.

5 The Effects of Monetary Policy on Portfolio Flows

This section shows that domestic and foreign investors rebalance their debt portfolios in response to target and path surprises. The analysis exploits the availability of daily data to better characterize the transmission mechanisms of monetary policy.

5.1 Daily Data on Portfolio Flows

Banxico collects daily data on the value of the holdings of different types of Mexican government securities, including Treasury bills (cetes), fixed-rate bonds (bonos) and inflation-protected bonds (udibonos). The analysis focuses on cetes and bonos because they are related to the (nominal) yield curve. The appendix reports the results for udibonos.

Banxico reports the holdings of domestic and foreign investors. Figure A.1 in the appendix compares the level of cetes and bonos holdings by residence. Foreign investors were once the main players in the cetes and bonos markets. They increased their bonos holdings substantially since they were included in the Citigroup's World Government

Bond Index in 2010 (Banxico 2014) and up to 2020,[35] when they reduced their exposure in response to the Covid-19 pandemic. Between late 2012 and early 2016, foreigners were also the main holders of cetes but rising hedging costs after the end of the zero lower bound era in the U.S. made the short-term carry trade less attractive, which partly explains the decline since then.

Banxico categorizes domestic investors into banks, mutual funds, pension funds, insurers and non-financial investors (firms and households). Figures A.2 and A.3 in the appendix show the level of cetes and bonos holdings by domestic investors, respectively. In the cetes market, non-financial investors are key players, while pension funds increased their holdings around the time foreign investors retreated, and mutual funds have increased their holdings recently.[36] In the bonos market, pension funds are key players but, in recent years, non-financial investors and banks started accumulating a larger share of bonos. Insurers play a minor role in both markets and are thus no longer considered.

Daily portfolio flows are defined as the daily change in the holdings. Positive and negative values respectively indicate purchases and sales of the security. The flows are expressed in billions of pesos. The bonos holdings are adjusted for valuation effects before computing their flows. Table A.1 in the appendix summarizes the flow data.

To account for the fact that changes in the nominal value of bonos holdings can reflect either a change in the amount of bonos or a change in the value of the bonos, I deflate the nominal value of bonos holdings with a rate equal to the percentage change in the price, so that a change in the holdings reflects net purchases, regardless of price movements. The daily percentage change in the price of the bonos is approximated as minus the duration times the daily change in the yield. The duration of the bonos is calculated using the par yields from the Bloomberg Fair Value (BFV) curve for Mexico and the average maturity of the bonos reported by Banxico.[37] Although the adjustment is far from perfect, it is

[35] This trend increased the liquidity premium in the bonos market (Christensen et al. 2021).

[36] In Mexico, most mutual funds are shot-term debt funds with highly liquid investments.

[37] The change in the log price of the bond, $\mathrm{d}\log(P)$, is approximately equal to $-D_{mod} \times \mathrm{d}y$, in which D_{mod} is the modified duration and $\mathrm{d}y$ is the change in the yield. Each day, the BFV yield closest to the average maturity is used to calculate D_{mod} and $\mathrm{d}y$. Banxico reports every month the average maturity (expressed in days) of the bonos outstanding. For the adjustment, the average maturity is expressed in years and rounded to the nearest integer; the same value is used for all the days in a month.

reasonable given the available data (e.g., average maturity is not broken down by tenor or by type of investor). The conclusions of the analysis remain regardless of the adjustment.

5.2 The Response of Portfolio Flows

Given the evidence in section 4.2 of a delayed response in asset prices, the analysis here focuses on the persistence (rather than on the contemporaneous effects) using local projections. Specifically, I run the following regressions:

$$H_{t+h} = \alpha_h^1 + \alpha_h^2 \, H_{t-1} + \beta_h^1 \, Target_t + \beta_h^2 \, Path_t + \eta_h^{'} z_{t-1} + u_{t+h}, \tag{5}$$

in which, the dependent variable H_{t+h} equals the holdings of a given category of cetes and bonos on day $t + h$, and the vector of lagged variables z_{t-1} controls for potential drivers of the flows (using the same variables as before). The rest is equal to the case with asset prices in equation (4).

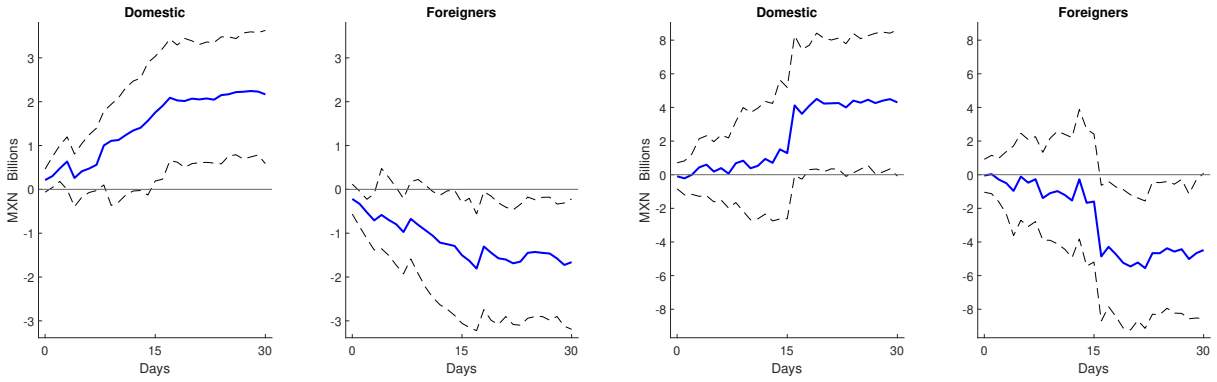
As before, I test for a strcutural break in equation (5) using a supremum likelihood ratio test to analyze whether the sensisitivity of portfolio flows to monetary policy changed over the sample period. For cetes, the test identifies a break date for domestic investors on April 4, 2019 and for foreign investors on March 17, 2016.[38] The increase in the cetes holdings of domestic investors in early 2019 (see figures A.1 and A.2) could be explained by several regulatory changes in the financial system around that time,[39] while the rising hedging costs mentioned in section 5.1 help explain the retreat of foreign investors. For bonos, the test identifies a break date for domestic investors on February 11, 2019, which could also be explained by the same regulatory changes just mentioned.

Figure 5 (top row) shows the persistence of the cetes flow response to target and path surprises before the break date for foreign investors. Before 2016Q1, domestic and foreign investors sit on different sides of the cetes market in response to a tightening of the monetary stance. In essence, foreigners sold cetes to domestic investors, immediately following a target tightening surprise, and after a couple of weeks following a path tight-

[38] For udibonos, the test identifies a break date for foreign investors on April 15, 2013, which can be related to the Taper Tantrum episode.

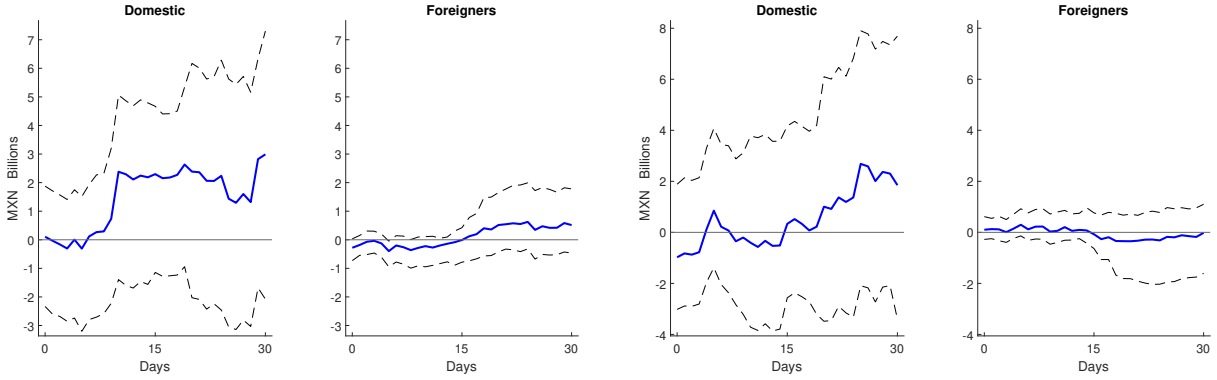
[39] Some of the regulatory changes include a larger pool of intermediaries and securities allowed in repo transactions, and the possibility of pension funds to invest in target date funds, see Banxico (2019).

Figure 5. Cetes Flow Response to Target and Path Surprises by Investor Residence



(a) Target Surprise Pre

(b) Path Surprise Pre



(c) Target Surprise Post

(d) Path Surprise Post

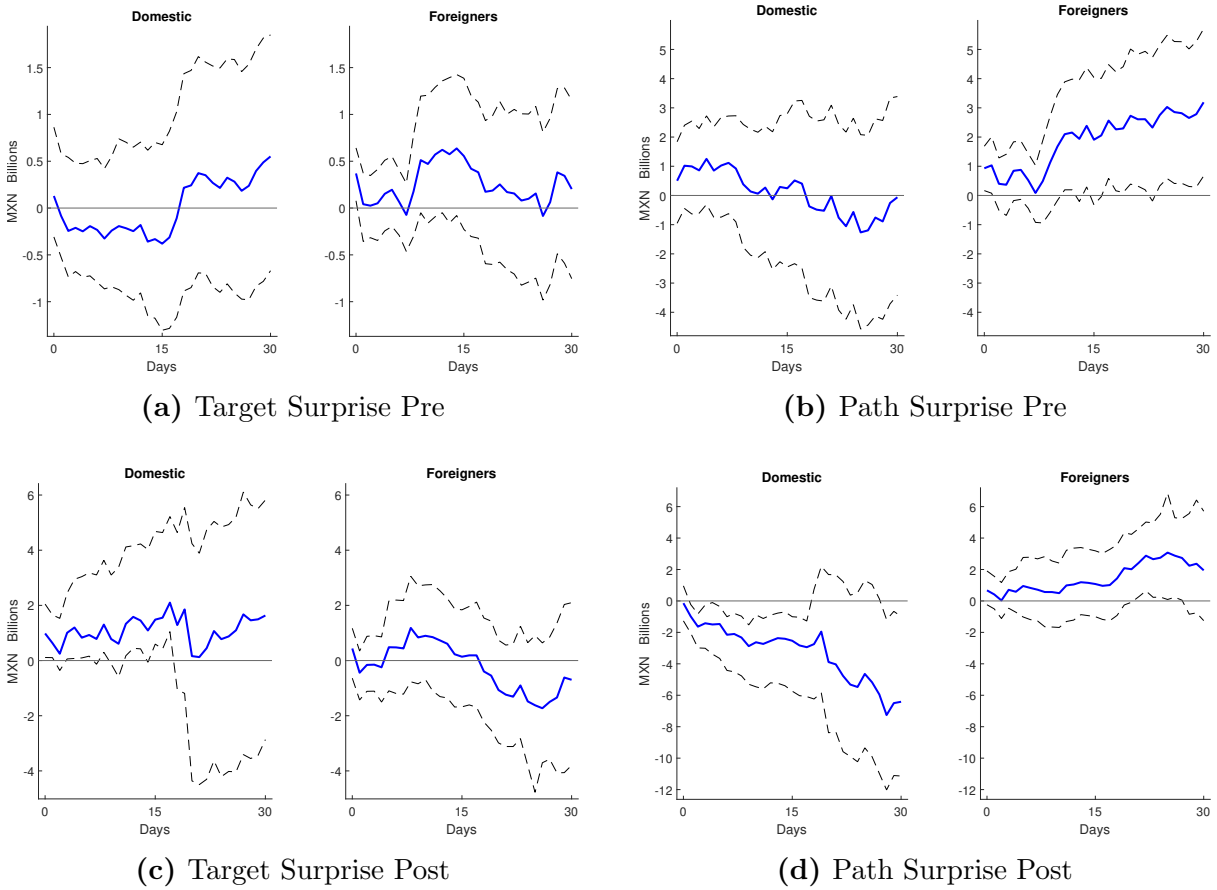
Notes: Coefficient estimates for the response of cetes flows to a 1 basis point target and path tightening surprises from day $t-1$ to day $t+h$, where t is a day with a monetary policy announcement and $h = 0, 1, \ldots, 30$. Dashed lines show 95% bootstrapped confidence bands. The sample includes all regular monetary policy announcements from January 2011 to June 2023. The top row shows the responses before March 17, 2016, and the bottom row the responses afterwards.

ening surprise. A key player in this dynamic is the non-financial sector (see figure A.9 in the appendix). Foreign investors stopped participating in this dynamic when their exposure to the cetes market decreased. Since then, domestic investors increased their positions in cetes to fill the void left in the market by foreigners (see figure A.1). In terms of financial stability, this result suggests that the market is flexible enough to welcome foreign investors when they decide to participate and cover for them when they retreat.

Figure 5 (bottom row) also shows the persistence of the cetes flow response to target and path surprises after the break date for domestic investors.[40] After 2019Q1, target

[40]The cetes flow response to monetary policy between the break dates of foreign and of domestic investors is reported in figures A.6 and A.7 in the appendix.

Figure 6. Bonos Flow Response to Target and Path Surprises by Investor Residence



(a) Target Surprise Pre

(b) Path Surprise Pre

(c) Target Surprise Post

(d) Path Surprise Post

Notes: Coefficient estimates for the response of bonos flows to a 1 basis point target and path tightening surprises from day $t-1$ to day $t+h$, where t is a day with a monetary policy announcement and $h = 0, 1, \ldots, 30$. Dashed lines show 95% bootstrapped confidence bands. The sample includes all regular monetary policy announcements from January 2011 to June 2023. The top row shows the responses before February 11, 2019, and the bottom row the responses afterwards.

and path surprises have a rebalancing effect within and across sectors on the cetes market. This can be seen in the widening of the confidence bands. Intuitively, each of the categories in which Banxico classifies domestic investors encompasses a diverse set of participants. For instance, the banks category puts together the big banks along with niche banks and those specializing in trading, not all of which will respond in the same direction to a monetary policy surprise. In fact, the confidence bands for some types of domestic investors widened after 2019Q1 (see pension funds in figure A.9 in the appendix).

Figure 6 shows the persistence of the bonos flow response to target and path surprises before and after the break date for domestic investors. Before 2019Q1, domestic investors

rebalance their bonos portfolios in response to target and path surprises (wide confidence bands). Similarly for foreign investors in response to target surprises, but they definitely increase their exposure to bonos a few days after a path surprise. After 2019Q1, their response to path surprises remains practically the same, which is reasonable given that their exposure to bonos is still significant and that the break date for bonos was due to domestic investors; however, the non-financial sector now essentially takes the other side of the market (by selling bonos) in response to a path tightening surprise (see figure A.10d in the appendix).

These results have two important implications. First, foreign investors clearly participate in the transmission of the local monetary policy.[41] Taking together the responses of cetes and bonos flows before their respective break dates gives an interesting dynamic: In response to a monetary stance tightening, domestic investors position themselves in the short end of the yield curve, while foreign investors prefer exposure to the long end.

Second, investors take time to rebalance their portfolios to surprises in monetary policy. Cetes and bonos investors do not only react on the day of an announcement. They rebalance their portfolios in the following days, either slowly since the surprise or until after a few days later. The effects are not only statistical but also economically significant, since the response to a 1 basis point increase in the surprises can represent up to 70% of a standard deviation of the flows (e.g. compare table A.1 and figure 5b). Moreover, the sluggish response of the flows supports the evidence of a delayed response in asset prices reported in section 4.2 and is consistent with the literature on slow-moving capital in asset pricing (Duffie 2010).

6 Concluding Remarks

This paper uses a new high-frequency dataset to identify monetary policy surprises in an emerging economy. The evidence shows that the central bank conducts monetary policy by adjusting its current policy rate *and* by managing expectations about its future path

[41] Figure A.8 in the appendix shows that they also play a role in the udibonos market, they sell udibonos after a target tightening surprise.

via statements, both of which influence asset prices and the portfolio flows of domestic and foreign investors. Moreover, the relative influence of each policy can change over time depending on macroeconomic circumstances and institutional arrangements. The multidimensionality of monetary policy is therefore not exclusive to central banks in advanced economies and does not require the zero lower bound to be binding.

Having the ability to manage market expectations about the future path of the policy rate via statements can enhance the conduct of monetary policy in emerging markets. For instance, by communicating information about future policy, emerging market central banks can influence medium- and long-term interest rates, which are relevant for the spending decisions of households and businesses.

Given the importance of statements documented here, central banks in emerging markets can follow best practices in monetary policy communications, including brief, clear and concise language without compromising the main message. References to non-monetary policy issues (e.g. structural reforms) should be minimal, if any.[42]

The results in this paper can be extended in several directions. For instance, decomposing the Mexican sovereign yields can provide additional evidence on the transmission of the two types of monetary policy surprises. In addition, the host country perspective for portfolio flows seems relevant for emerging markets in connection with macroprudential policies. In particular, given how foreign investors rebalance their portfolios in response to local monetary policy surprises, policymakers could be interested in the interaction of target and path surprises with different macroprudential policies, including capital controls. Finally, more research is needed to assess the extent to which the results reported here apply to other emerging markets.

[42]On this regard, Banxico committed to issue clear and concise statements in February 2020. The guidelines are publicly available at `https://www.banxico.org.mx/publicaciones-y-prensa/miscelaneos/%7B4C09D772-2CDF-8BD6-3F04-65DE03CA6212%7D.pdf`.

References

Altavilla, Carlo, Luca Brugnolini, Refet S. Gürkaynak, Roberto Motto, and Giuseppe Ragusa. (2019) "Measuring Euro Area Monetary Policy." *Journal of Monetary Economics* 108, 162–179.

Andreasen, Martin M., Jens H.E. Christensen, and Simon Riddell. (2021) "The TIPS Liquidity Premium." *Review of Finance* 25 (6), 1639–1675.

Andrews, Donald W. K. (1993) "Tests for Parameter Instability and Structural Change With Unknown Change Point." *Econometrica* 61 (4), 821–856.

Banxico. (2014) *The Mexican Government Securities Market*. Banco de México.

Banxico. (2019) *Reporte de Estabilidad Financiera Diciembre*.

Beauregard, Remy, Jens H. E. Christensen, Eric Fischer, and Simon Zhu. (2021) "Inflation Expectations and Risk Premia in Emerging Bond Markets: Evidence from Mexico." *FRBSF Working Paper* 2021-08.

Blinder, Alan S., Michael Ehrmann, Marcel Fratzscher, Jakob De Haan, and David Jan Jansen. (2008) "Central Bank Communication and Monetary Policy: A Survey of Theory and Evidence." *Journal of Economic Literature* 46 (4), 910–945.

Bowman, David, Juan M. Londono, and Horacio Sapriza. (2015) "U.S. Unconventional Monetary Policy and Transmission to Emerging Market Economies." *Journal of International Money and Finance* 55 (921), 27–59.

Christensen, Jens H. E., Eric Fischer, and Patrick J. Shultz. (2021) "Bond Flows and Liquidity: Do Foreigners Matter?" *Journal of International Money and Finance* 117 (102397).

Cragg, John G., and Stephen G. Donald. (1997) "Inferring the Rank of a Matrix." *Journal of Econometrics* 76 (1-2), 223–250.

De Pooter, Michiel, Patrice Robitaille, Ian Walker, and Michael Zdinak. (2014) "Are Long-Term Inflation Expectations Well-Anchored in Brazil, Chile and Mexico?" *International Journal of Central Banking* 10 (2), 337–400.

Duffie, Darrell. (2010) "Presidential Address: Asset Price Dynamics with Slow-Moving Capital." *The Journal of Finance* 65 (4), 1237–1267.

Ferrari, Massimo, Jonathan Kearns, and Andreas Schrimpf. (2021) "Monetary Policy's Rising FX Impact in the Era of Ultra-Low Rates." *Journal of Banking and Finance* 129, 106142.

Fischer, Eric. (2020) "Monetary Surprises and Global Financial Flows: A Case Study of Latin America." *Journal of Emerging Market Finance* 19 (2), 189–225.

Fratzscher, Marcel, Marco Lo Duca, and Roland Straub. (2018) "On the International Spillovers of US Quantitative Easing." *Economic Journal* 128 (608), 330–377.

Gürkaynak, Refet S., Brian P. Sack, and Eric T. Swanson. (2005) "Do Actions Speak Louder Than Words? The Response of Asset Prices to Monetary Policy Actions and Statements." *International Journal of Central Banking* 1 (1), 55–93.

Hanson, Samuel G., and Jeremy C. Stein. (2015) "Monetary Policy and Long-Term Real Rates." *Journal of Financial Economics* 115 (3), 429–448.

Hausman, Joshua, and Jon Wongswan. (2011) "Global Asset Prices and FOMC Announcements." *Journal of International Money and Finance* 30 (3), 547–571.

Ilzetzki, Ethan, Carmen M Reinhart, and Kenneth S Rogoff. (2019) "Exchange Arrangements Entering the Twenty-First Century: Which Anchor will Hold?" *The Quarterly Journal of Economics* 134 (2), 599–646.

Jeanneau, Serge, and Camilo E. Tovar. (2008) "Latin America's Local Currency Bond Markets: An overview." *BIS Papers* (36), 46–64.

Jordà, Oscar. (2005) "Estimation and Inference of Impulse Responses by Local Projections." *American Economic Review* 95 (1), 161–182.

Kearns, Jonathan, and Phil Manners. (2006) "The Impact of Monetary Policy on the Exchange Rate: A Study Using Intraday Data." *International Journal of Central Banking* 2 (4), 157–183.

Kohlscheen, Emanuel. (2014) "The Impact of Monetary Policy on the Exchange Rate: A High Frequency Exchange Rate Puzzle in Emerging Economies." *Journal of International Money and Finance* 44, 69–96.

Kuttner, Kenneth N. (2018) "Outside the Box: Unconventional Monetary Policy in the Great Recession and Beyond." *Journal of Economic Perspectives* 32 (4), 121–146.

Nakamura, Emi, and Jón Steinsson. (2018) "Identification in Macroeconomics." *Journal of Economic Perspectives* 32 (3), 59–86.

OECD. (2016) *Liquidity in Secondary Markets for Government Bonds.*

OECD. (2020) *Emerging Market Government Securities: Long-Term Trends and Developments since the Pandemic.*

OECD. (2023) *OECD 2022 Survey on Liquidity in Government Bond Secondary Markets.*

Rosa, Carlo. (2011) "The High-Frequency Response of Exchange Rates to Monetary Policy Actions and Statements." *Journal of Banking and Finance* 35 (2), 478–489.

Ruch, Franz Ulrich. (2021) "Neutral Real Interest Rates in Inflation Targeting Emerging and Developing Economies." *World Bank Working Paper* 9711.

Solís, Pavel. (2023) "Does the Exchange Rate Respond to Monetary Policy in Mexico? Solving an Exchange Rate Puzzle in Emerging Markets." *Journal of Money, Credit and Banking* (forthcoming).

Su, Shiwei, Ahmad Hassan Ahmad, and Justine Wood. (2019) "How Effective is Central Bank Communication in Emerging Economies? An Empirical Analysis of the Chinese Money Markets." *Review of Quantitative Finance and Accounting*, 1–25.

Swanson, Eric T. (2021) "Measuring the Effects of Federal Reserve Forward Guidance and Asset Purchases on Financial Markets." *Journal of Monetary Economics* 118, 32–53.

Online Appendix

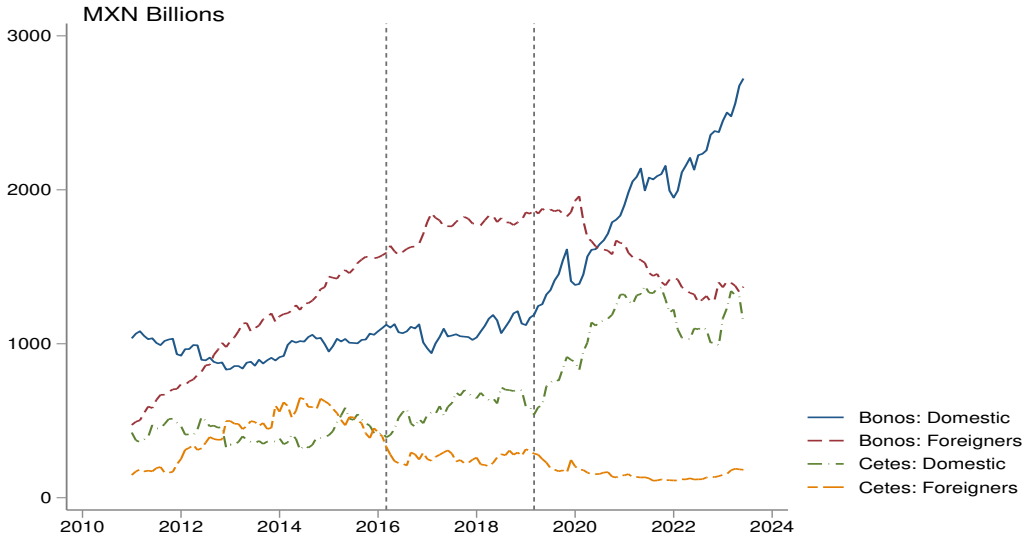
Do Central Bank Words Matter in Emerging Markets? Evidence from Mexico

Table A.1. Summary Statistics for Cetes, Bonos and Udibonos Flows

	Mean	Std. Dev.	Min.	Max.	Obs.
Cetes: Banks	0.027	11.65	-75.25	64.35	3,144
Cetes: Mutual Funds	0.027	7.92	-44.76	34.34	3,144
Cetes: Pension Funds	0.033	4.75	-21.20	48.32	3,144
Cetes: Insurers	0.012	0.99	-8.36	7.99	3,144
Cetes: Non-Financial	0.102	11.83	-54.98	60.78	3,144
Cetes: Domestic	0.212	11.36	-108.29	106.92	3,144
Cetes: Foreigners	0.026	8.24	-108.45	37.69	3,144
Bonos: Banks	0.112	28.35	-293.13	250.35	3,144
Bonos: Mutual Funds	0.010	11.93	-52.28	42.09	3,144
Bonos: Pension Funds	0.210	6.88	-40.57	30.95	3,144
Bonos: Insurers	0.019	1.28	-12.37	12.32	3,144
Bonos: Non-Financial	0.124	23.24	-222.01	247.97	3,144
Bonos: Domestic	0.538	12.08	-182.09	81.31	3,144
Bonos: Foreigners	0.289	9.40	-73.02	112.74	3,144
Udibonos: Banks	0.000	0.88	-10.37	8.07	3,144
Udibonos: Mutual Funds	0.001	0.75	-4.69	4.18	3,144
Udibonos: Pension Funds	0.048	0.52	-7.09	3.85	3,144
Udibonos: Insurers	0.019	0.13	-1.97	2.45	3,144
Udibonos: Non-Financial	0.012	1.00	-11.26	5.94	3,144
Udibonos: Domestic	0.081	1.07	-27.09	3.35	3,144
Udibonos: Foreigners	0.003	0.17	-1.84	1.41	3,144

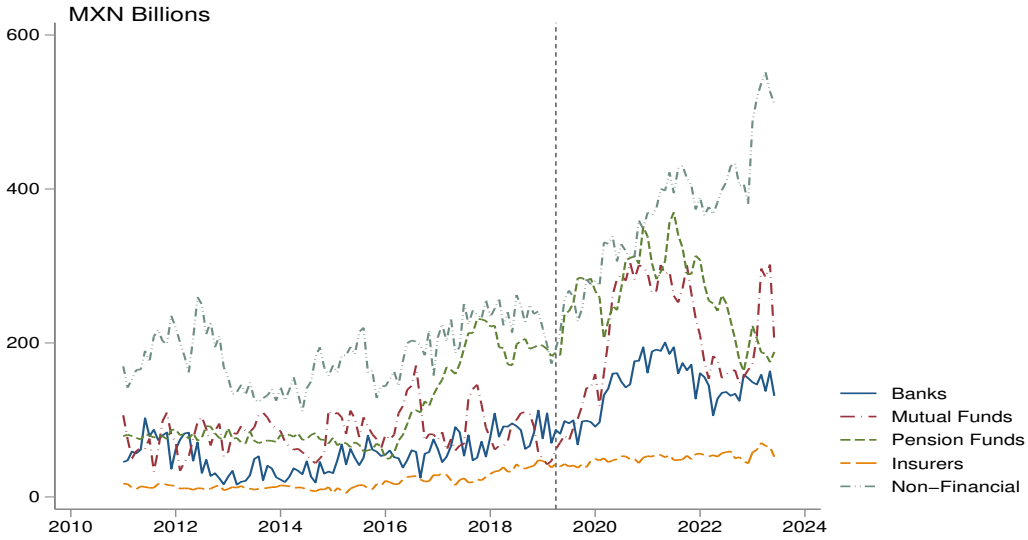
Notes: This table shows summary statistics for different categories of daily flows of cetes, bonos (after adjusting for valuation effects) and udibonos. The flows are obtained as the daily change in the holdings of the respective security. The flows for cetes and bonos are expressed in billions of Mexican pesos, and those for udibonos in billions of UDI (an inflation-linked index). The sample period starts in January 2011 and ends in June 2023.

Figure A.1. Holdings of Cetes and Bonos by Investor Residence



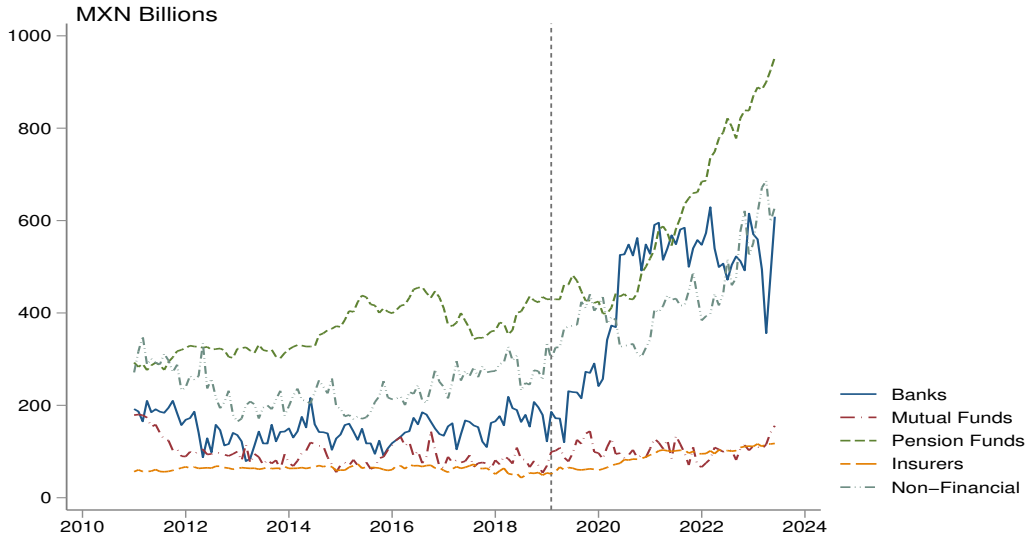
Notes: This figure shows the net holdings of Mexican Treasury bills (cetes) and fixed-rate sovereign bonds (bonos) by investor residence from January 2011 to June 2023. Vertical lines indicate break dates, see text for details.

Figure A.2. Holdings of Cetes by Type of Investor



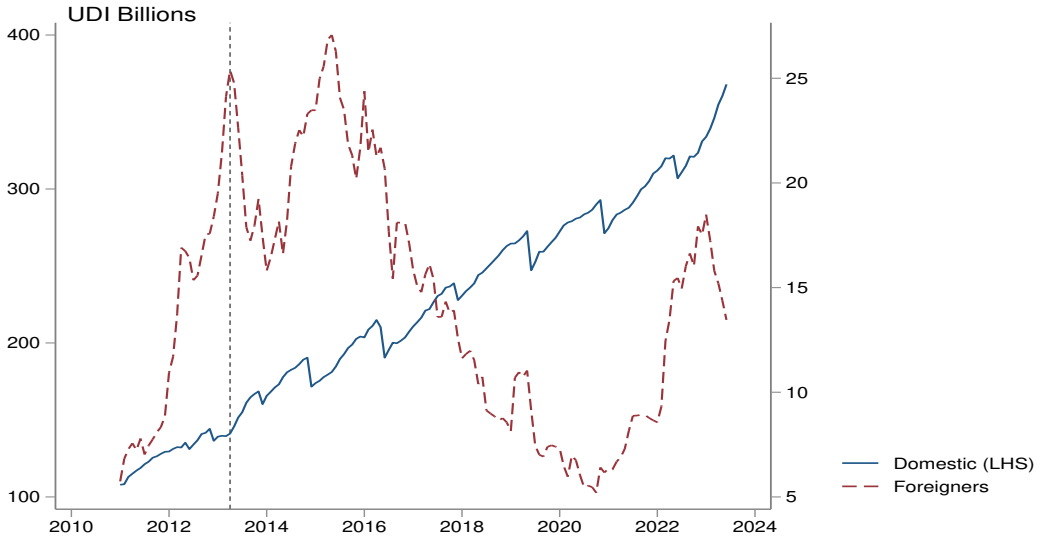
Notes: This figure shows the net holdings of Mexican Treasury bills by type of domestic investor from January 2011 to June 2023. The vertical line indicates a break date, see text for details.

Figure A.3. Holdings of Bonos by Type of Investor



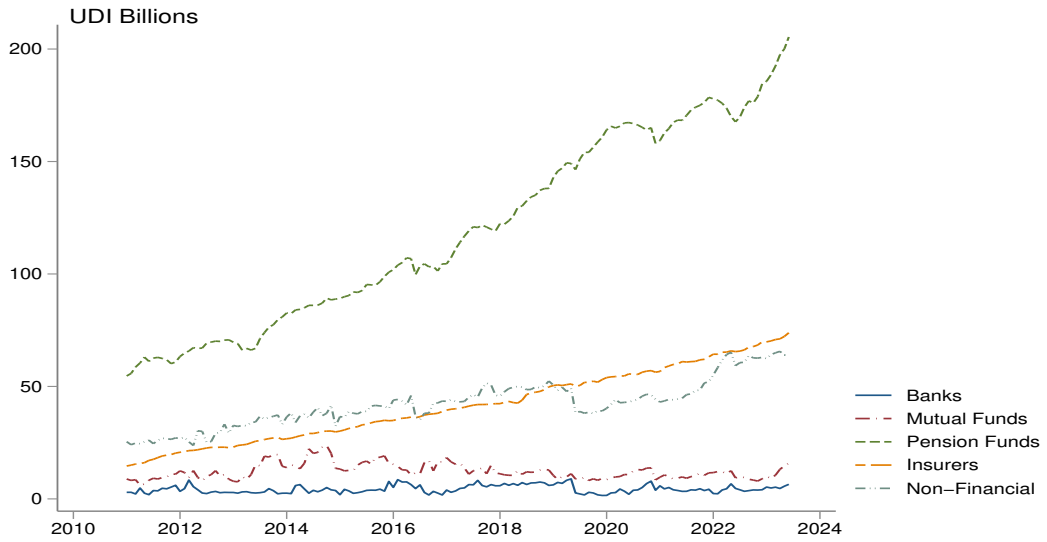
Notes: This figure shows the net holdings of fixed-rate Mexican sovereign bonds (bonos) by type of domestic investor from January 2011 to June 2023. The vertical line indicates a break date, see text for details.

Figure A.4. Holdings of Udibonos by Investor Residence



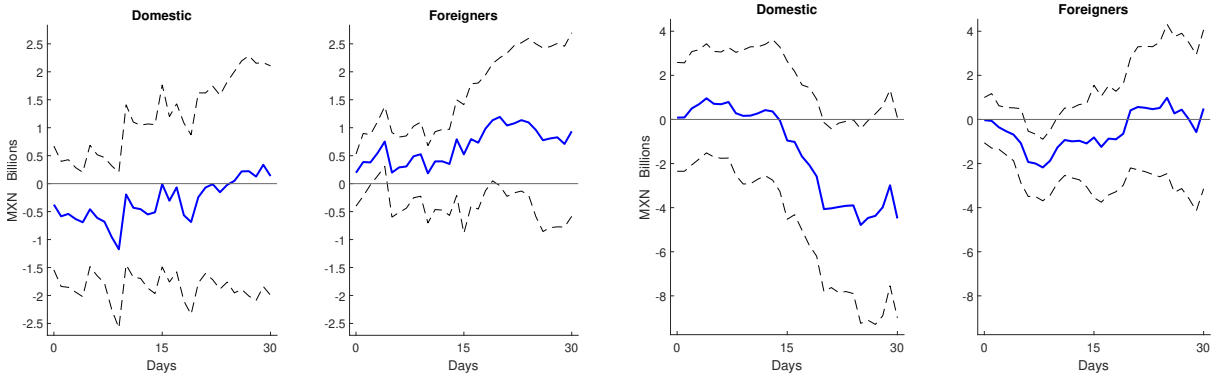
Notes: This figure shows the net holdings of Mexican inflation-protected bonds (udibonos) by investor residence from January 2011 to June 2023. The vertical line indicates a break date, see text for details.

Figure A.5. Holdings of Udibonos by Type of Investor



Notes: This figure shows the net holdings of inflation-protected bonds (udibonos) by type of domestic investor from January 2011 to June 2023.

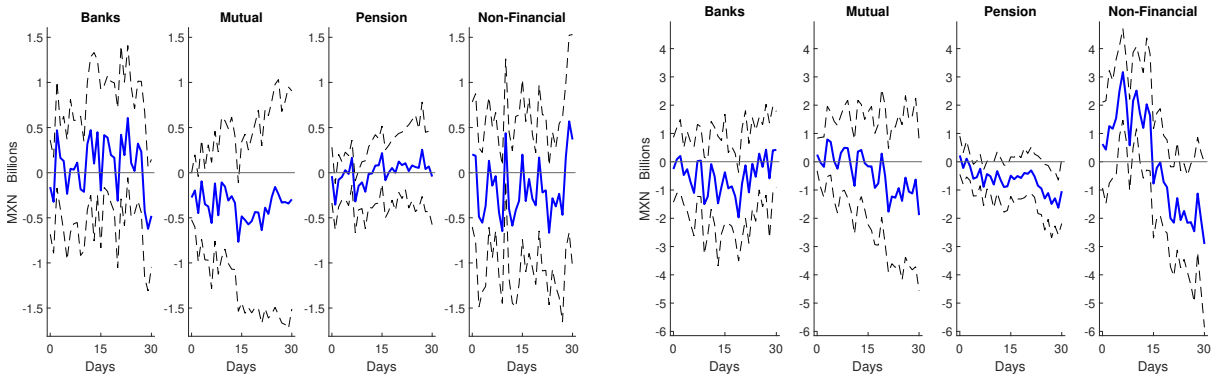
Figure A.6. Cetes Flow Response to Target and Path Surprises by Investor Residence: 2016-2019



(a) Target Surprise **(b)** Path Surprise

Notes: Coefficient estimates for the response of cetes flows to a 1 basis point target and path tightening surprises from day $t-1$ to day $t+h$, where t is a day with a monetary policy announcement and $h = 0, 1, \ldots, 30$. Dashed lines show 95% bootstrapped confidence bands. The sample includes all regular monetary policy announcements between March 2016 and April 2019.

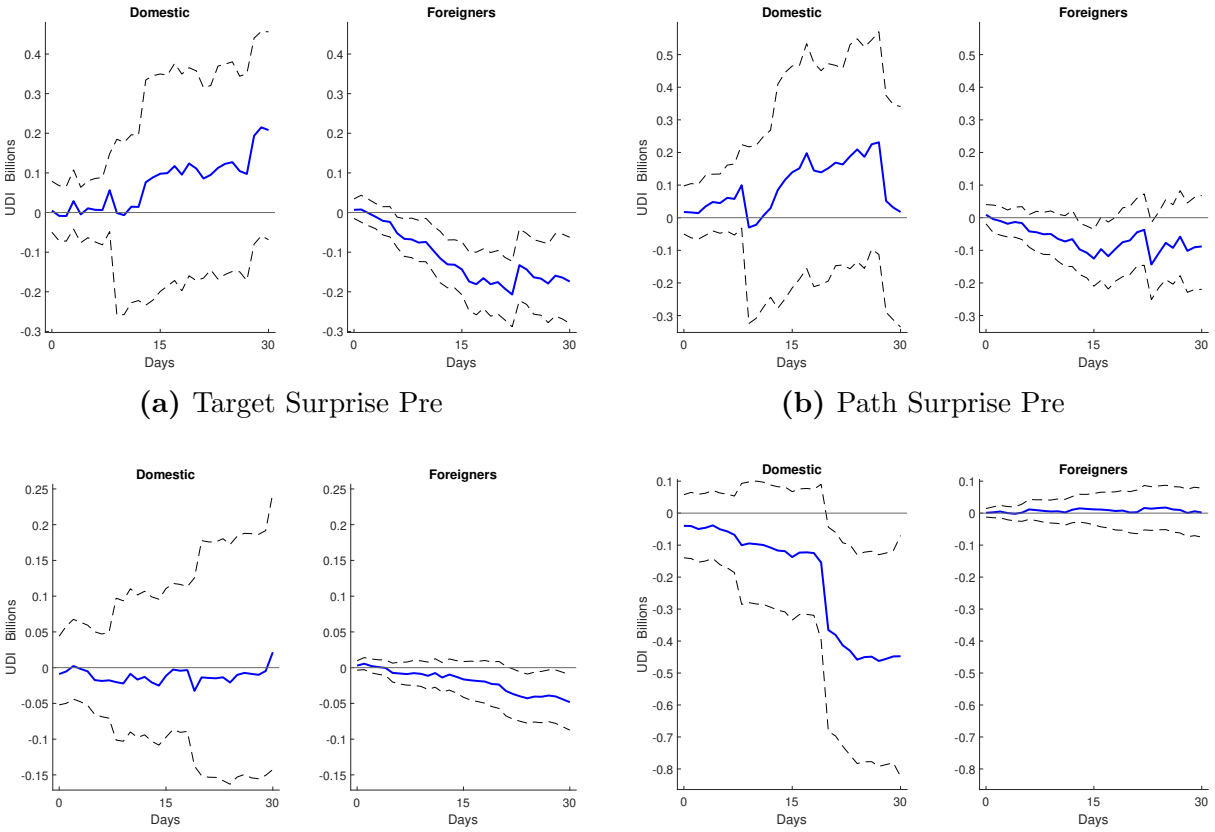
Figure A.7. Cetes Flow Response to Target and Path Surprises by Type of Domestic Investor: 2016-2019



(a) Target Surprise **(b)** Path Surprise

Notes: Coefficient estimates for the response of cetes flows to a 1 basis point target and path tightening surprises from day $t-1$ to day $t+h$, where t is a day with a monetary policy announcement and $h = 0, 1, \ldots, 30$. Dashed lines show 95% bootstrapped confidence bands. The sample includes all regular monetary policy announcements between March 2016 and April 2019.

Figure A.8. Udibonos Flow Response to Target and Path Surprises by Investor Residence



(a) Target Surprise Pre

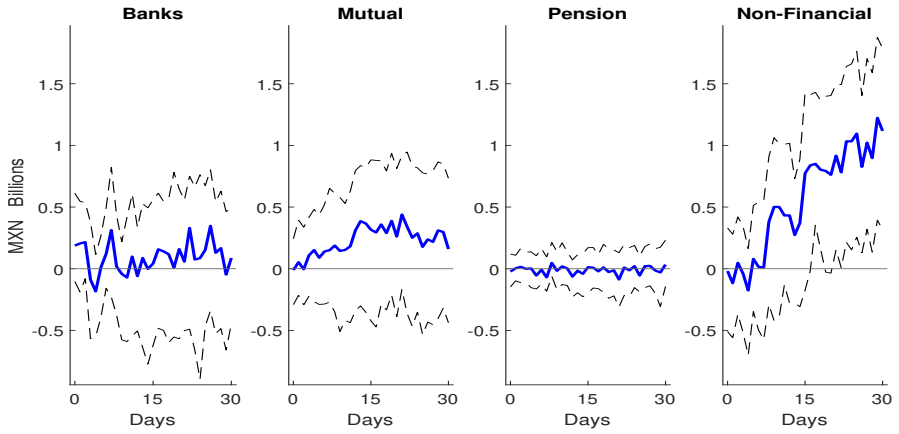
(b) Path Surprise Pre

(c) Target Surprise Post

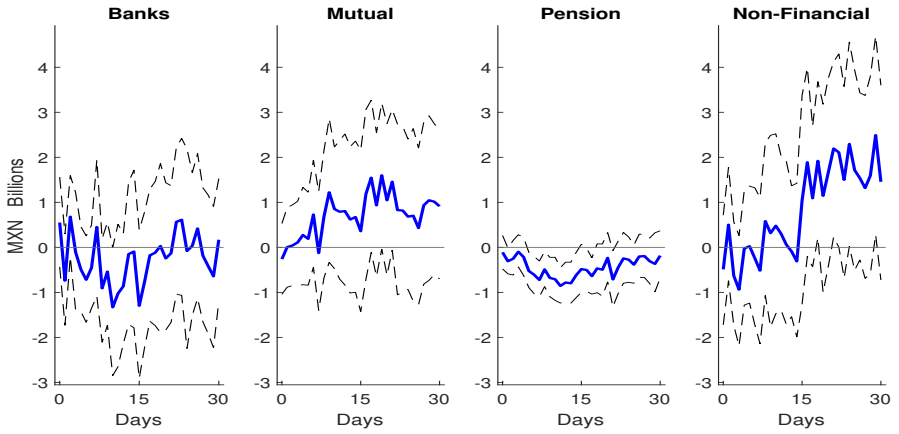
(d) Path Surprise Post

Notes: Coefficient estimates for the response of udibonos flows to a 1 basis point target and path tightening surprises from day $t-1$ to day $t+h$, where t is a day with a monetary policy announcement and $h = 0, 1, \ldots, 30$. Dashed lines show 95% bootstrapped confidence bands. The sample includes all regular monetary policy announcements from January 2011 to June 2023. The top row shows the responses before April 15, 2013, and the bottom row the responses afterwards.

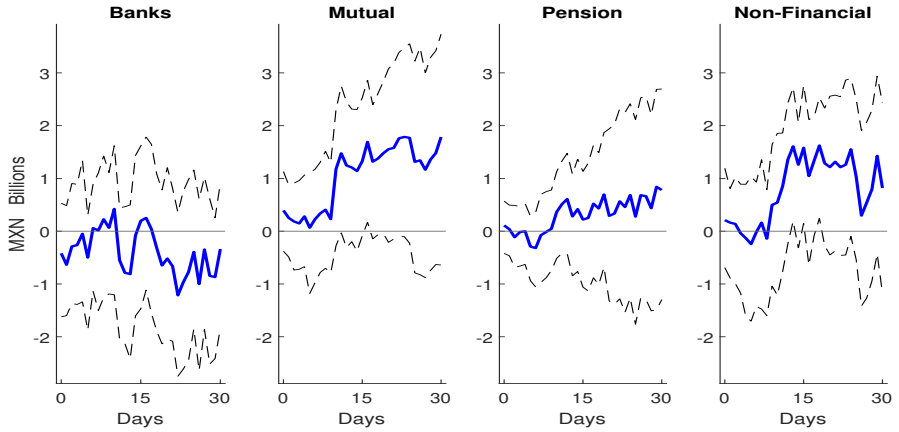
Figure A.9. Cetes Flow Response to Target and Path Surprises by Type of Domestic Investor



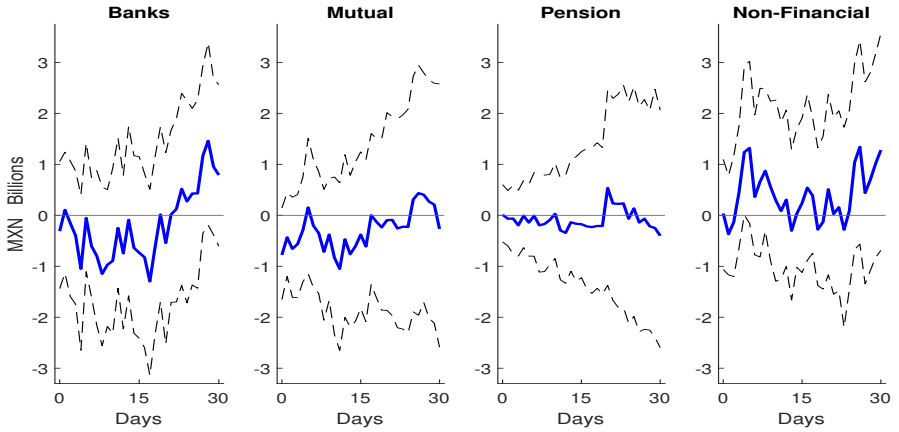
(a) Target Surprise Pre



(b) Path Surprise Pre



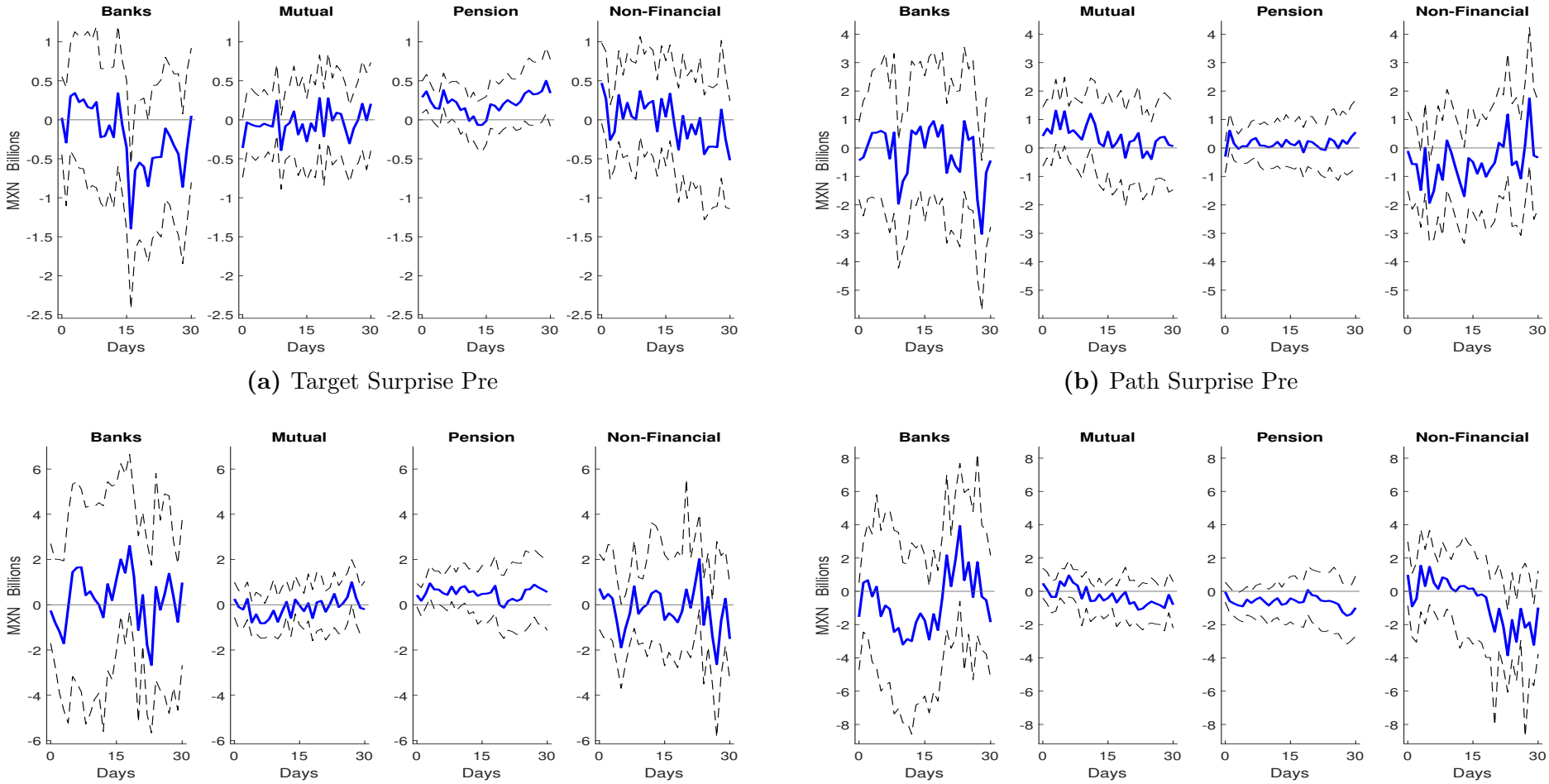
(c) Target Surprise Post



(d) Path Surprise Post

Notes: Coefficient estimates for the response of cetes flows to a 1 basis point target and path tightening surprises from day $t-1$ to day $t+h$, where t is a day with a monetary policy announcement and $h = 0, 1, \ldots, 30$. Dashed lines show 95% bootstrapped confidence bands. The sample includes all regular monetary policy announcements from January 2011 to June 2023. The top row shows the responses before March 17, 2016, and the bottom row the responses afterwards.

Figure A.10. Bonos Flow Response to Target and Path Surprises by Type of Domestic Investor



(a) Target Surprise Pre

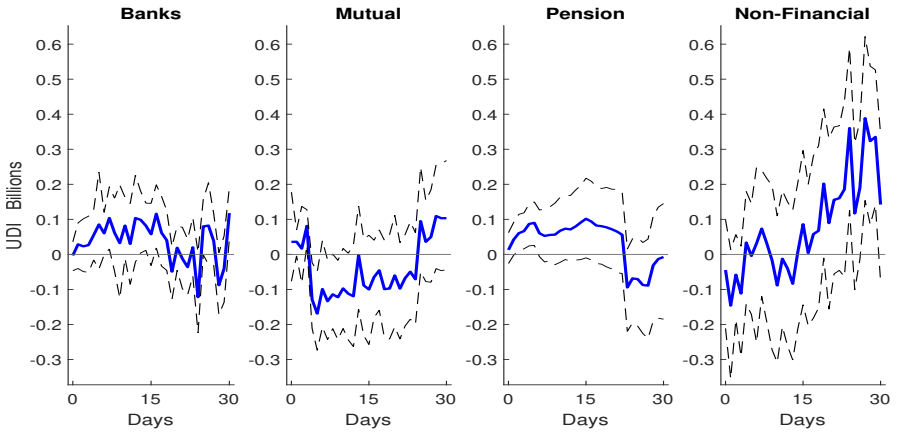
(b) Path Surprise Pre

(c) Target Surprise Post

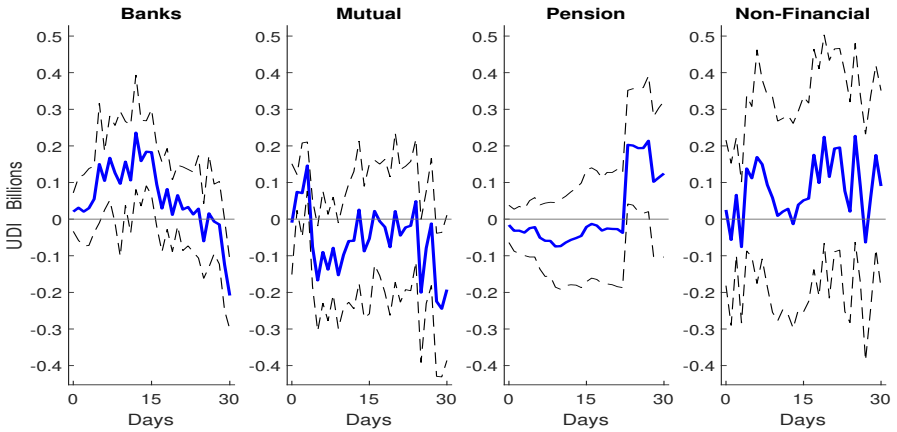
(d) Path Surprise Post

Notes: Coefficient estimates for the response of bonos flows to a 1 basis point target and path tightening surprises from day $t-1$ to day $t+h$, where t is a day with a monetary policy announcement and $h = 0, 1, \ldots, 30$. Dashed lines show 95% bootstrapped confidence bands. The sample includes all regular monetary policy announcements from January 2011 to June 2023. The top row shows the responses before February 11, 2019, and the bottom row the responses afterwards.

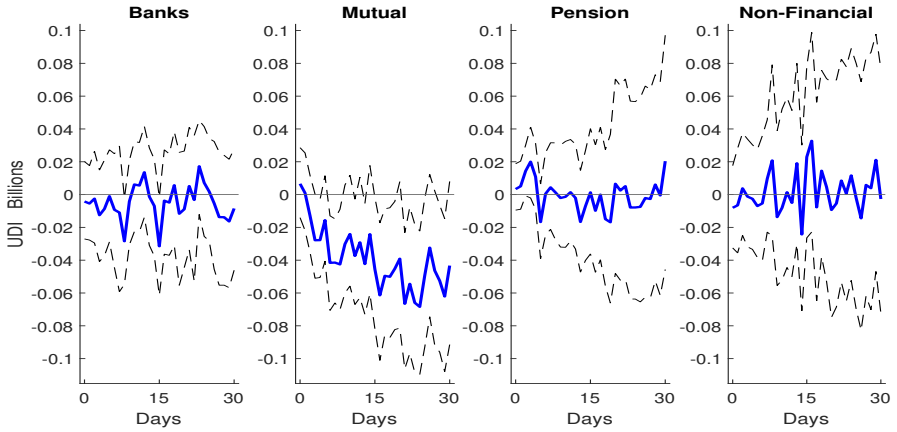
Figure A.11. Udionos Flow Response to Target and Path Surprises by Type of Domestic Investor



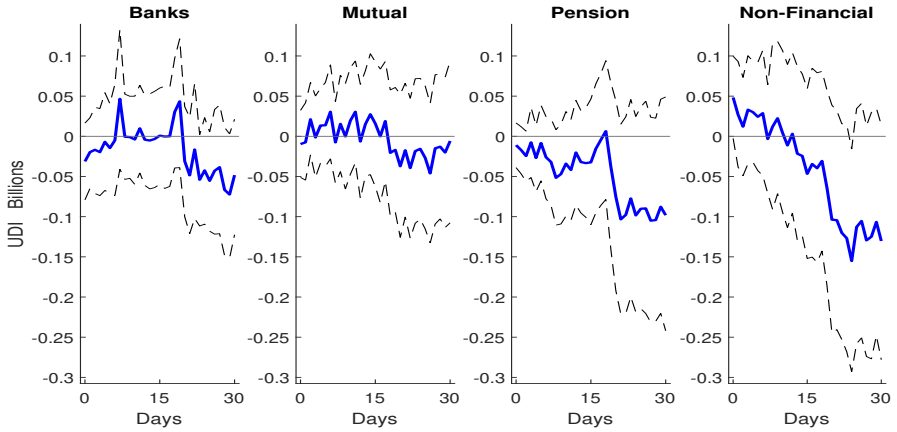
(a) Target Surprise Pre



(b) Path Surprise Pre



(c) Target Surprise Post



(d) Path Surprise Post

Notes: Coefficient estimates for the response of udibonos flows to a 1 basis point target and path tightening surprises from day $t-1$ to day $t+h$, where t is a day with a monetary policy announcement and $h = 0, 1, \ldots, 30$. Dashed lines show 95% bootstrapped confidence bands. The sample includes all regular monetary policy announcements from January 2011 to June 2023. The top row shows the responses before April 15, 2013, and the bottom row the responses afterwards.