Federal Reserve Bank of Cleveland Working Paper Series

The Transmission of International Monetary Policy Shocks on Firms' Expectations

Serafin Frache, Rodrigo Lluberas, Mathieu O. Pedemonte, and Javier Turen

Working Paper No. 23-01

January 2023

Suggested citation: Frache, Serafin, Rodrigo Lluberas, Mathieu O. Pedemonte, and Javier Turen. 2023. "The Transmission of International Monetary Policy Shocks on Firms' Expectations." Working Paper No. 23-01. Federal Reserve Bank of Cleveland. https://doi.org/10.26509/frbc-wp-202301.

Federal Reserve Bank of Cleveland Working Paper Series
ISSN: 2573-7953

The Transmission of International Monetary Policy Shocks to Firms' Expectations*

Serafin Frache[†]
Universidad de Montevideo

Rodrigo Lluberas[‡]
Universidad ORT Uruguay

Mathieu Pedemonte[§]
Cleveland Fed

Javier Turen[¶]
Pontificia Universidad Catolica de Chile

December 28, 2022

Abstract

Motivated by the dominant role of the US dollar, we explore how monetary policy (MP) shocks in the US can affect a small open economy through the expectation channel. We combine data from a panel survey of firms' expectations in Uruguay with granular information about firms' debt position and total imports on a monthly basis. We show that a contractionary MP shock in the US reduces firms' inflation and cost expectations in Uruguay. This result contrasts with the inflationary effect of this shock on the Uruguayan economy, suggesting uncertainty about the policy regime. We discuss the issues and challenges of this expectation channel.

Keywords: Firms' Expectations, Global Financial Cycle, Monetary Policy Spillovers
JEL codes: E31, E58, F41, D84, E71

---

*We thank Katharina Bergant, Larry Christiano, Olivier Coibion, Ed Knotek, Ina Hajdini, Aeimit Lakdawala, Gerardo Licandro, Tumisang Loate, Juan Pablo Medina, José Mourelle, Ernesto Pastén, Giovanni Ricco, Alejandro Vicondoa, Michael Weber and seminar participants at the Federal Reserve Bank of Cleveland, the Uruguayan Central Bank, SECHI, LACEA-LAMES and the ERSA CEPR conference for useful comments and suggestions. The views expressed here are solely those of the authors and do not necessarily reflect the views of the Federal Reserve Bank of Cleveland or the Federal Reserve System.

[†]Email: sfrache@um.edu.uy
[‡]Email: lluberas@ort.edu.uy
[§]Email: Mathieu.PedemonteLavis@clev.frb.org
[¶]Email: jturen@uc.cl

1 Introduction

Expectations about *future* conditions are relevant as they significantly affect firms' *current* decisions. The impact of expectations on decisions operates by transmitting news and as a source of shocks (Born et al. (2021)). Existing evidence suggests that expectations matter for firms' current hiring, pricing, and investment decisions (Coibion, Gorodnichenko, and Ropele (2020)). Although there is evidence studying the different factors that shape agents' expectations, very little is known about whether policy decisions across borders matter for firms' expectations and their decisions in small open economies.

In this paper, we study the impact of the transmission of international monetary policy shocks on firms' expectations about the local economy and their own conditions. We aim to characterize the main channels along which shocks across borders propagate through expectations, and discuss their effects on the local economy. Using a panel survey of expectations for Uruguayan firms, we find that they respond to an international monetary policy shock in the short *and* medium run, thus affecting the capacity of local monetary authorities to stabilize expectations. We provide novel evidence about a new channel by which monetary policy abroad can push firms to revise expectations about their local economy and markets. We also study the potential effects of such shocks on firms' decisions.

Recent works have shown that US monetary policy has global effects and that financial and trade linkages exacerbate those effects. In particular, Degasperi, Hong, and Ricco (2020) show that a monetary tightening in the US has significant contractionary effects on both developed and non-developed economies. In addition, Gopinath et al. (2020) show how US monetary policy affects the global economy through the role of the US dollar as a dominant currency. In addition, Egorov and Mukhin (2021) discuss how the use of the US dollar as a dominant currency for trade reduces the capacity of local central banks to respond to external shocks. In related work, Miranda-Agrippino and Rey (2020) show evidence stressing the interplay between the US monetary policy and "global financial cycle" (GFC). The existence of a GFC is not innocuous for other economies as central banks would have fewer policy tools as a consequence of this international cycle, as discussed by Rey (2015).

We start by relying on a fairly unexplored survey of firms' expectations in Uruguay. On a monthly basis, a panel of firms are asked to report their expectations about the country's inflation and about how much they expect their costs, in local currency, would change over different time horizons. Using monetary policy shocks in the US, we show that a contractionary monetary policy shock in the US significantly reduces inflation expectations at both 12 and 24 months ahead. An unexpected 1 percentage point increase in the policy rate in the US decreases Uruguayan firms' inflation expectations one and two year ahead by about 0.8 percent after 10 months. We find a similar effect for firm's cost expectations at 12 and 24 months: a 1 percentage point increase in the policy rate in the US decreases firms' cost expectations one and two year ahead by around 0.4 percent after one year.

This result is consistent with the contractionary effects of a US MP shock found by Degasperi, Hong, and Ricco (2020). Thus, our results show that global shocks have significant implications for firms' expectations *outside* the US. We check the effect of a US MP shock on the Uruguayan economy in the same period of time. We find that the shock produces a depreciation and a decrease in economic activity. More importantly, we find that this effect is mildly inflationary, contradicting firms' expectations. While this result sounds puzzling, it is consistent with firms expecting an intervention from the monetary authority to defend the value of the currency. In a peg regime, a MP shock from the US should be deflationary. While the Uruguayan economy has a history of exchange rate interventions, in the period analyzed, there is an inflation-targeting regime characterized by a floating exchange rate that is, in fact, managed floating. These characteristics may potentially explain why firms have uncertainty about the monetary policy regime and how that uncertainty could drive the results found in the empirical section. Another possible explanation could come from agents having uncertainty about the nature of the shock. In any case, our results challenge the role that central banks can play in the presence of global shocks: under misspecified beliefs, firms might not know the true policy regime, hindering monetary authorities' policy.

Then, we merge the firms' expectations survey with granular monthly information about firms' debt currency and maturity position. Crucially, through the external information, we are able to distinguish the share of debt that is denominated in the local currency (Uruguayan pesos) from debt issued in US dollars at the firm level. Although recently many countries have been actively collecting information about firms' expectations, we are able to merge a long panel of firms' expectations with actual (i.e., not self-reported) external information about firms' debt position. Through this information, we assess the heterogeneous effects of the MP shock on expectations as a function of firms' debt position. While indebted firms decrease their inflation expectations by less, the effect is compensated across firms with debt denominated in US dollars. A similar pattern is found for cost expectations.

Regarding the transmission channel, we show that when the Federal Reserve policy tightens policy, the Uruguayan peso depreciates against the US dollar. Intuitively, the exchange rate depreciation would particularly affect firms holding a large share of US-dollar-denominated debt. Crucially, and despite the fact that the shock has a negative effect on overall expectations, the cost expectations of this particular group of firms is revised *upward* after the shock, relative to the less exposed firms. Moreover, the transmission of international MP shocks to cost expectations is confirmed when we look at the response of the same shock to inflation expectations in Uruguay. In this case, the results show no meaningful reaction of expectations. To the best of our knowledge, our paper is the first empirical attempt to show that US MP can also have an impact on firms' expectations beyond its already studied effects. This finding adds another challenge for local central banks beyond the ones discussed in the GFC literature.

We then turn to firms' decisions. We show that a contractionary policy shock decreases the share of debt denominated in US dollars among Uruguayan firms, consistent with the finding that the Uruguayan peso appreciates after an expansionary monetary policy shock in the US. This effect is concentrated in long- and medium-term debt. We do not find a statistically significant effect on total debt or on the share of short-term debt in US dollars.

With these data, we also can clearly identify the share of firms that are more exposed to international fluctuations in US dollars and assess the implications for expectations. We then merge the survey of expectations data with administrative data on firms' total exports and imports at a monthly frequency. While most firms do not react in terms of imports after the shock, we show that firms with a larger share of debt denominated in US dollars (whose cost expectations reacted the most) tend to *increase* their total imports immediately after the shock. This circles back to the relevance of expectations and confirms the forward-looking feature of firms. Since this particular group of firms anticipates a future rise in their costs caused by the future depreciation of the Uruguayan *peso* relative to the US dollar, the firms decide to increase their total imports right after the shock. By immediately raising their total imports, they are reacting, in a precautionary way, to the expected rise in the exchange rate.

As discussed earlier, while firms react when expecting a decrease in prices after a contractionary US monetary policy shock, the same does not happen in the aggregate Uruguayan data. We find a positive but mildly significant effect of US monetary policy on CPI inflation for the Uruguayan economy. The same shock produces a depreciation of the Uruguayan peso and a drop in economic activity, in line with the findings of Degasperi, Hong, and Ricco (2020) for a panel of countries. In the context of the US dollar as the dominant currency, Egorov and Mukhin (2021) show that the effect on prices depends on the policy reaction of the local central bank. When the US dollar is the dominant currency, an increase in the policy rate produces a depreciation, while there is little expenditure switching for exports, as firms exports their products in US dollar everywhere. The depreciation increases the price of imports, thus increasing local CPI inflation. Depending on the policy rule, this effect can be offset by the local central bank. If the central bank wants to protect the price of the Uruguayan peso, local CPI can decrease as a result of the aggressive policy reaction.

Our results suggest that Uruguayan firms expect an intervention to protect the value of the Uruguayan peso, while the official policy of the central bank and the data show that the local policy is consistent with a floating regime. In order to understand the effects of this behavior, we propose a simple DSGE model a là Gali and Monacelli (2005) where we allow firms to have a misperception about the policy framework. In particular, firms react to the current macroeconomic outcomes, but form expectations as if the economy follows an exchange rate peg. In the model, firms observe a depreciation and expect a local tightening of the monetary policy, and, with this, a reduction in overall prices. Due to this misperception, firms react by expecting a reduction in their prices. The economy reacts to the shock with lower CPI inflation and a strong depreciation, as we find in the aggregate data. These results have important implications for emerging economies where the US dollar price is an important indicator tracked by households and firms. While the central bank can have a defined policy rule, households and firms might perceive the depreciation of the local currency negatively, and then react accordingly. In that sense, good policy communication can help to align expectations with policies.

Firms' inflation expectations play an important role in economic decisions. Recent work has shown that changes in inflation expectations can affect economic decisions, as shown in Coibion, Gorodnichenko, and Ropele (2020). While Coibion, Gorodnichenko, and Kumar (2018) show that firms' inflation expectations in countries with low inflation expectations are disperse and apparently unanchored, Frache, Lluberas, and Turen (2021) show that this is not necessarily the case in higher inflationary environments. Moreover, Frache, Lluberas, and Turen (2021), using the same survey from Uruguay show that price-adjustment decisions are correlated with firms' beliefs about the evolution of their future cost. D'Acunto et al. (2021) also show that consumers' inflation expectations are shaped by their own experiences. As explained in Coibion, Gorodnichenko, and Ropele (2020), communication from monetary authorities can affect firm expectations under certain conditions. In addition, they show that changes in firms' inflation expectations, measured by surveys, affect firms' economic decisions. While there is evidence on how firms' information in the context of local shocks affects expectations, in this paper we explore how international shocks can affect expectations and how this channel matters when analyzing the implications of international shocks.

The GFC has been studied recently and many works have shown how international shocks can affect the local economy. This was initially motivated by Rey (2015) and **?**, but new studies, such as Degasperi, Hong, and Ricco (2020), also show that international monetary policy shocks affect other economies. The consequence outlined in this literature is that local economic authorities, in particular central banks, have a harder time when trying to stabilize output. In this paper we add a new layer to understanding the mechanisms behind those effects and we also add a new variable to consider. On one side we show that a MP shock in the US affects firms' inflation and cost expectations, suggesting an expectation channel of the GFC, which implies that local central banks could have a harder time managing inflation expectations after a global shock. In addition, we provide micro-level evidence of firms' reactions after a global MP shock in terms of debt and imports. These findings help us to understand the mechanism behind the effects found in works such as Miranda-Agrippino and Rey (2020) and Degasperi, Hong, and Ricco (2020).

The rest of the paper is organized as follows. Section 2 describes the main data that we use in this paper. Section 3 discusses empirically how an international MP shock affects firms' expectations in Uruguay. Section 4 then shows the effects of the shock on firms' dollar-denominated debt and on their import decisions, operating through the expectation channel. Section 5 concludes.

2 Data

In this section, we describe the main sources of data that we use in this paper. As discussed, we do not rely solely on a fairly novel and unexplored panel survey of firms' expectations in Uruguay; instead, we combine this information with granular data at a monthly frequency from firms' balance sheets and credit records.

2.1 Survey of firms' expectations

We use the Uruguayan survey on firms' expectations carried out by the National Statistical Institute (INE), commissioned by the Central Bank of Uruguay (BCU). The survey follows a panel of firms monthly, and the survey is representative of firms with more than 50 employees at both the country and the sector level, with the exception of the public, agriculture, and financial sectors. Every month firms are asked about their inflation expectations, i.e., the expected annual change in the consumer price index, along with their own cost expectations, i.e., the expected change in their total production costs in local currency over different time horizons: (1) until the end of the current year, (2) over the next 12 months and (3) over the next 24 months. In this paper, we will focus on expectations at the 12- and 24-month horizon. The survey started in October 2009 and we use data until March 2020. We stop in March to remove the possible effects of the COVID-19 pandemic. For further specific details about the survey, along with a comparison with other existing surveys of firms' expectations, we refer the reader to Frache, Lluberas, and Turen (2021).

2.2 Firms' credit position

Endowed with this unique long survey, we merge firms' expectations with monthly data on firms' credit positions with the financial sector. We extract this information from the Credit Register of the BCU. The Credit Register is a public database with information on all loans issued by the regulated financial sector to firms and households. In particular, we are able to collect information about firms' total credit, the specific bank that is lending money to the firm, the length of the credit (short, medium and long term) and more importantly, whether the credit was *issued* in either local currency (Uruguayan peso) or US dollars. Hence, we are able to characterize firms' financial position and merge this information with firms' expectations on a monthly basis.

Since Uruguay lacks a well-developed equity market, credit access by firms is not common in that country. Even though our expectations survey sample is composed of relatively large firms (i.e., with more than 50 employees), about 40 percent of the firms included in the original sample do not borrow from the financial sector during our sample period. Although there has been a decline in USD-denominated credit, firms still borrow in USD. On average, the proportion of USD-denominated credit among firms is 71 percent.

2.3 Custom monthly data at the firm level

We also collect custom data at the firm level extracted from the General Customs Administration (*Direccón General de Aduanas, DGA*). We have monthly data on total goods imports of each firm available continuously for all years covering our sample of analysis. Each individual record provides detailed information on the Uruguayan firm ID, the code at the 10-digit Harmonized System (HS) level of the product object of the transaction, the country of origin, the date of the transaction, the value in US dollars, and the quantity. In our study we use the quarterly average of total imports by firm and classify them using the Broad Economic Categories (BEC Revision 5) to analyze how goods' imports evolve by end-use category.

2.4 Monetary policy shocks

We rely on the series for monthly US monetary policy shocks proposed by Bu, Rogers, and Wu (2021). The series bridges episodes of conventional and unconventional monetary policy while removing the Fed's information effects. Hence, monetary policy surprises allow us to study directly the transmission of a traditional monetary shock across borders.[1] We selected this monetary policy shock series because of its properties and time series availability. In Appendix C we show that our main results are robust to many shocks, proposed and extended by Acosta (2022). In addition, we use a series of monetary policy shocks in Uruguay according

[1]The paper relies on a two-stage procedure to identify such shocks. In the first stage, the idea is to regress interest rates at different maturities around FOMC announcements. To remove non-monetary-policy news, Bu, Rogers, and Wu (2021) use the heteroskedasticity-based estimator. Then, in the second stage, all of the outcome variables are regressed using the sensitivity index estimated in the previous stage.

to Basal et al. (2016).

3 The transmission of US monetary policy shocks

There is a relevant strand of literature, motivated by Rey (2015), that studies the existence of a global financial cycle. In particular, the work of Miranda-Agrippino and Rey (2020) documents a financial channel through which monetary policy conducted by the Federal Reserve has a global impacts. In addition, work on the role of the US dollar as the dominant currency explains how a US monetary contraction can have global effects, through changes in the nominal exchange rate, since firms price their exports in this currency (Gopinath et al. (2020)). In that context, Miranda-Agrippino and Rey (2020) find that after a contractionary US monetary policy shock, there is a short-term decrease in real global activity outside the US, which then recovers and expands after a year. Nominal exchange rates in the UK and the EU depreciate on impact and remain at the new level for between one and two quarters.

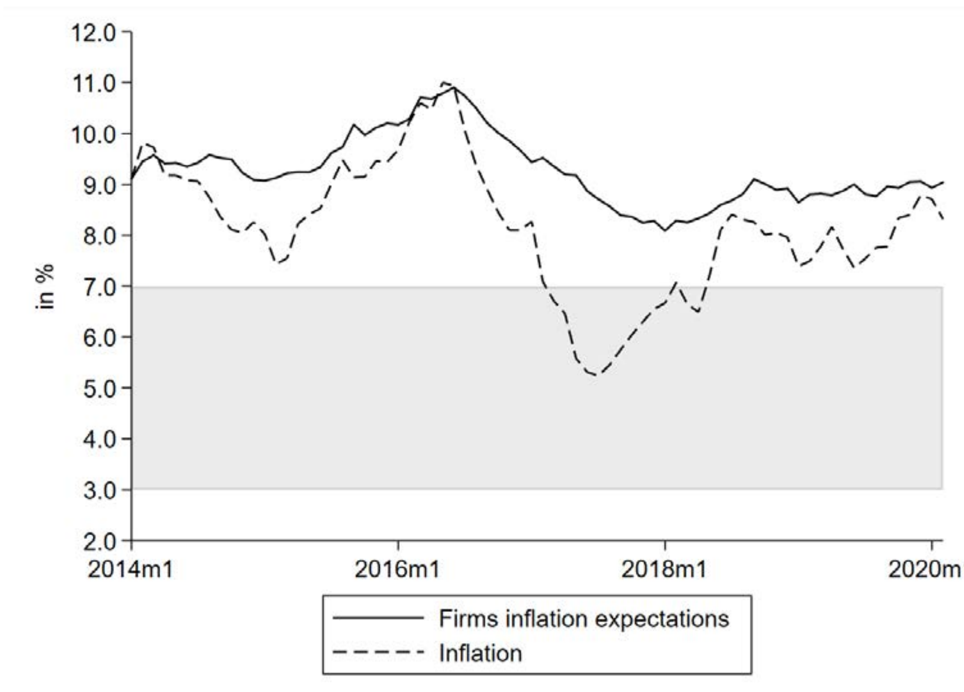
Similarly, Degasperi, Hong, and Ricco (2020) estimate the effect of US monetary policy shocks on a panel of countries. They show that US monetary policy strongly affects relevant economic variables outside of the US. While we rely on those results, in this section, we compute the effects of US monetary policy on the Uruguayan economy.

3.1 Monetary policy in Uruguay

After the 2002 financial and economic crisis, Uruguay started a process to gradually adopt an inflation-targeting regime, leaving a period during which the policy target was the exchange rate. During this process, both the inflation target range and the monetary policy instrument were revised on many occasions. While at the beginning the target was not explicit and the objective was M1 growth, shortly afterward the objective turned to an inflation range. The inflation target range was between 4 percent and 6 percent until June 2014, and then it was widened to 3 percent and 7 percent until August 2022. From July 2013 until August 2020, a window that covers all our sample period, the monetary policy instrument adopted by the Central Bank was $M1'$.[2]

Figure 1 exhibits the evolution of inflation and firms' average inflation expectations between January 2014 and February 2020. The gray area shows the inflation target range during that period. As we can see from the graph, inflation most of the time was above the upper bound of the target range. On the other hand, on average, firms' inflation expectations were never within that range. Despite this, observed and expected inflation in our sample period were relatively stable, with a mean of 8.2 percent and 9.3 percent, respectively.

Figure 1: Inflation and inflation expectations in Uruguay



3.2 "Fear of floating" statistics

The term "fear of floating" was originally proposed by Calvo and Reinhart (2002) to characterize countries that claim they allow their exchange rate to freely float, but frequently intervene to

[2] $M1'$ includes currency in circulation, checking account deposits, and non-interest-bearing savings accounts.

avoid abrupt fluctuations in the nominal exchange rate. In their setting, fear of floating arises due to the dollarization of debt, a lack of credibility that results in high risk premiums, a high pass-through of the exchange rate to domestic prices, and inflation targeting. According to Calvo and Reinhart (2002), floaters should show high fluctuations in their exchange rate and low fluctuations in their foreign reserves.

Ilzetzki, Reinhart, and Rogoff (2019) show that the majority of countries remain under a limited flexibility exchange rate regime, at least in the period between 1946 and 2016. They propose a classification based on the anchor currency and the exchange rate regime. Under their classification, Uruguay followed a *de facto crawling band that is narrower than or equal to +/-5 percent* between 2003, after abandoning a pre-announced crawling band. If we extend the analysis of Ilzetzki, Reinhart, and Rogoff (2019) to the period 2017-2019, just before the COVID-19 pandemic, the absolute value of the average monthly change in the exchange rate suggests that Uruguay can still be considered to be following a *de facto crawling band that is narrower than or equal to +/-5 percent*. Also, in the early 2000s, the Central Bank of Uruguay intervened on several occasions. Puppo and Gari (2009) show that between 2004 and 2006, the central bank intervened the exchange rate market in 351 opportunities,

3.3 Effect of MP shocks on the domestic economy

When the Federal Reserve tightens policy, we expect an outflow of capital from Uruguay and consequently a depreciation of the Uruguayan peso against the US dollar. Given the exchange rate pass-through, the depreciation is expected to affect inflation as well, and this effect should be exacerbated in the context of the US dollar being the dominant currency. Depending on the magnitude of the adjustment, we expect the interest rate in Uruguay react in line with the central bank's response to the external monetary policy shock.

To test whether an unexpected increase in interest rates in the US affects inflation, the nominal exchange rate and the interest rate in Uruguay we estimate the following equation through Jordà's (2005) local projections method:

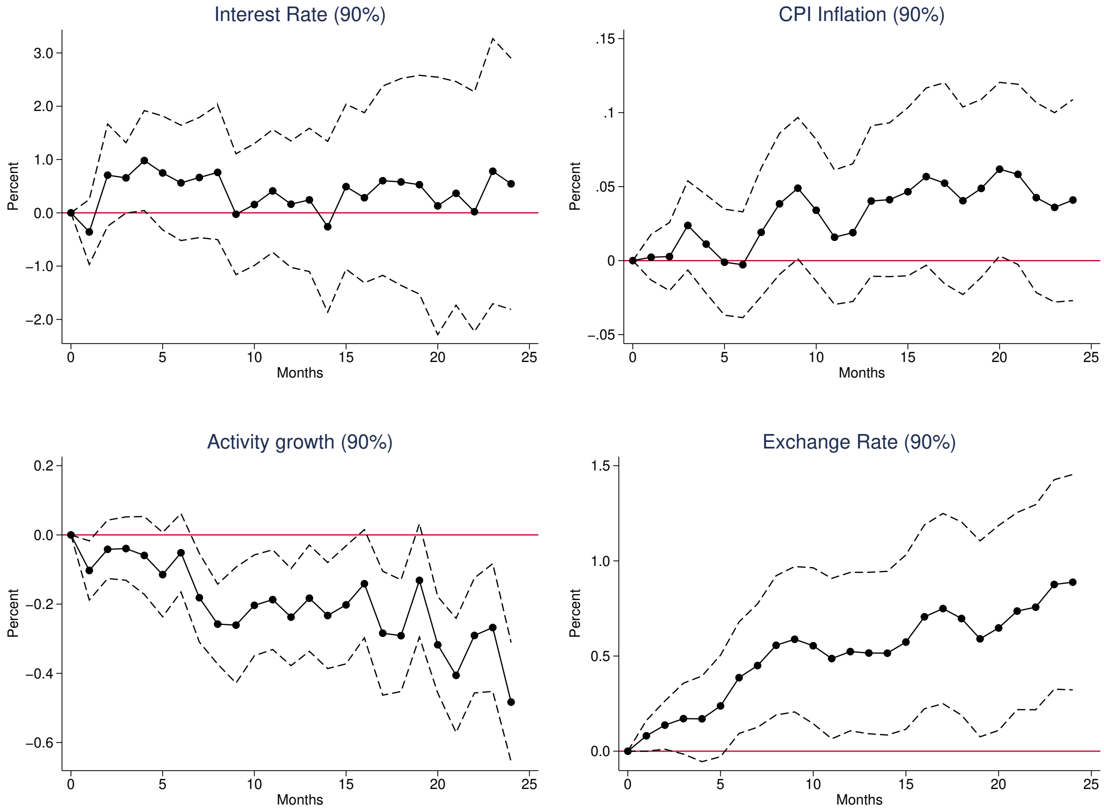
$$\Delta(\%)X_{t+h,t-1} = \alpha + \sum_{j=0}^{J} \beta^{h,j} MP_{t-j} + \sum_{j=1}^{J} \theta^{h,j} \Delta(\%)X_{t,t-j} + \varepsilon_{t+h}^{h},\ \forall h \in [0, H] \qquad (1)$$

where $\Delta(\%)X_{t+h,t} = \frac{X_{t+h}-X_t}{X_t}$. X_t is an outcome in time t that could be i_t, a proxy for a short-term interest rate; π_t, the Uruguayan inflation rate; y_t, the growth of local activity; or FX_t, the nominal exchange rate in Uruguay.[3] Moreover, MP_t is the US monetary policy shock according to Bu, Rogers, and Wu (2021) at time t. We control for lags of the change in variable X_t and lags of the monetary policy shock. Our parameter of interest is $\beta^{h,0}$ which captures the direct effect of monetary policy shocks in the US on the interest rate, inflation, economic activity, and nominal exchange rate in Uruguay in period h after the shock. We use the sample from 2009 to February 2020.[4] The IRFs for each variable are shown in Figure 2.

[3]Local economic activity in Uruguay is measured by the monthly index of economic activity (in Spanish, *Indice mensual de actividad economica (IMAE)*) constructed by the Central Bank of Uruguay. The nominal exchange rate is measured by the amount of Uruguayan pesos per US dollar.

[4]While our main results in terms of expectations use a smaller sample, from 2014 to February 2020, to be able to match the data with different samples, in Appendix D we show that the result for expectations are the same in terms of the direction for a sample from 2009.

Figure 2: Effect of US MP shocks on the domestic economy



Note: The upper panel shows the effect of a monetary shock in the US for the interest rate (upper left panel) and CPI (upper right panel) in Uruguay. The lower figures show the effect of that monetary policy shock for the years 2009 to 2020 on economic activity (lower left panel) and on the exchange rate, defined as Uruguayan Peso to US Dollar (lower right panel). For the lower panel figures, the results come from estimating (1), were the dependent variable is the percentage change between the base period and H. We use $J = 12$ and robust standard error. The dashed lines represent 95 percent confidence interval.

We find that a contractionary monetary policy shock in the US causes a significant and persistent contraction in economic activity in Uruguay that materializes approximately seven months after the shock. Moreover, the international shock also causes a depreciation of the Uruguayan peso against the US dollar. Both of these result are consistent with the findings of Degasperi, Hong, and Ricco (2020) for a panel of countries. This will obviously affect firms more exposed to the exchange rate, such as those holding a large share of their debt denominated in US dollars or those that import their inputs or final products to sell in the domestic market. Although it is not statistically significant, we also find some evidence of an increase in the interest rate and the inflation rate after the shock. The positive co-movement between the two series suggests an active monetary policy reaction from the central bank to a price increase. The rise in prices is partially driven by the pass-through of a more depreciated exchange rate as a response to the external shock.

To contrast these effects, we estimate (1), but now we use a monetary policy surprise *in* Uruguay instead.[5] As expected, after a tightening of monetary policy in the local economy, domestic inflation reacts negatively and local interest rates rise. The accumulated effect on inflation is around a 2 percent drop, five to six periods after the shock. Interestingly, in this case, although there is a mild appreciation of the exchange rate right after the shock, there is no meaningful or significant reaction of this variable to the local shock in contrast to the persistent and significant response after the external shock. The specific results for the local shock are discussed in Appendix B.

3.4 Effect of MP shocks on firms' expectations

We now move to studying the effect of the international MP shocks on Uruguayan firms' expectations. While a monetary policy shock in the US can affect firms' expectations through different channels, as discussed in the previous section, we expect that the local economic authorities adjust their decisions to partially mute these potential effects. In particular, if local monetary authorities are actively trying to reduce the effects of those shocks, local inflation should not be affected and then expectations should remain relatively stable. Therefore, we will assess whether short-run expectations (one year ahead) and medium run expectations (two years ahead) respond to MP shocks abroad while studying any dynamic features. We will explore the reaction of both local inflation and expectations

[5]In this case, the series of MP surprises in the local economy are backed out from a DSGE model, which is one of the models used by the Central Bank of Uruguay to guide its policy decisions. For references see Basal et al. (2016). Although the interpretation is the same, the model is calibrated at the quarterly frequency, so we adjust our estimates accordingly.

about costs separately. Then, we will also explore whether firms react to these changes conditioning on their different exposure to the US dollar.

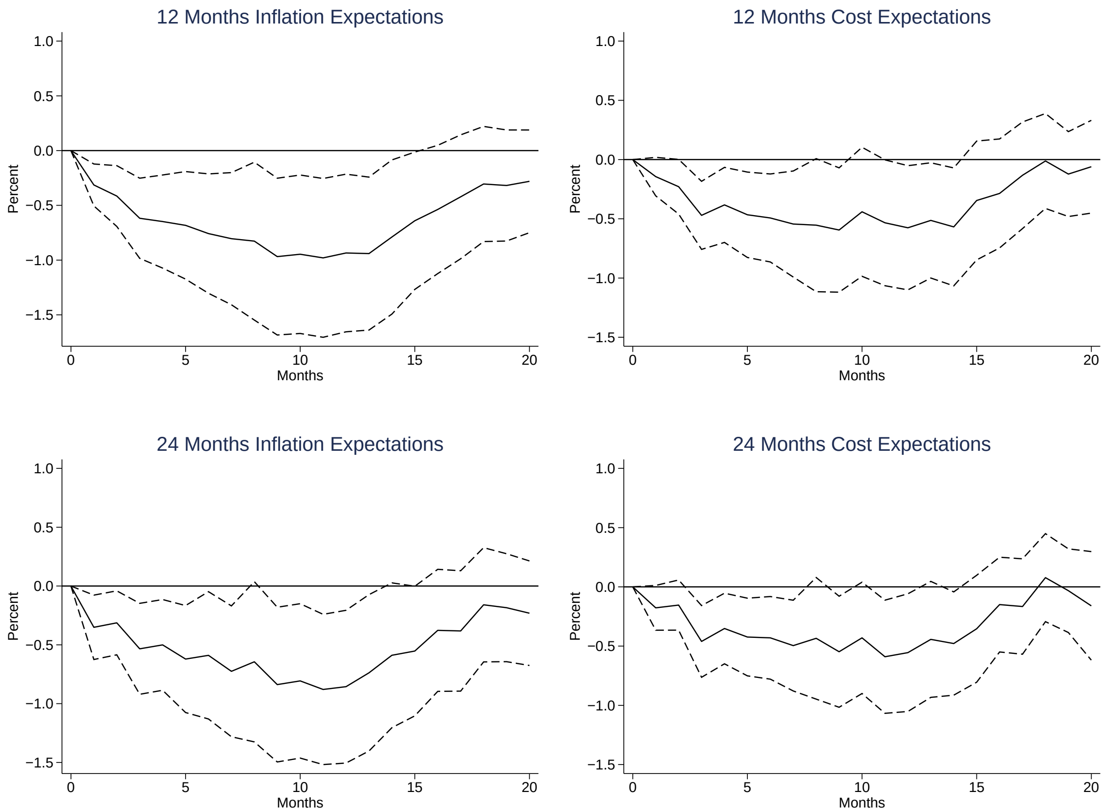
Previously, we showed that a US monetary policy shock slightly increases Uruguayan prices, in line with other empirical findings. We also discussed that a monetary policy tightening in the US would have different effects abroad depending on the policy reaction. In the case of Uruguay, the official policy is a medium-run inflation-targeting regime with a floating exchange rate. The empirical results are consistent with those findings: the Uruguayan peso depreciates and there is a pass-through to inflation, while policy tightens slightly and the economy contracts. The effect on prices is a moderate inflation. In this section, we will see whether firms form their expectations in line with those reactions. In Appendix B we show that firms form expectations in a similar fashion to what happens in the aggregate economy, after a monetary policy shock in Uruguay.

We again rely on Jordà's (2005) local projections method specification as in (1), but we specify it in a panel version as in Auerbach and Gorodnichenko (2012) and Herreño and Pedemonte (2022). Specifically, we run:

$$\Delta(\%)X_{i,t+h,t} = \alpha_i^h + \sum_{j=0}^{J} \beta^{h,j} MP_{t-j} + \sum_{j=0}^{J} \theta^{h,j} \Delta(\%)X_{i,t,t-j} + \varepsilon_{i,t+h}^h,\ \forall h \in [0, H] \tag{2}$$

The dependent variable is $\Delta(\%)X_{i,t+h,t}$, defined as a percentage change as before, but for an individual firm. $X_{i,t}$ is firm i's expectation for inflation or costs at either 12 months or 24 months horizon. Since inflation was relatively volatile over that period of time and firms' expectations can have even more dispersed values, we use the percentage change of firms' expectation, as a way to control for the baseline inflation of the firm. Given the panel structure, we also include a firm-specific fixed effect α_i^h, which is constant for the whole period. We use the monetary policy shock proposed by Bu, Rogers, and Wu (2021) as in the previous section. In Appendix C we show that our results are robust to the use of other shocks. In addition, we use a sample size from January 2014 to March 2020 so that out results are comparable with those in the next section, where we merge the survey with administrative data available only since 2014. In Appendix D, we also show that when we use a sample size starting in 2009 we obtain similar results. Figure 3 shows the results.

Figure 3: Effect of US MP shocks on firms' expectations



Note: This figure shows the effect of a monetary policy shock on firms' 12-month inflation expectations (upper left), 12-month own cost expectations (upper right), 24-month inflation expectations (lower left), and 24-month own cost expectations (lower right). The results come from estimating (2), where the dependent variable is the firms specific percentage change between the base period and H. We use $J = 12$. Standard errors are clustered at the time and firm level. The dashed lines represent 95 percent confidence intervals.

A positive monetary policy shock is associated with a significant decrease in inflation expectations and cost expectations on both horizons. This result shows that firms didn't follow what happened in the Uruguayan economy. In Section 3.3, we showed that inflation moderately increased after a US monetary policy shock. The shock reduced economic activity and produced a slightly increase in the policy rate. In addition, it produced a depreciation of the Uruguayan peso against the US dollar. The results on the firm side are in line with a contractionary policy shock, but it seems that firms overestimate the effect of the shock on prices. In terms of magnitudes, the effects are significant. The plot shows the percentage changes for each individual firm. Over the sample, the shock has a standard deviation of 0.03, or 3 basis points. This means that one standard deviation of the shock decreased firms' inflation expectations by approximately 3 percent after 10 months. The average inflation expectation of firms over the sample is 9.33 percent, meaning that the decrease after a one standard deviation of the shock is 0.28 percentage points in terms of inflation expectations.

For the case of the US, the empirical literature has studied the effects of a monetary policy shock. As discussed by Romer and Romer (2004), a contractionary monetary policy shock decreases wages and output in the economy. The drop in overall production should also reduce wages (Herreño and Pedemonte (2022) and Bergman, Matsa, and Weber (2022)), thus reducing firms' costs. Firms not only expect a drop in the overall price level as a consequence of the shock, they also revise their cost expectations downward. Related to the significance of the dynamic response, the results also suggest that the Central Bank of Uruguay was not able to neutralize the effect of the shock in terms of its effect on agents' inflation expectations. In particular, the shock caused a revision of both short- and medium-run expectations. This finding is interesting since it adds a new layer to the implications discussed by Miranda-Agrippino and Rey (2022). Our results suggest that the GFC is also able to affect forward-looking decisions of local firms, by shifting their inflation and cost expectations.

While the results show that Uruguayan firms seem to overestimate the negative effects of the shock and might interpret the depreciation as a negative sign, they might also expect a different policy reaction. In Section 4 we discuss those implications in more detail.

3.5 Effect of MP shocks on exposed firms

Adding to the discussion in the previous section, we estimate the response of the change in the one-year-ahead expectations (percentage) at the firm level $\Delta\mathbb{E}(X)_{i,t+h,t}$ to monetary policy shocks while conditioning on firms' degree of exposure to the US economy. In particular, we study the consequences of firms' debt with the financial sector and then we assess the implications of having that debt denominated in US dollars.

3.5.1 Exposure to external debt

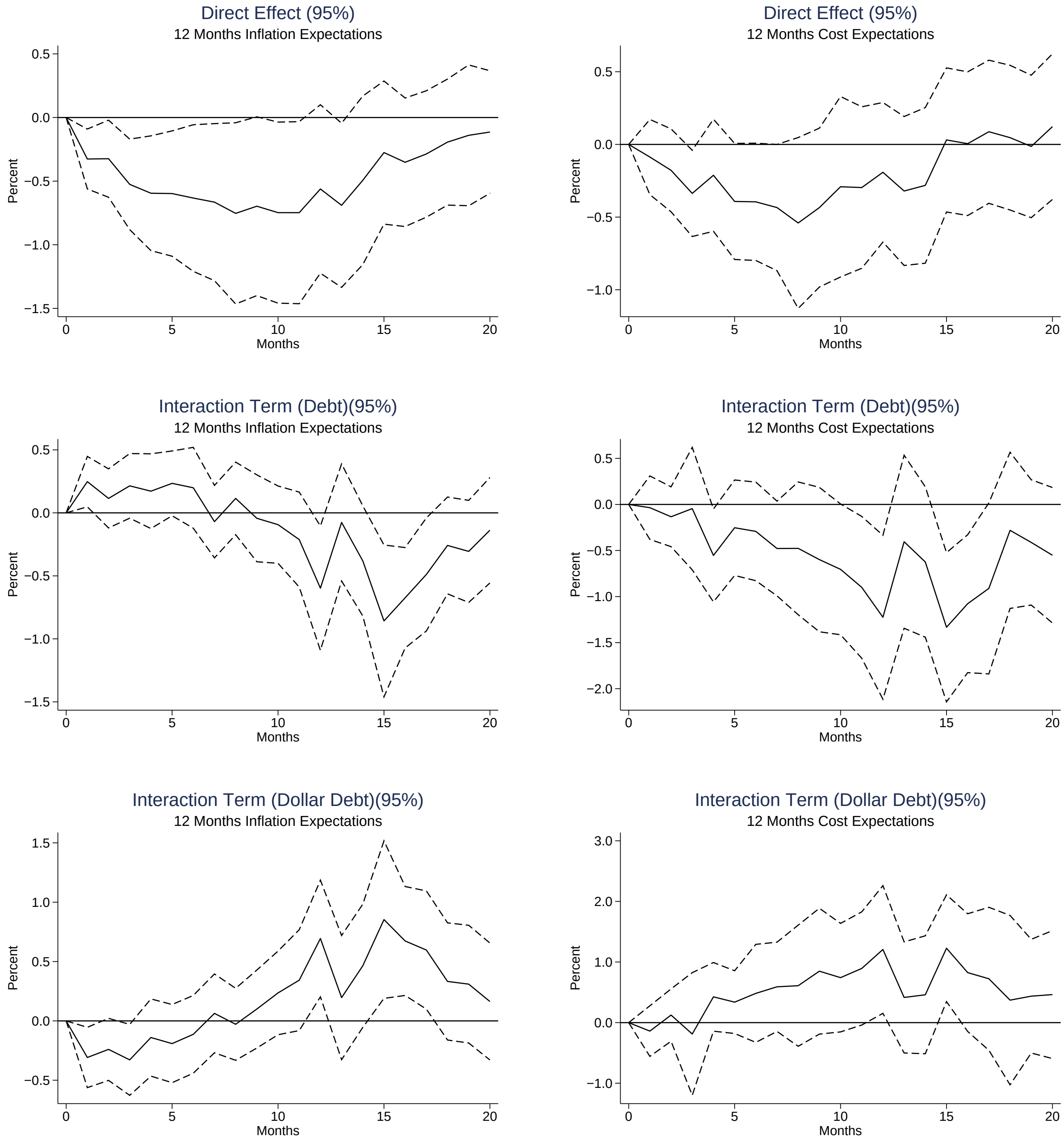
Before assessing the different responses of the subset of exposed firms to the external economy, it is worth to summarizing some of its main characteristics. In particular, medium and large firms are the ones holding US-dollar-denominated debt. Of the subset of exposed firms, around 60 percent of them serves only the Uruguayan internal market, i.e., do not export. Hence, our measure is mostly informative about financial rather than trading exposure. Finally, it is worth mentioning in which sectors most of the exposed firms are concentrated: manufacturing, trade and transport, storage and communications.

We estimate a local projection specification, where we also include interactions with other variables as in Cloyne, Jorda, and Taylor (2020) and in Herreño and Pedemonte (2022). In particular, we estimate:

$$\begin{aligned}\Delta\mathbb{E}(X)_{i,t+h,t} = \alpha_i^h + \sum_{j=0}^{J}\beta^{h,j}MP_{t-j} + \sum_{j=0}^{J}\gamma^{h,j}(MP_{t-j}\times Debt_{i,t-j-1}) + \\ \sum_{j=0}^{J}\zeta^{h,j}(MP_{t-j}\times Dollar_{i,t-j-1}\times Debt_{i,t-j-1}) + \sum_{j=0}^{J}Z'_{t-j}\theta^{h,j} + \varepsilon_{i,t+h}^{h},\ \forall h\in[0,H]\end{aligned} \tag{3}$$

where $Z_{t-j} = [Dollar_{i,t-j-1}, Debt_{i,t-j-1}, Dollar_{i,t-j-1}\times Debt_{i,t-j-1}, \Delta\mathbb{E}(X)_{i,t,t-j}]$, and where $Debt_{i,t}$ is an indicator of whether firm i has debt in time t and $Dollar_{i,t}$ is the share firm i's debt in US dollar at time t. The specification also includes firm, month and year fixed-effects, and we cluster the standard errors at the firm level. In terms of the specification, Baek and Lee (2021) suggest that the amount of lags should be as long as the shock lasts. In the case of this survey, firms do not necessarily have to answer the survey every month. In order to avoid too many missing values, we use $J = H = 12$. In equation (3), $\beta^{h,0}$ will capture the aforementioned direct effect of monetary policy shocks on the revision of firms' expectations in time h after the shock. The coefficient $\gamma^{h,0}$ captures the response of expectations for firms with debt to a MP shock, while $\zeta^{h,0}$ is interpreted as the effect of the shock on expectations across firms with debt denominated in US dollars. The results of estimating (3) are presented in Figure 4. The first column studies the effects on inflation expectations and the second column shows cost expectations.

Figure 4: Response expectations to a US MP shocks



Inflation Expectations | Cost Expectations

Note: This figure shows the effect of a monetary policy shock on firms' expectations, exploiting their level of exposure to debt and debt in US dollars, using specification (3). The upper panels show the direct effect ($\beta^{h,0}$) or the effect on firms without debt. The middle panels plot $\gamma^{h,0}$, or the effect of firms with debt in Uruguayan pesos. The lower panels plot $\zeta^{h,0}$, or the effect on firms with debt in US dollars. The dependent variable is the firms' inflation expectations (left) and cost expectations (right). We include a firm fixed effect. We use $J = 12$. Standard errors are clustered at the time and firm level. The dashed lines represent 95 percent confidence interval.

As noticed in the first row of Figure 4, and in line with our previous findings, the MP shock is interpreted as recessionary by firms, leading them to revise their expectations downward. Similarly, the response of both inflation and cost expectations for firms with debt is negative approximately seven months after the shock. We interpret the negative reaction as indebted firms anticipating a future drop in interest rates as a consequence of the initial shock and the effects on local activity. The most interesting reaction arises when we observe the response across firms with a large share of debt in US dollars. As discussed, initially the shock results in a depreciation of the Uruguayan peso against the international currency, which particularly affects this subset of firms. The observed response is completely in line with this intuition, since this group of firms revise their expectations upward. In particular, the overall cost expectations are revised upward by approximately 1 percent 12 months after the shock. Hence, it seems that one of the main mechanisms by which an international MP shock is transmitted to local firms' expectations is through firms' own exposure to the exchange rate.

The results imply an immediate and quick effect in term of expectations. As found in Romer and Romer (2004) and Gertler and Karadi (2015), MP shocks could have a delayed effect on inflation. On the contrary, the fast reaction of firms' expectations suggests that they anticipate that those changes will occur in the future. Moreover, we conjecture that most of the immediate effects are in part disciplined by the relatively quick exchange rate adjustment which is particularly relevant in the case of a small open economy, such as Uruguay. Beyond the exposure through USD-denominated debt, there are other channels by which firms in Uruguay could be exposed to international shocks. In Appendix A we explore the exposure to imported goods and its interplay with monetary policy shocks abroad.

3.6 Effect of MP shocks on firms' decisions

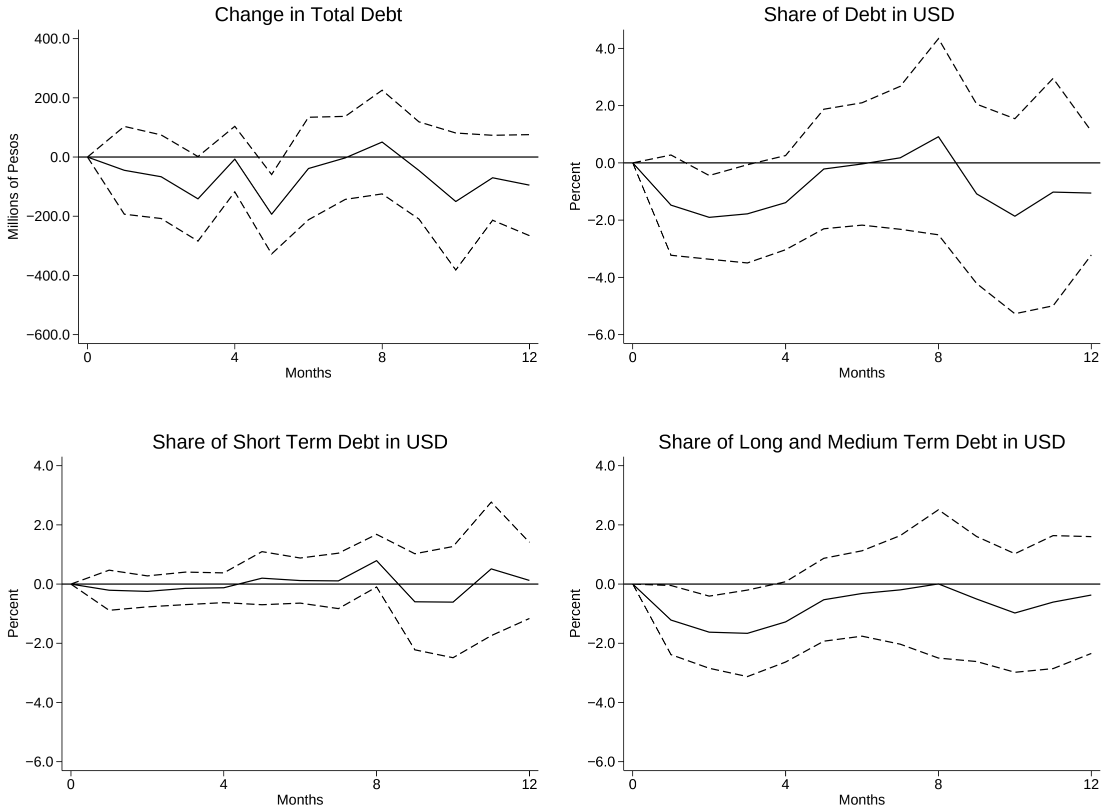
We now turn to the possible effects of international shocks on firms' local decisions. In particular we focus on firms debt' position and import decisions. Initially we run specification

(3) but now instead of the revision of expectations, the dependent variable is $\Delta(X)_{i,t+h,t} = Debt_{i,t+h} - Debt_{i,t-1}$. The variable $Debt_{i,t+h}$ can take either of two forms, it could account for the percent change in the share of firms i's total debt over time or it could be the change in debt denominated in US dollars as a percentage of the total debt, during each month. Besides the currency of the debt, we also have information about its maturity, i.e., the proportion of short-, medium- or long-term debt. In this case, we adjust the dependent variable to reflect each subgroup's adjustment. We also explore a second specification where $\Delta(X)_{i,t+h,t} = Imports_{i,t+h} - Imports_{i,t-1}$, i.e., the adjustment in imports at the firm level over time.

3.6.1 Firms' debt decisions

The dynamic response of firms' debt position, both total and USD-denominated debt, to a US monetary policy shock is presented in Figure 5.

Figure 5: Effect of US MP shocks on Firms' Debt



Note: This figure shows the effect of a monetary policy shock on firms' total debt (upper left), share of debt in US dollars (upper right), share of short-term debt in US dollar (lower left), and share of medium- and long-term debt in US dollars (lower right). The results come from estimating (3), where the dependent variable is the firms' specific percentage change between the base period and H. We include a firm fixed effect. We use $J = 12$ and standard errors are clustered at the time level. The dashed lines represent 95 percent confidence intervals.

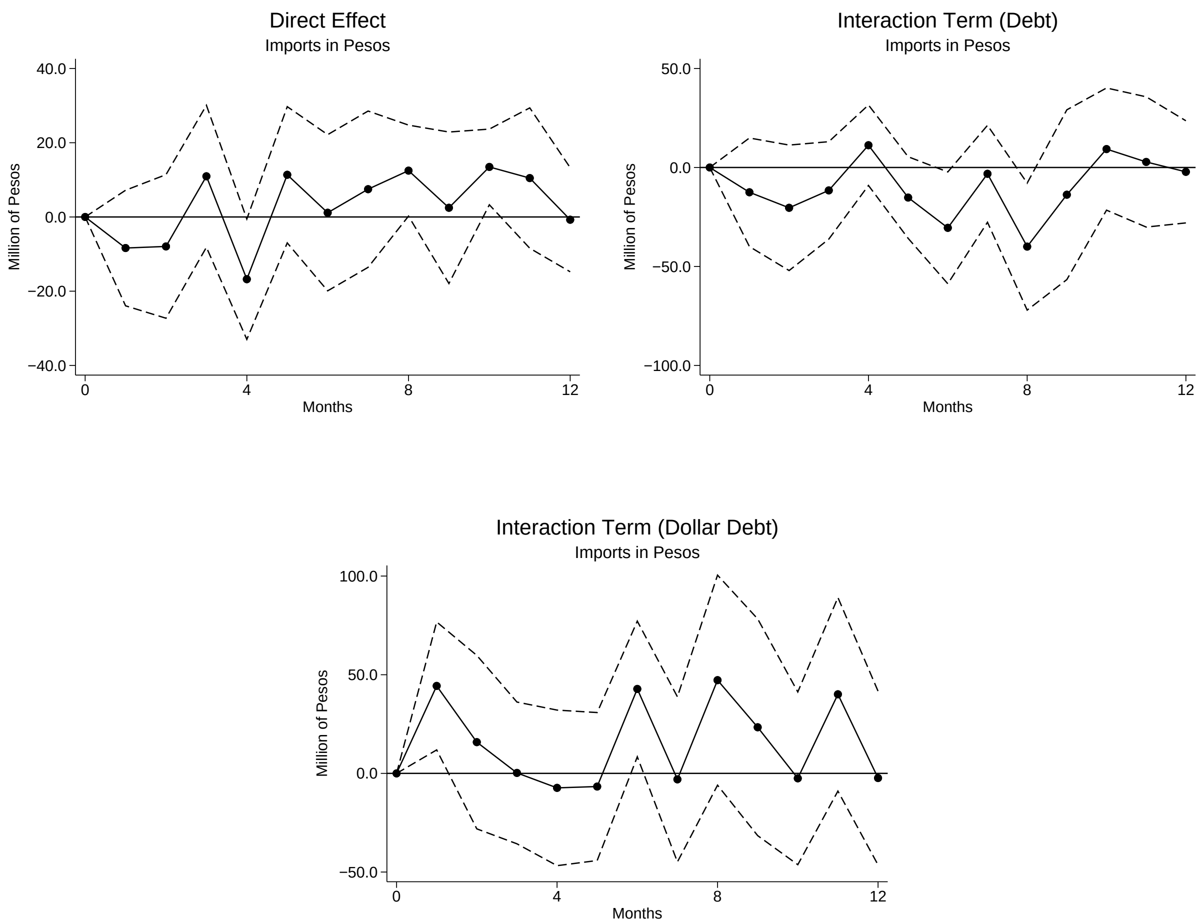
From the top-left panel of Figure 5, we notice total debt does not significantly react after the shock. The point estimate is negative, but not significantly different from zero. However, there is a significant decrease in the share of debt in USD, particularly between the second and the fourth month, as a consequence of the shock. We conjecture that this is a response to the expected depreciation of the exchange rate and suggests that the occurrence of the international shock also affects firms decisions. Focusing on debt denominated in USD and splitting it by maturity, the results suggest that firms decrease by approximately 0.6 percent their share of medium- and long-term debt after a one standard deviation increase in the monetary policy shock (3 basis points) during the first few months after the shock. Hence, although the international shock is transitory, it has long lasting effects on decisions, in particular it alters firms' preferences for longer debt contracts. On the contrary, the short term debt does not present a statistically meaningful reaction. We interpret the heterogeneous reaction of the debt as further evidence related to expected inflation over longer horizons.

3.6.2 Firms' import decisions

Building on the previous exercise, we now focus on the change in total imports at the firm level. We collect total imports from administrative data since, as discussed, we have the universe of imports by firm in Uruguay on a monthly basis. Controls are similar relative to specification (3) $Z_{i,t-j} = [Dollar_{i,t-j-1}, Debt_{i,t-j-1}, Dollar_{i,t-j-1} \times Debt_{i,t-j-1}, \Delta X_{i,t,t-j}]$ and we use the same lags and number of controls. The results are robust to relying on actual imports, but we smooth this variable to generate a less volatile result. Figure 6 shows the results.

Imports of firms not exposed to debt do not seem to react differently to the shock. The response of firms exposed to debt, although is negative, is not significant except for a few horizons. The effect is, however, different across firms that are exposed to debt denominated in US dollars. In this case, we actually observe an increase in their imports, relative to the firms indebted in Uruguayan pesos. The positive effect is significant right after the impact. As discussed, firms holding US-dollar-denominated debt have higher inflation expectations than firms with debt denominated in pesos. As they expect a depreciation of the nominal exchange rate in the near future, relative to other firms, they increase their imports today to avoid the expected depreciation, and with this, the subsequent increase in the cost of imports.

Figure 6: Change in imports (Thousands) and dollar debt position



Note: The figure shows the results of regression (3). The upper left panel plots $\beta^{h,0}$. The upper right panel plots $\gamma^{h,1}$ and the lower panel plots $\zeta^{h,0}$. We use firm fixed effects and $J = 12$. Standard errors are clustered at the time level. Dashed lines show 95 percent confidence intervals.

4 Discussion

Circling back to our main results, there seems to be a misalignment between expectations and the dynamic responses of macroeconomic variables in Uruguay. The effect of a US MP shock ultimately depends on how policy accommodates and responds to it. For example, in the context of a New Keynesian model and dominant currency pricing, Nispi Landi and Flaccadoro (2022) find that the effect of an dominant country's MP shock is disciplined by the policy framework in the local economy. In particular, when the small open economy is under a currency peg, the CPI inflation decreases, as the local central bank will raise the policy rate to maintain the nominal exchange rate parity. This policy reaction produces a bigger contraction in local economic activity.

While Uruguay was in a flexible exchange rate regime in the period of time studied, ans in line with the discussion in Section 3.2, firms seem to have reacted as if the country is under a peg currency regime. This reaction could come either from the recent history of a currency peg in the country or from skepticism about the policy framework. In that sense, the way that local firms perceive the shock and the future depreciation of the local currency is important in understanding the effects of a monetary policy shock abroad on the local economy. In order to evaluate those effects, we build on a very simple version of a small open economy model, as in Gali and Monacelli (2005). There is a large economy, the world economy, which we model by a simple three-equation New Keynesian model with Calvo pricing.[6] Details of the model are presented in Appendix E. The large economy is characterized by the following IS curve

$$y_t^* = -\frac{1}{\gamma}(i_t^* - E_t\Pi_{t+1}^*) + E_t y_{t+1}^*, \tag{4}$$

a Phillips curve

$$\Pi_t^* = \beta E_t \Pi_{t+1}^* + \kappa(\alpha + \gamma) y_t^*, \tag{5}$$

and a Taylor rule

$$i_t^* = \phi_\pi \Pi_t^* + y_t^* + \epsilon_t, \tag{6}$$

[6] The small open economy, on the other hand, doesn't play a role since it is of mass zero.

where y_t^* is output, i_t^* the interest rate, and Π_t^* is inflation in the price of the good in the large economy. The parameter γ is the intertemporal elasticity of substitution, β the intertemporal discount factor, $\kappa = \frac{(1-\theta)(1-\theta\beta)}{\theta}$, where θ is the Calvo parameter, α is the inverse of the labor supply elasticity, ϕ_π is how much the central bank penalizes inflation from its rule. Finally, ϵ_t is the monetary policy shock, where $\epsilon_t = \rho\epsilon_{t-1} + \varepsilon_t$, with ε_t an iid shock with mean zero and standard deviation equal to one.

The small open economy consumes local and foreign goods and has similar parameters. The consumers maximizes:

$$E_0 \sum_{t=0}^{\infty} \beta^t C_t - \frac{L_t^{1+\alpha}}{1+\alpha}, \tag{7}$$

subject to

$$P_t C_t + (1+i_t)B_t = B_{t+1} + W_t L_t + \Pi_t^f, \tag{8}$$

with

$$C_t = \left[\phi c_{H,t}^{\frac{\sigma-1}{\sigma}} + (1-\phi) c_{F,t}^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}, \tag{9}$$

where C_t is the consumption basket formed by home ($c_{H,t}$) and foreign goods ($c_{F,t}$), σ is the elasticity of substitution between local and foreign goods and ϕ are the preferences for the local good. When $\phi > 0.5$ there is home bias. Goods are produced by a continuum of firms with elasticity of substitution η, as $c_{i,t} = \int_0^1 c_{i,t}(z)dz$. Π_t^f are local firms' profits, and W_t are local wages. Local consumers buy foreign goods paying an exchange rate E_t. The price index is:

$$P_t = \left[\phi P_{H,t}^{1-\sigma} + (1-\phi)\left(E_t P_{F,t}\right)^{1-\sigma}\right]^{\frac{1}{1-\sigma}}, \tag{10}$$

We introduce a reduced-form departure from rational expectations to allow for misperceived beliefs. In particular, we assume that firms have a distorted view of the central bank's policy framework. For instance, while the central bank declares a flexible exchange rate policy, firms may think that the monetary authority might intervene in the case of a strong depreciation. We model an economy where firms think that the central bank tries to peg the exchange rate to the US dollar with some probability, while the central bank actually follows a Taylor rule. Then, firms' expectations about any variable are:

$$E_{f,t}x_{t+1} = \zeta E^{peg}_{f,t}x_{t+1} + (1-\zeta)E^{FIRE}_{f,t}x_{t+1}, \tag{11}$$

where $E^{peg}_{f,t}$ is the expectations operator that agents in the economy would have in the peg regime. According to that operator, the firm sees the state variables and the shock and weights them in the same way as in the version of the model with a peg regime to form expectations. In that sense, the firm uses all of the available information at all periods of time, but have a wrong idea of the policy rule, depending on the value of ζ. $E^{FIRE}_{f,t}$ is the full information rational expectations operator. ζ represents how much bias the firm has; when $\zeta = 0$, the rest of the agents in the economy have full information rational expectations.

As discussed in Section 3.2, firms might have expectations where they allocate a probability to a different regime because of a history of exchange rate intervention. The Central Bank of Uruguay has a history of interventions in the exchange rate market to protect the value of the Uruguayan Peso. Firms might take time to learn about the floating regime or consider the probability of interventions, the expectations formation that we consider. The log-linearized[7] Phillips curve is characterized by:

$$\check{\pi}_t = \beta E_{f,t}\check{\pi}_{t+1} + \kappa \check{mc}_t, \tag{12}$$

where $E_{f,t}$ is the expectation term for the local firm and $\check{mc}_t$ the marginal cost, with $\check{mc}_t =$

[7] with $\check{x} = \frac{x_t - \bar{x}}{\bar{x}}$

$\check{w}_t - \check{p}_t$

In addition, the log-linearized risk-sharing condition is:

$$-\gamma\check{c}_t + \gamma\check{y}_t^* = \check{P}_t^* - \check{P}_t - e_t \tag{13}$$

where e_t is the log-linearized exchange rate. In addition, the uncovered interest rate parity is

$$\check{i}_t - \check{i}_t^* = e_{t+1} - e_t \tag{14}$$

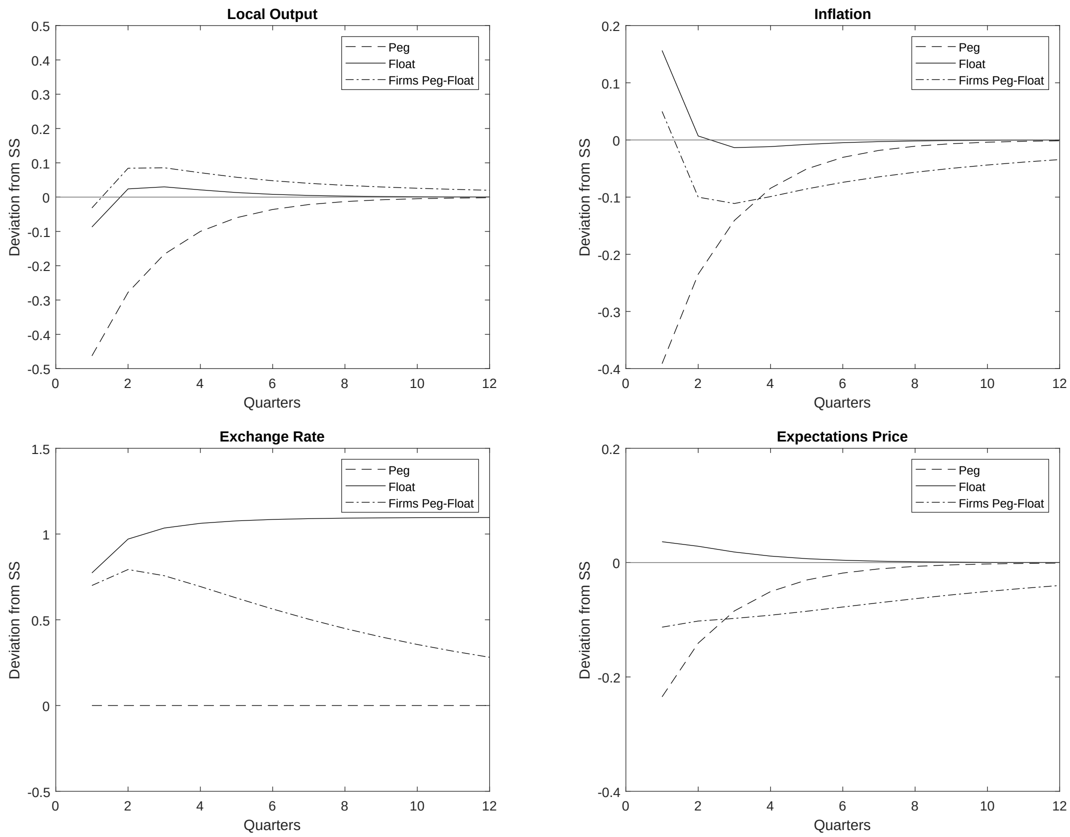
Following the market clearing condition of the local economy, as in Gali and Monacelli (2005), we have

$$\check{y}_t = \check{y}_t^* + (1/\sigma_a) * (\check{P}_t^* + \check{e}_t - \check{p}_t),$$

with $\sigma_a = \frac{\gamma}{/}(\phi) + (1-\phi)\omega$ and $\omega = (\gamma\eta + (\phi)(\gamma\sigma - 1))$. Finally, the central bank in the small open economy follows two rules. When there is a floating regime, it follows $\check{i}_t = \sigma_\pi \check{\pi}_t + \check{y}_t$ and when there is a peg it follows $e_t = 0$.

We use the calibrated values of Gali and Monacelli (2005), that is: $\phi = 0.6$, $\gamma = 0.6$, $\alpha = 3$, $\eta = 1$, $\sigma = 1$, and $\theta = 0.75$. We also use $\rho = 0.6$, $\sigma_\pi = 1.5$ and $\zeta = 0.25$. With our model we compute the dynamic reaction of local outcome, local inflation, the exchange rate and firms' own price inflation expectations to a monetary policy shock in the large economy. Figure 7 shows the results.

Figure 7: Impulse response functions for selected variables



Note: The figure shows impulse response functions to a 100 basis point foreign interest rate shock for a regime where the central bank pegs the exchange rate (Peg), follows a Taylor rule (Float), and one where it follows a Taylor rule, but the firms have expectations of a Peg (Firms Peg-Float).

In our scenario where firms form wrong expectations about the current regime we can see that while inflation increases initially, firms' inflation expectations adjust downward, consistent with what will happen under the peg regime. Moreover, based on the simulated evolution of the variables, firms' expectations remain negative for a long period of time. The presence of the depreciation leads firms to think that the central bank will intervene; so they perceive the shock as contractionary for a prolonged period of time. This effect on expectations produces a lower effect on aggregate prices and a long-lasting depreciation, consistent with what we observed in the data. We also see an initial decline in output, also consistent with the data.

While in this section we focus on uncertainty about the policy regime, other theories can explain the effect, which would work in a similar fashion. For example, firms could have uncertainty about the nature of the shock, thinking that a depreciation is actually the response to a negative local shock, which would make them think that it is associated with a deflationary scenario. This could happen, for example, with a negative demand shock. In that case it would work similar to the scenario modeled previously, where there is a reduction in prices and a depreciation of the local currency. In any case, given the response of firms to local shocks and the history of policy in Uruguay, it seems likely that the uncertainty is about the policy regime. This effect is expected to be transitory in the absence of interventions, as firms should eventually learn about the policy regime.

5 Conclusion

Expectations matter for economic decisions. How expectations affect firms' decisions have been extensively studied in the context of closed economies and with local shocks. In this paper we explore how external shocks propagate to firms' expectations. Moreover, we show that a monetary policy surprise happening in the US will indeed affect firms' inflation expectations and cost expectations in the short and middle run. Our results are relevant since they add another source of expectations instability with which the local central bank must deal. Besides the direct effect on firms' expectations, we argue that firms' level of exposure to the US economy matters significantly, since it results in different responses to the shock in terms of both sign and persistence.

We interpret our results through a DSGE model where we allow firms to have misperceived beliefs. We argue that the empirical responses we report are consistent with a model where firms expect a different reaction to an international shock with respect to the policy that the monetary authority is actually following.

These results are interesting since we introduce a novel mechanism by which US monetary policy can affect small open economies abroad through the expectation channel. Although this channel has not been explored, it can have important implications for understanding extensions of international financial cycles. In addition, it generates other avenues through which local monetary authorities can lose sovereignty over their nominal variables, other than the one exposed by Rey (2015) and Ilzetzki, Reinhart, and Rogoff (2019). Since the effects described in this paper are related to forward-looking variables, a combination of policy action and communication from local economic authorities could be useful in addressing the effects of external shocks on the local economy.

References

Acosta, Miguel. 2022. "The perceived causes of monetary policy surprises." *Published Manuscript* URL https://www1.columbia.edu/~jma2241/papers/acosta_jmp.pdf.

Auerbach, Alan J. and Yuriy Gorodnichenko. 2012. "Fiscal multipliers in recession and expansion." In *Fiscal Policy after the Financial Crisis*, edited by Alberto Alesina and Francesco Giavazzi. National Bureau of Economic Research, 63–98. URL https://www.nber.org/chapters/c12634.

Bachmann, Rüdiger and Steffen Elstner. 2015. "Firm optimism and pessimism." *European Economic Review* 79:297–325. URL https://doi.org/10.1016/j.euroecorev.2015.07.017.

Baek, ChaeWon and Byoungchan Lee. 2021. "A guide to autoregressive distributed lag models for impulse response estimations." *Oxford Bulletin of Economics and Statistics* 84 (5):1101–1122. URL https://doi.org/10.1111/obes.12494.

Basal, Jorge, Patricia Carballo, Fernanda Cuitiño, Serafín Frache, Gerardo Licandro, José Mourelle, Helena Rodríguez, Verónica Rodriguez, and Leonardo Vicente. 2016. "Un modelo estocástico de equilibrio general para la economía Uruguaya." Documento de trabajo 2016002, Banco Central del Uruguay. URL https://ideas.repec.org/p/bku/doctra/2021006.html.

Bergman, Nittai, David A. Matsa, and Michael Weber. 2022. "Inclusive Monetary Policy: How Tight Labor Markets Facilitate Broad-Based Employment Growth." Working paper 29651, National Bureau of Economic Research. URL https://doi.org/10.3386/w29651.

Born, Benjamin, Zeno Enders, Gernot J. Müller, and Knut Niemann. 2021. "Chapter 15 - Firm expectations about production and prices: facts, determinants, and effects." In *Handbook of Economic Expectations*, chap. 15. URL https://www.uni-heidelberg.de/md/awi/professuren/wipol/bemn_2022_chap15_firmexp.pdf.

Bu, Chunya, John Rogers, and Wenbin Wu. 2021. "A unified measure of Fed monetary policy shocks." *Journal of Monetary Economics* 118:331–349. URL https://doi.org/10.1016/j.jmoneco.2020.11.002.

Calvo, Guillermo A. and Carmen M. Reinhart. 2002. "Fear of floating." *The Quarterly Journal of Economics* 117 (2):379–408. URL http://www.jstor.org/stable/2696430.

Cloyne, James, Oscar Jorda, and Alan Taylor. 2020. "Decomposing the fiscal multiplier." Working Paper 2020-12, Federal Reserve Bank of San Francisco. URL https://doi.org/10.24148/wp2020-12.

Coibion, Olivier, Yuriy Gorodnichenko, and Saten Kumar. 2018. "How do firms form their expectations? New survey evidence." *American Economic Review* 108 (9):2671–2713. URL https://doi.org/10.1257/aer.20151299.

Coibion, Olivier, Yuriy Gorodnichenko, and Tiziano Ropele. 2020. "Inflation expectations and firm decisions: new causal evidence." *The Quarterly Journal of Economics* 135 (1):165–219. URL https://doi.org/10.1093/qje/qjz029.

D'Acunto, Francesco, Ulrike Malmendier, Juan Ospina, and Michael Weber. 2021. "Exposure to grocery prices and inflation expectations." *Journal of Political Economy* 129 (5):1615–1639. URL https://doi.org/10.1086/713192.

Degasperi, Riccardo, Seokki Hong, and Giovanni Ricco. 2020. "The global transmission of US monetary policy." Discussion paper DP14533, CEPR. URL https://ideas.repec.org/p/cpr/ceprdp/14533.html.

Egorov, Konstantin and Dmitry Mukhin. 2021. "Optimal policy under dollar pricing." URL https://www.lse.ac.uk/CFM/assets/pdf/CFM-Discussion-Papers-2021/CFMDP2021-24-Paper.pdf. Manuscript.

Frache, Serafin, Rodrigo Lluberas, and Javier Turen. 2021. "Belief-dependent pricing decisions." Documentos de trabajo 2021007, Banco Central del Uruguay. URL https://ideas.repec.org/p/bku/doctra/2021007.html.

Gali, Jordi and Tommaso Monacelli. 2005. "Monetary policy and exchange rate volatility in a small open economy." *The Review of Economic Studies* 72 (3):707–734. URL https://doi.org/10.1111/j.1467-937X.2005.00349.x.

Gertler, Mark and Peter Karadi. 2015. "Monetary policy surprises, credit costs, and economic activity." *American Economic Journal: Macroeconomics* 7 (1):44–76. URL https://doi.org/10.1257/mac.20130329.

Gopinath, Gita, Emine Boz, Camila Casas, Federico J. Díez, Pierre-Olivier Gourinchas, and Mikkel Plagborg-Møller. 2020. "Dominant currency paradigm." *American Economic Review* 110 (3):677–719. URL https://doi.org/10.1257/aer.20171201.

Herreño, Juan and Mathieu Pedemonte. 2022. "The geographic effects of monetary policy." Working paper 22-15, Federal Reserve Bank of Cleveland. URL https://doi.org/10.26509/frbc-wp-202215.

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. URL https://doi.org/10.1093/qje/qjy033.

Jarociński, Marek and Peter Karadi. 2020. "Deconstructing monetary policy surprises—the role of information shocks." *American Economic Journal: Macroeconomics* 12 (2):1–43. URL https://doi.org/10.1257/mac.20180090.

Jordà, Òscar. 2005. "Estimation and inference of impulse responses by local projections." *American Economic Review* 95 (1):161–182. URL https://doi.org/10.1257/0002828053828518.

Miranda-Agrippino and Hélene Rey. 2022. "The global financial cycle." In *Handbook of International Economics*, vol. 6, edited by Gita Gopinath, Elhanan Helpman, and Kenneth Rogoff, chap. 1. 1–43. URL https://doi.org/10.1016/bs.hesint.2022.02.008.

Miranda-Agrippino, Silvia and Hélene Rey. 2020. "US monetary policy and the global financial cycle." *The Review of Economic Studies* 87 (6):2754–2776. URL https://doi.org/10.1093/restud/rdaa019.

Nakamura, Emi and Jón Steinsson. 2018. "High-frequency identification of monetary non-neutrality: the information effect." *The Quarterly Journal of Economics* 133 (3):1283–1330. URL https://doi.org/10.1093/qje/qjy004.

Nispi Landi, Valerio and Marco Flaccadoro. 2022. "Foreign monetary policy and domestic inflation in emerging markets." Temi di Discussione (Working Paper) 1365, Banca D'Italia. URL https://www.bancaditalia.it/pubblicazioni/temi-discussione/2022/2022-1365/en_tema_1365.pdf.

Puppo, Pablo and Juan Francisco Gari. 2009. "Intervenciones del Banco Central en el mercado de cambios." *Tesis de grado. Universidad de la República (Uruguay), Facultad de Ciencias Económicas y de Administración* URL https://hdl.handle.net/20.500.12008/126.

Rey, Hélène. 2015. "Dilemma not trilemma: the global financial cycle and monetary policy independence." Working paper 21162, National Bureau of Economic Research. URL https://doi.org/10.3386/w21162.

Romer, Christina D and David H Romer. 2004. "A new measure of monetary shocks: derivation and implications." *American Economic Review* 94 (4):1055–1084. URL https://doi.org/10.1257/0002828042002651.

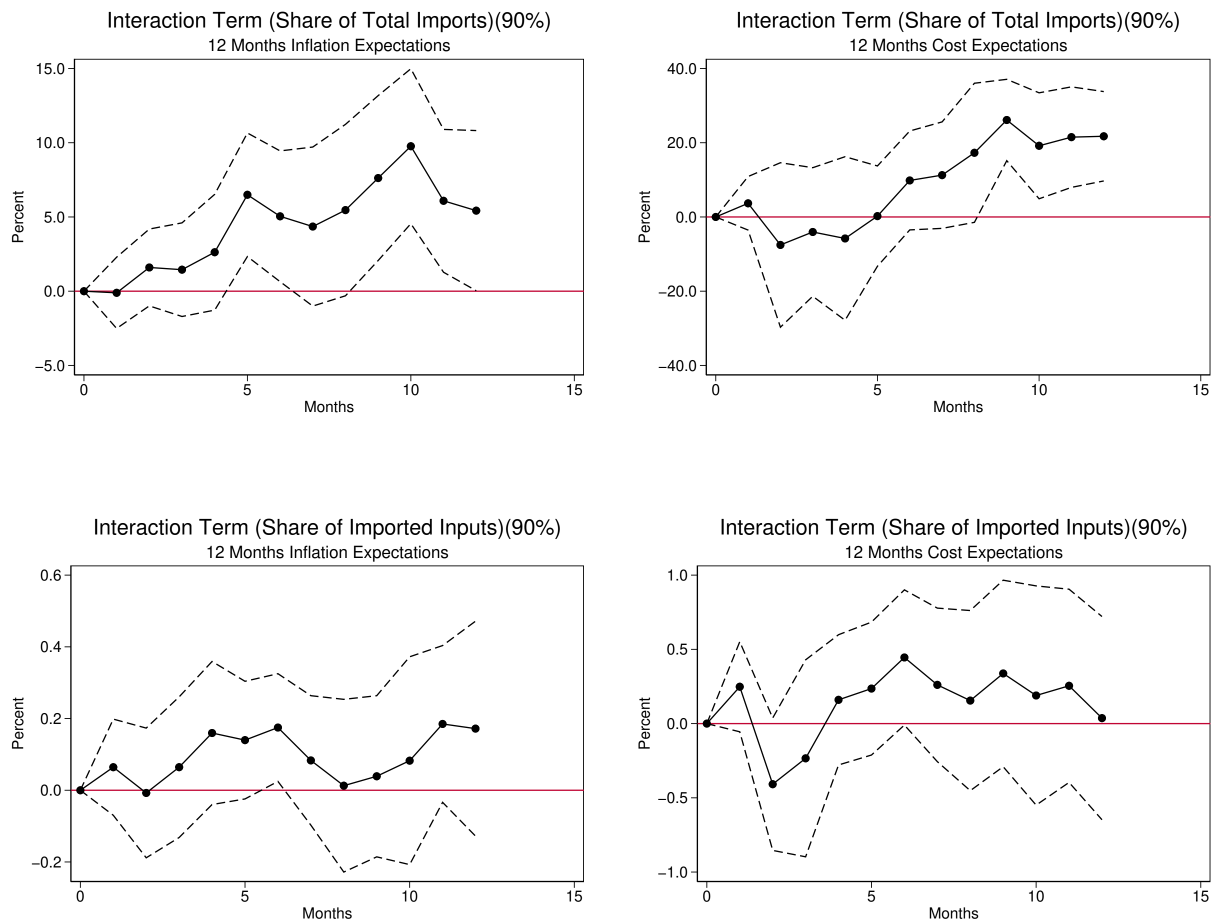
A International shocks and exposure to imported goods

Besides the debt position in external currency, the share of imported goods at the firm level could also play a crucial role in the transmission of external MP shocks to firms' expectations. We allow for two distinctions to measure imported goods in the data. On the one hand, we start by focusing on firms' total imported goods at a monthly frequency, including both inputs and final goods sold directly to customers. We measure total imports as a function of firms' annual sales. On the other hand, we tackle the importance of imported goods with respect to the production function of the firm by controlling only for the share of imported inputs. In this latter case, we measure total imported inputs as a function of total imports.

Following the same approach as in equation (3), we instead control for the relevance of imported goods instead of focusing on debt. In particular, we interact each measure of imported goods (one at a time) with our measure of MP shocks and assess the response to expectations. Figure 8 presents the results.

Interestingly, in this case there is a mild significant reaction across firms that import either their inputs or their final goods. Consistent with the intuition, both expectations for this group of firms are revised upward after the international MP shock and the upcoming depreciation in the nominal exchange rate. Similar to the results discussed in Section 3.5.1 the degree of exposure to the US economy and particularly to the US dollar matters in order to understand the reaction of firms' expectations. Finally, focusing on the share of imported inputs only, we observe no significant reaction of expectations.

Figure 8: Response of MP shocks to importers' expectations



Inflation Expectations　　　　Cost Expectations

Note: This figure shows the effect of a monetary policy shock on firms' expectations, exploiting their level of exposure to imports, using specification (3). The upper panels plot $\gamma^{h,0}$, or the effect on firms that import. The lower panels plot the same coefficient, but for firms that import their inputs. The dependent variable is the firms' inflation expectations (left) and cost expectations (right). We include a firm fixed effect. We use $J = 12$ and robust standard errors. The dashed lines represent 90 percent confidence intervals.

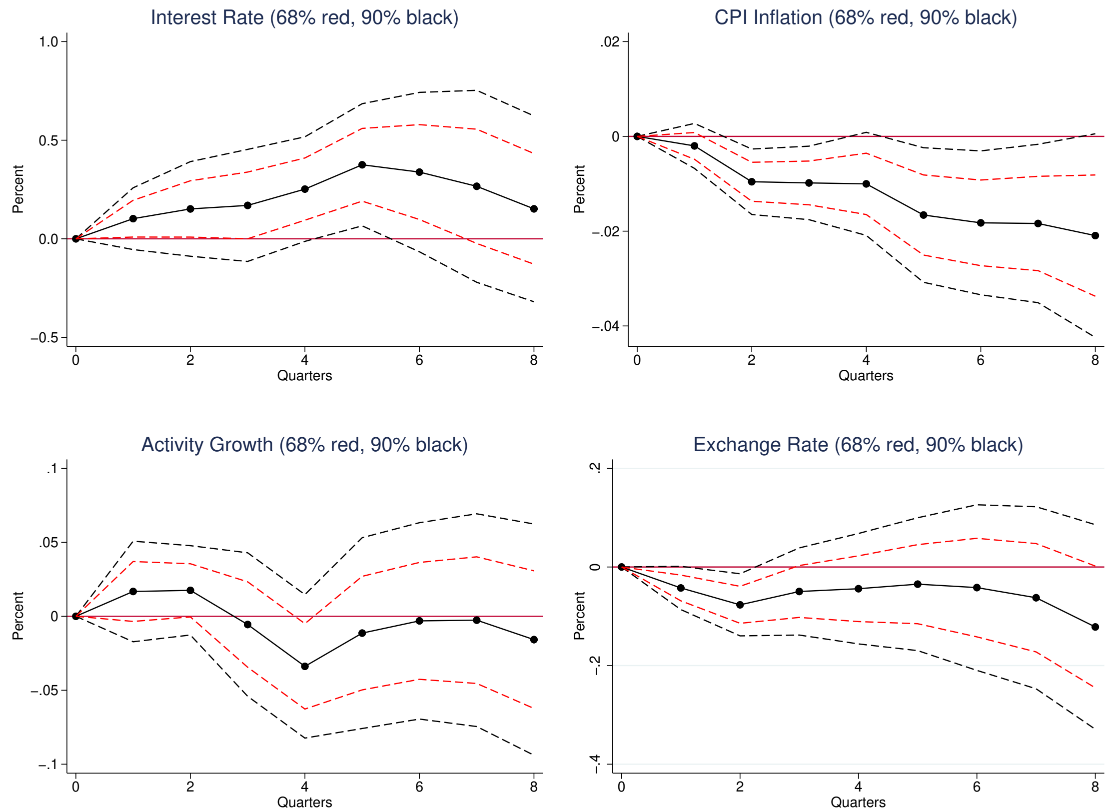
B Effects of a Uruguayan MP shock

We discuss the effects of a Uruguayan MP shock on local macroeconomic variables and also the response of both inflation and cost expectations across firms. To do so, we collect a monetary policy shocks using the DSGE model in Basal et al. (2016). The model is calibrated at a quarterly frequency so we adjust the estimation accordingly.

B.1 Effects of MP shock on local economy

Figure 9 below shows the response of inflation, a short-term interest rate, and the nominal exchange rate after a local MP tightening. Approximately after six quarters, inflation drops by 2 percent after a positive MP shock. The effect is significant even if we focus solely on a 95 percent confidence interval. As expected, the reaction of short-term rates is also positive and significant. The reaction of the nominal exchange rate is mildly significant right after a shock but then the effect dies out after the second quarter.

Figure 9: Effect of Uruguayan MP shocks on the domestic economy

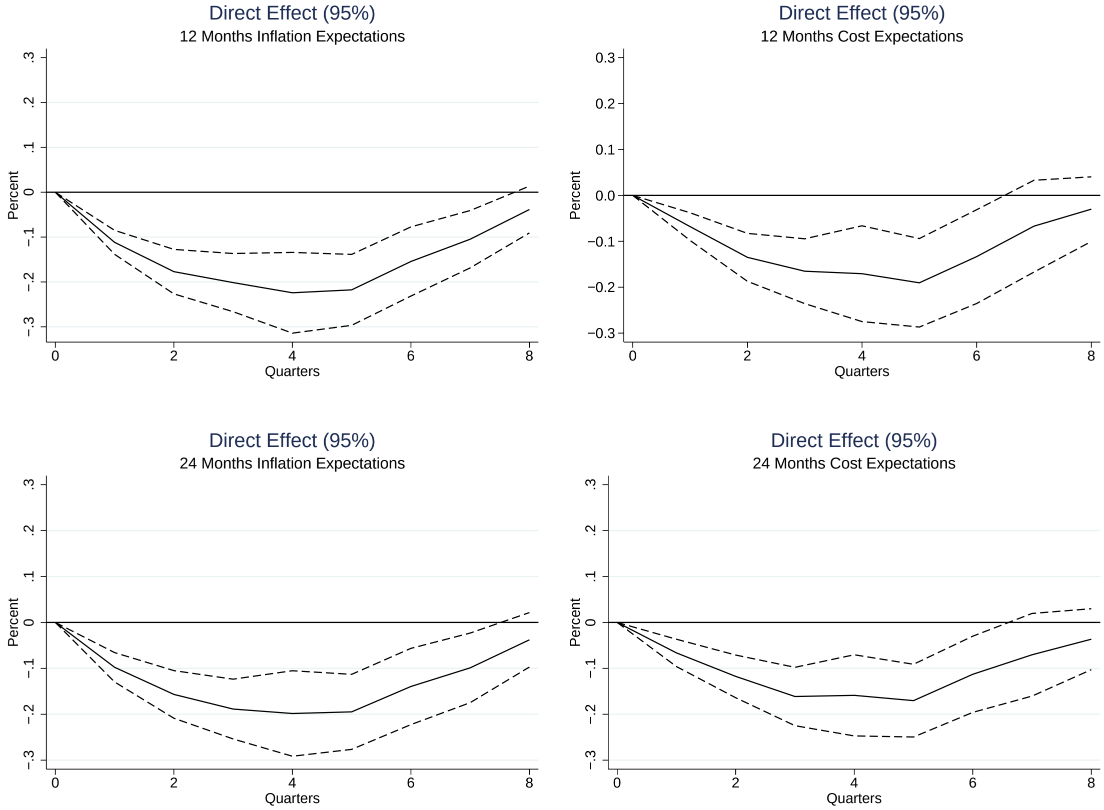


Note: The Figure shows the effect of a monetary shock in Uruguay on interest rate (upper-left pannel), CPI inflation (upper-right), economic activity (lower-left) and exchange rate (lower-right). We use $J = 4$ quarters and robust standard error. The dashed black lines represent 90 percent confidence interval and dashed red lines represent 68 percent confidence intervals

B.2 Direct effect on expectations of Uruguayan MP shock

As shown in the previous section a local MP shock induces a drop in current prices in Uruguay. Now, we assess the response of inflation and cost expectations. This is shown in Figure 10. In line with a recessionary shock, firms revise both expectations downwards at both 12 months and 24 months. Hence, firms anticipate a reduction in activity and demand that will bring a possible drop in their input costs as well as in overall prices. As the direct effect on expectations of the two shocks is observationally equivalent, we now study

Figure 10: Effect of Uruguayan MP shocks on the firms' expectations



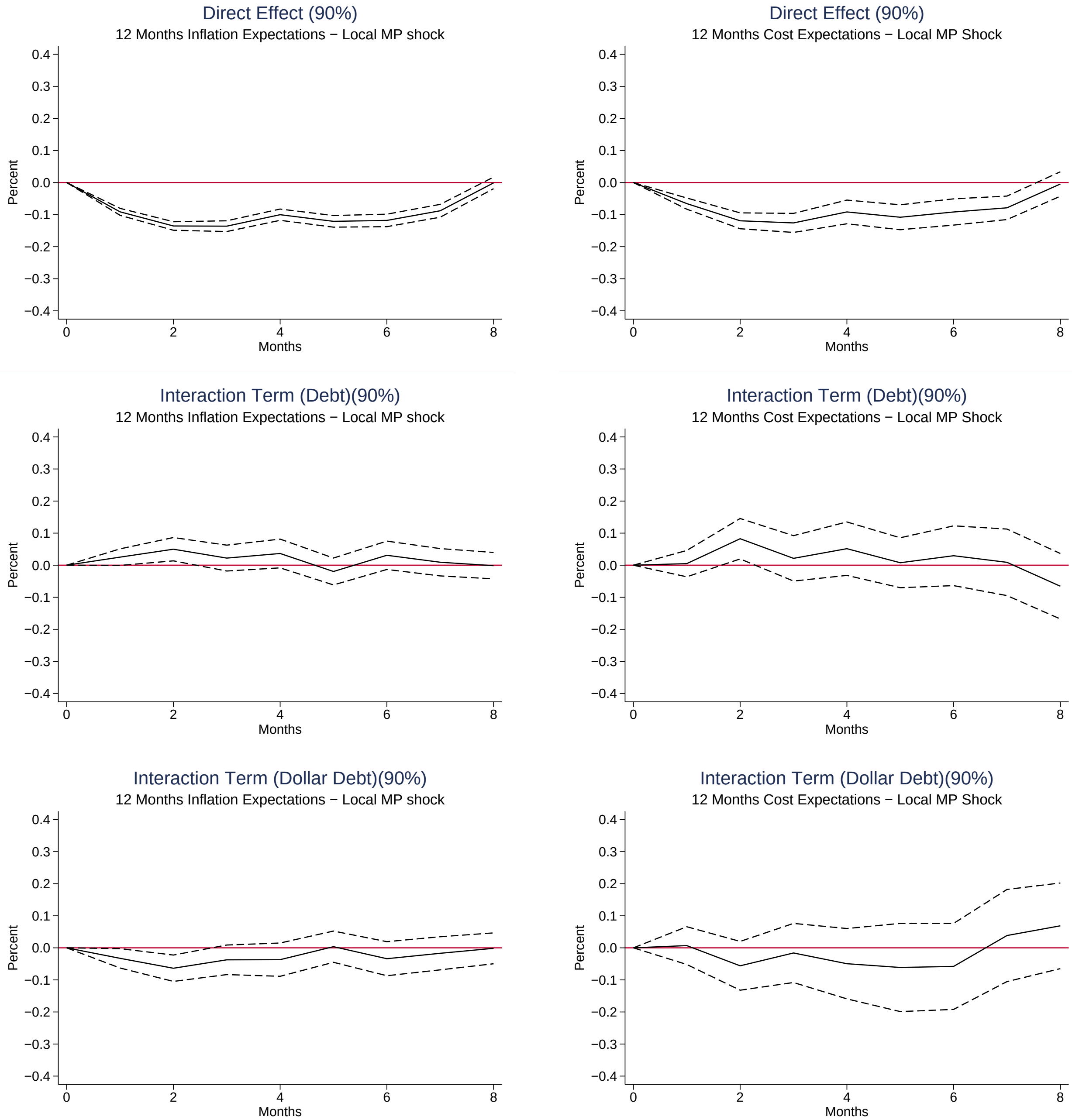
Note: This figure shows the effect of a monetary policy shock in Uruguay on firms' 12-month cost expectations (upper right), 12-month inflation expectations (upper left), 24-months cost expectations (lower right) and 24-months inflation expectations (lower left). The results come from estimating 2, were the dependent variable is the firms specific percentage change between the base period and H. We use $J = 4$. Standard errors are clustered at the time and firm level. The dashed lines represent 95 percent confidence interval.

whether such an effect is indeed heterogeneous depending on the degree of exposure to the US economy.

B.3 Interactions' effect on expectations of Uruguayan MP shock

Even though the direct effect of a local MP shock is similar to that of an external shock, and in line with our transmission intuition, we expect no heterogeneous reaction to a local shock when we control for the level of exposure to the US economy. Figure 11 shows the responses to the local shock when we interact such a shock with our "debt" dummy variable which reflects whether or not the firm has debt or not and our “dollar” variable, which computes the share of debt denominated in US dollars.

Figure 11: Adjustment of expectations to a local MP shock



Inflation Expectations

Cost Expectations

Note: This figure shows the effect of a monetary policy shock on firms' expectations, exploiting their level of exposure to debt and debt in US dollar, using specification (3). The upper panels show the direct effect ($\beta^{h,0}$) or the effect for firms without debt. The middle panels plot $\gamma^{h,0}$, or the effect on firms with debt in Uruguayan pesos. The lower panels plot $\zeta^{h,0}$, or the effect on firms with debt in US Dollar. The dependent variable is the firms' inflation expectations (left) and cost expectations (right). We include a firm fixed effect. We use $J = 4$ and robust standard errors. The dashed lines represent 90 percent confidence intervals.

As expected, and in line with our intuition, the result show no meaningful reaction across the subset of firms more heavily exposed to the US dollar. Although the dynamics of the response suggest a slight positive reaction, none of the specifications deliver significant results.

B.4 Interactions' effect on expectations of US MP shock - Accuracy

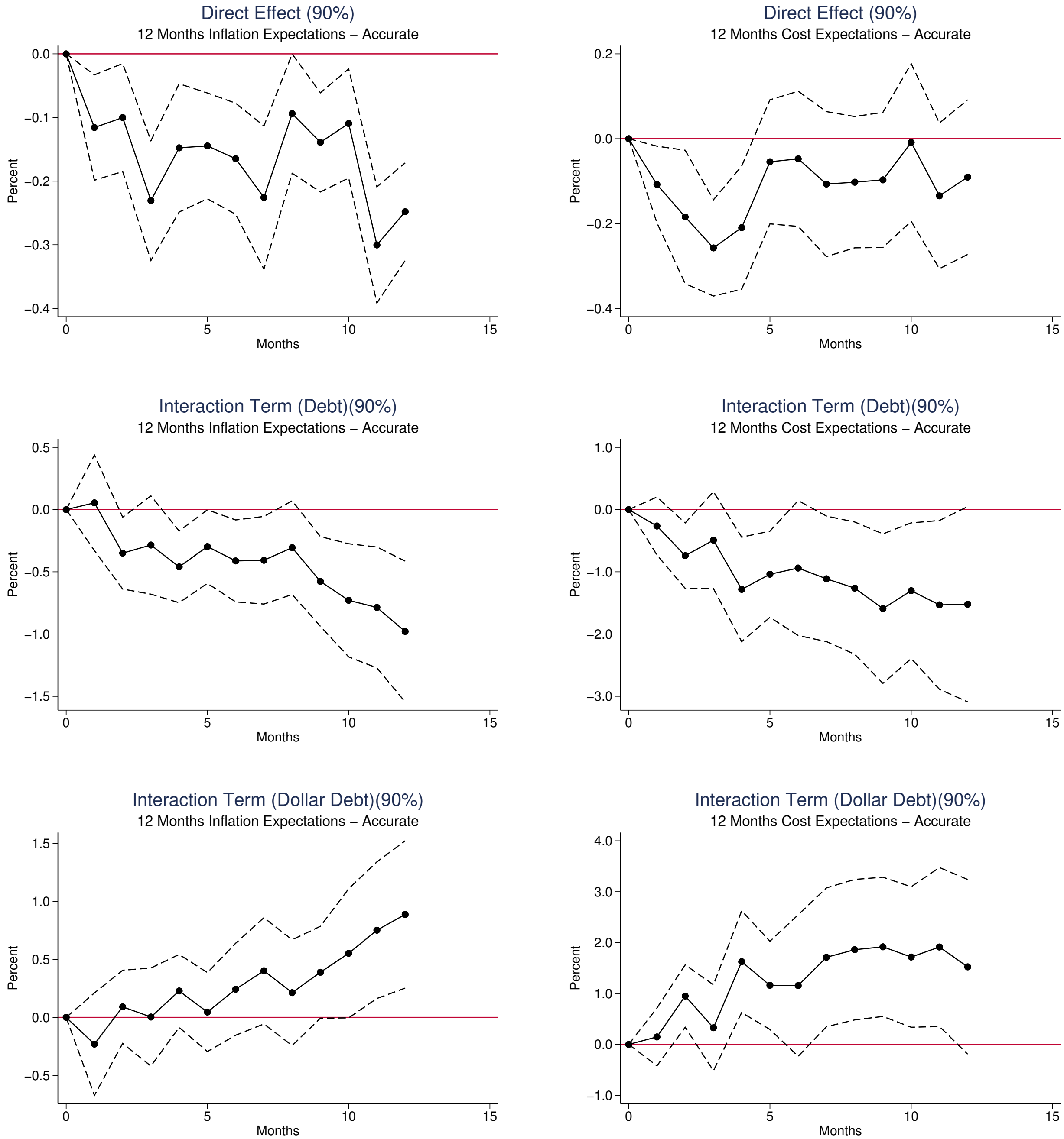
In this section, we split the firms in terms of their ex-post accuracy. While we do not have specific information about costs, we can compare their predictions for inflation to its actual outcome. The idea is to assess whether part of the significant reaction of expectations to the external shock is driven by the "quality" of expectations. In particular, it could be that firms that are reacting to the shock are precisely those that are more informed and are tracking overall economic conditions more closely.

We compute the forecast error $FE_{i,t}$ for inflation expectations as the difference between the predicted inflation at time t and its $t + 12$ actual realization. Following Bachmann and Elstner (2015) we then run firm-level regressions of the forecast errors on a constant, and given the sign of the estimated constant, we classify firms as: "Accurate" and "Non-Accurate." Accurate firms correspond to the ones whose estimated constant is not statistically different from zero at the 95 percent confidence level, i.e., on average, their forecast error is zero. Non-accurate corresponds to firms whose constant is statistically either positive or negative.[8] In Figure 12 we repeat the estimation, controlling for the level of exposure to the US economy, but also conditioning on Accurate and Non-accurate firms.

Overall, the results are roughly similar to those of the baseline estimation. Both the direct and the interacted effects show similar dynamics after we control for the degree of accuracy of expectations. Focusing on the reaction for the group of exposed firms, the positive response of both inflation and cost expectations is particularly significant for the subset of accurate firms. Thus, it seems that the level of information or attentiveness across firms, coupled with the level exposure to the US, is also relevant for determining the response of expectations to an international shock.

[8] Strictly speaking, Bachmann and Elstner (2015) propose three categories of accuracy: "Realists," "Optimists" and "Pessimists." Realists correspond to firms whose estimated constant is not statistically different from zero at the 95% confidence level. The Optimists group includes firms with a negative average for the error, i.e., those that expect lower than realized cost changes over the next year. Finally, the Pessimists group is composed of firms that expect higher than observed costs.

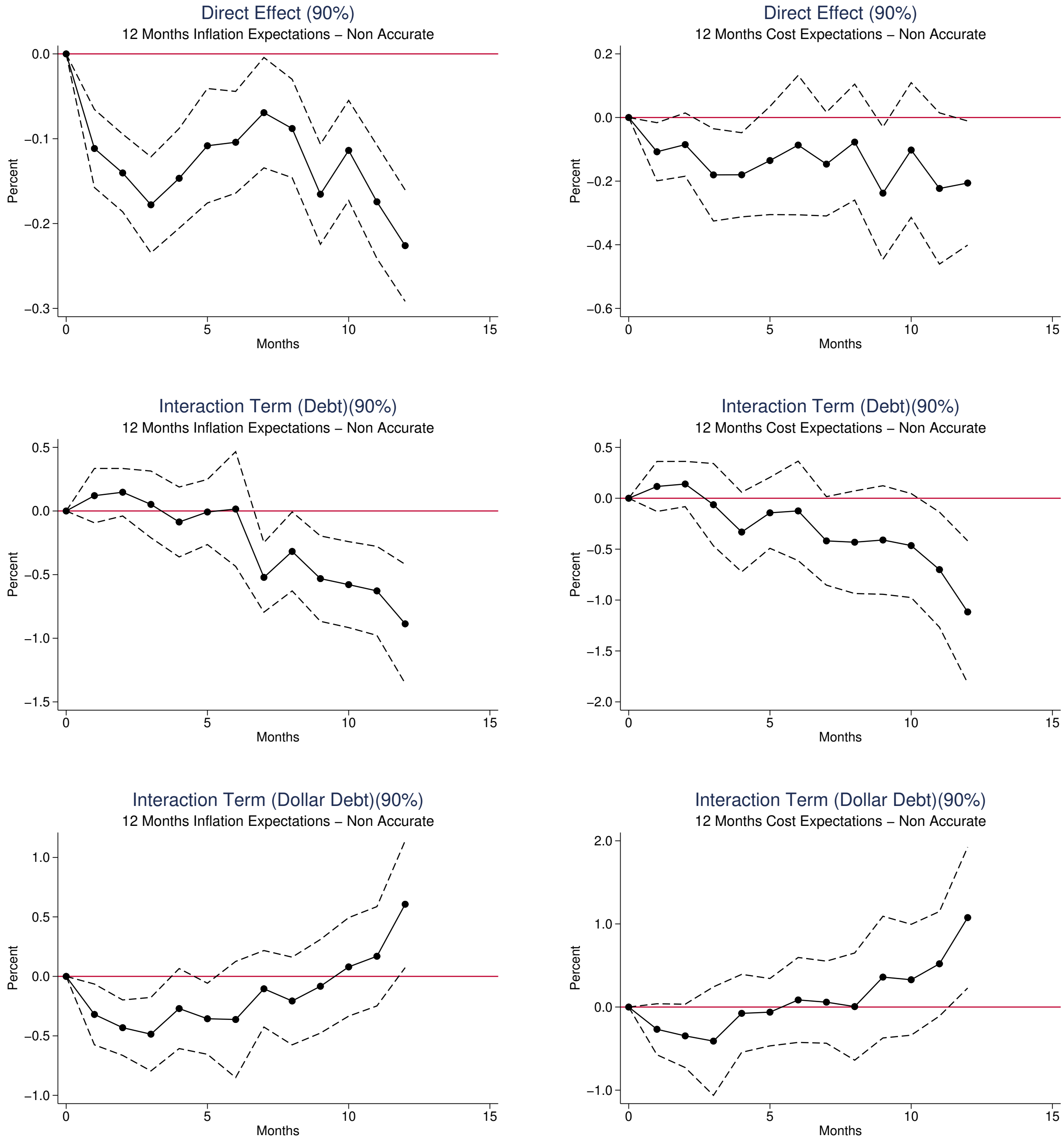
Figure 12: Adjustment of expectations in response to MP shock



Inflation Expectations | Cost Expectations

Note: This figure shows the effect of a monetary policy shock on firms' expectations, exploiting their level of exposure to debt and debt in US dollar, using specification (3). The upper panels show the direct effect ($\beta^{h,0}$) or the effect on firms without debt. The middle panels plot $\gamma^{h,0}$, or the effect on firms with debt in Uruguayan pesos. The lower panels plot $\zeta^{h,0}$, or the effect on firms with debt in US dollar. The dependent variable is the firms' inflation expectations (left) and cost expectations (right). We include a firm fixed effect. We use $J = 12$ and robust standard errors. The dashed lines represent 90 percent confidence intervals.

Figure 13: Adjustment of expectations in response to MP shocks



Inflation Expectations

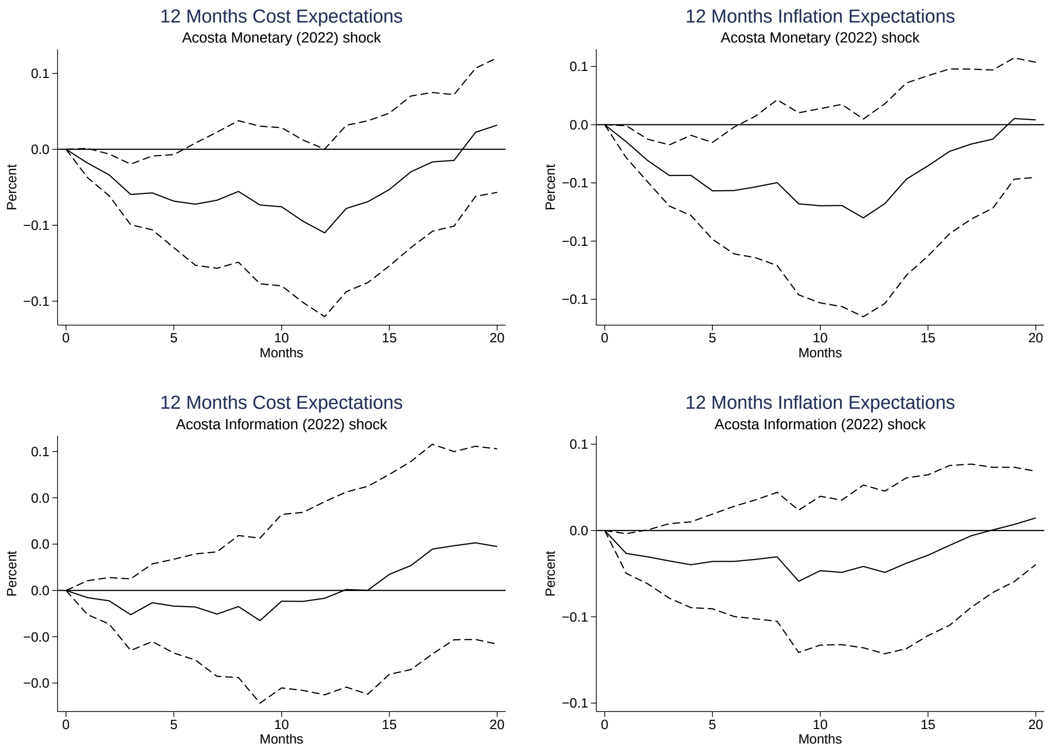
Cost Expectations

Note: This figure shows the effect of a monetary policy shock on firms' expectations, exploiting their level of exposure to debt and debt in US dollar, using specification (3). The upper panels show the direct effect ($\beta^{h,0}$) or the effect on firms without debt. The middle panels plot $\gamma^{h,0}$, or the effect on firms with debt in Uruguayan pesos. The lower panels plot $\zeta^{h,0}$, or the effect on firms with debt in US dollar. The dependent variable is the firms' inflation expectations (left) and cost expectations (right). We include a firm fixed effect. We use $J = 12$ and robust standard errors. The dashed lines represent 90 percent confidence intervals.

C Robustness with alternative shocks

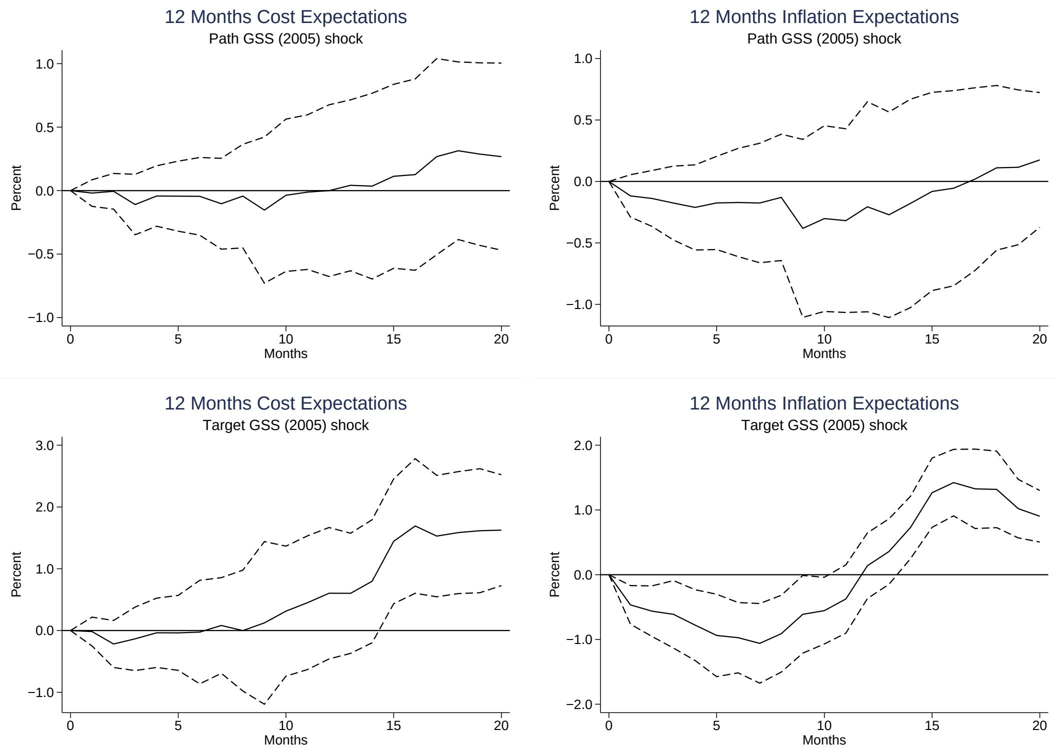
Our main results use a monetary policy shock in the US developed by Bu, Rogers, and Wu (2021). While this shock eliminates the information effect of the monetary policy shock, there are other shocks that aim to have a similar effect. In this section we evaluate the effect on expectations of information and monetary policy shocks and compare it with the main results. Using the extensions of Acosta (2022), we evaluate the shock of Nakamura and Steinsson (2018), **?**, and Acosta (2022) and policy surprises in a 30 minute window. These shocks are separated by information and monetary policy shocks. Figure 14 15 and 16 show the results.

Figure 14: Effect of response to MP shocks on firms' expectations (according to Acosta (2022))



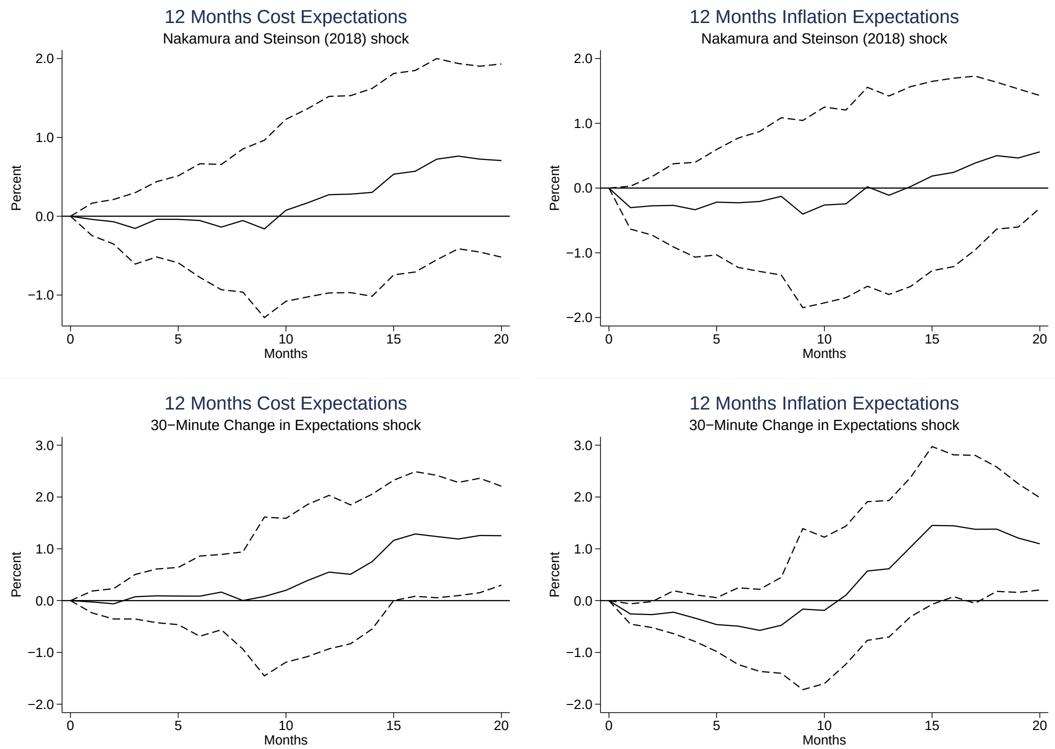
Note: Figures show how a 1 percentage point monetary policy shock according to Acosta (2022) changes the percentage change in Uruguayan firms' inflation and cost expectations. Dashed lines represent 95 percent confidence intervals. Standard errors are clustered at the time level.

Figure 15: Effect of response to MP shocks on firms' expectations (according to Gurkaynak, Sack and Swanson (2005))



Note: Figures show how a 1 percentage point monetary policy shock according to **?** changes the percentage change in Uruguayan firms' inflation and cost expectations. Dashed lines represent 95 percent confidence intervals. Standard errors are clustered at the time level.

Figure 16: Effect of response to MP shocks on firms' expectations (according to Nakamura and Steinson (2018))



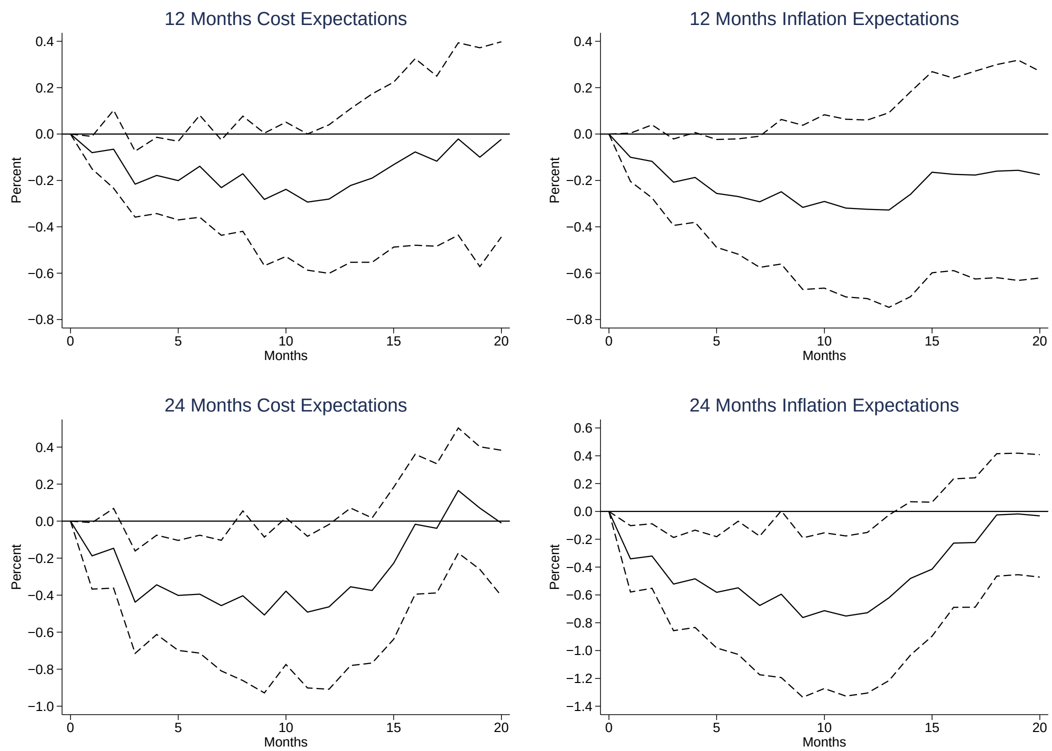
Note: Figures show how a 1 percentage point monetary policy shock according to Nakamura and Steinsson (2018) and 30-minute changes in expectations change the percentage change in Uruguayan firms' inflation and cost expectations. Dashed lines represent 95 percent confidence intervals. Standard errors are clustered at the time level.

We can see that monetary policy shocks not related to the information channel confirm our results. This is because the information channel is associated with a expansionary demand shock as shown by Jarociński and Karadi (2020).

D Results since 2009

Our main specification uses data from January 2014 to February 2020, as it overlaps with the sample size that we have for other data sources. In addition, that period of time is characterized by policy normalization in the US after a prolonged period with the policy rate at the effective zero lower bound. Since the shocks of Bu, Rogers, and Wu (2021) include the whole term of the rates, they construct shocks for the period of the zero lower bound. In this appendix, we extend our results to a sample from October 2009, when the survey starts, to February 2020, prior to the COVID-19 pandemic. Figure 17 shows the results of our main specification.

Figure 17: Effect of response to MP shocks on firms' expectations for sample starting in 2009



Note: Figures show how a 1 percentage point monetary policy shock according to Bu, Rogers, and Wu (2021) changes the percentage change on Uruguayan firms' inflation and cost expectations. Dashed lines represent 95 percent confidence intervals. Standard errors are clustered at the time level.

We can see that the results show a similar pattern and a similar effect. After a contractionary monetary policy shock, expectations of inflation and costs at 12 and 24 months are adjusted downward as in our main results.

E Model Details

We use a simple small open economy model as in Gali and Monacelli (2005). The large economy has the same preferences as the small open economy. The only departure is the expectations formation of the firms $E_{f,t}$. In order to compute those expectations, we first run the model in the peg version. Then we obtain the reaction function and next we construct the auxiliary expectations of the firm. To do so, we construct an auxiliary variable that is equal to the firm's own price expectations of the form $\pi^{aux}_{H,t} = \pi_{H,t+1}$. Then, the model policy function would depend on the following state variables: the lag in the price of the small open economy firm, the lag price in the large economy firm, the lag in the price index of the small economy, and the monetary policy shock variable. Finally, $E^{peg}_{f,t}$ is defined by

$$E^{peg}_{f,t}\pi_{H,t+1} = \phi_{\varepsilon} * \varepsilon_t + \phi_{P_H}\check{p}_{H,t-1} + \phi_{P^*}\check{P}^*_{t-1} + \phi_{\epsilon}\epsilon_{t-1} + \phi_P\check{P}_{t-1},$$

With that variable, we compute $E_{f,t}$ in the model.

The log-linearized model equations are:

$$\Pi^*_t = \kappa(\alpha + \gamma))y^*_t + \beta E_t \Pi^*_{t+1}$$

$$c^*_t = -(1/\gamma)(i^*_t - \Pi_{t+1}) + E_t c^*_{t+1}$$

$$i^*_t = \sigma_\pi \Pi^*_t + y^*_t + \epsilon_t$$

$$c^*_t = y^*_t$$

$$\Pi^*_t = P^*_t - P^*_{t-1}$$

$$i_t - i^*_t = E_t e_{t+1} - e_t$$

$$\pi_t = \kappa * mc_t + \beta * \pi^{aux}_t$$

$$-\gamma * c_t + \gamma * c^*_t = P_t - P^*_t - e_t$$

$$P_t = \phi p_t + (1-\phi)(P_t^* + e_t)$$

$$\Pi_t = P_t - P_{t-1}$$

$$\pi_t = p_t - p_{t-1}$$

$$mc_t = \alpha y_t + (\gamma - (1/\sigma))c_t + ((1/\sigma)) * c_{H,t}$$

$$-c_{F,t} + c_{H,t} = \sigma(P_t^* + e_t - p_t)$$

$$c_t = \phi c_{H,t} + (1-\phi)c_{F,t}$$

$$y_t = y_t^* + (1/\sigma_a) * (P_t^* + e_t - p_t)$$

$$\epsilon_{t-1} = \rho\epsilon_{t-1} + \varepsilon_t$$

Expectations of the firms could be either

$$\pi_t^{aux} = E_t \pi_{t+1}$$

or

$$\pi_t^{aux} = E_{f,t} \pi_{t+1}$$

Then, the two policy regimes for the local economy are:

$$e_t = 0$$

$$i_t = \sigma_\pi \Pi_t + y_t$$