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Heterogeneity in the Transmission of Global Shocks to the Distribution of Inflation Expectations☆

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Resumen

Este documento analiza cómo las perturbaciones financieras y monetarias globales influyen en la distribución completa de las expectativas de inflación de las empresas uruguayas. Mediante una encuesta mensual única y choques identificados exógenamente, se analiza la respuesta de la media, la dispersión y los percentiles. Un choque monetario global contractivo reduce la inflación esperada, particularmente en la cola superior de la distribución en aproximadamente 2 puntos porcentuales y comprime el desacuerdo entre firmas, en consonancia con una mayor credibilidad de las políticas. Por el contrario, los de riesgo globales y las apreciaciones generales del dólar estadounidense elevan las expectativas en toda la distribución (0,1 puntos porcentuales en promedio). La depreciación del peso uruguyo también aumenta las expectativas, pero principalmente para las empresas no exportadoras, lo que expone la heterogeneidad de las empresas. En conjunto, los datos ponen de relieve que el canal del tipo de cambio es la vía dominante por la que las perturbaciones mundiales llegan a las creencias de las empresas. En el caso de las pequeñas economías abiertas, los marcos monetarios creíbles pueden anclar las expectativas en medio de la turbulencia internacional, pero la comunicación debe adaptarse a públicos heterogéneos.

Abstract

This paper studies how global financial and monetary shocks shape the full distribution of Uruguayan firms' inflation expectations. Using a unique monthly survey and externally identified shocks, we trace the response of the mean, dispersion, and percentiles of the distribution to global shocks. A contractionary global monetary shock lowers expected inflation most clearly in the upper tail by about 2 percentage points and compresses disagreement, consistent with stronger policy credibility. In contrast, global risk shocks and broad U.S. dollar appreciations raise expectations across the distribution (0.1 pp. on average). A domestic peso depreciation also increases expectations, but primarily for non-exporters, underscoring firms' heterogeneity. Taken together, the evidence highlights the exchange-rate channel as the dominant conduit from global shocks to firms' beliefs. For small open economies, credible monetary frameworks can anchor expectations amid global turbulence, but communication should be tailored to heterogeneous audiences.

JEL: E31, E52, E58, Q41
Keywords: Firms' inflation expectations, global monetary shocks, financial shocks, distribution inflation expectations, Uruguay.

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1 Introduction

Inflation expectations play a central role in monetary policy and macroeconomic outcomes. Ever since the seminal works of Friedman (1968) and Phelps (1967) emphasized the importance of expectations for inflation and unemployment dynamics, central banks have tried to keep inflation expectations well anchored. Beyond aggregate measures such as the mean expected inflation, recent research has highlighted the value of examining the *entire distribution* of expectations across agents (Reis, 2021). In particular, the dispersion and skewness of inflation expectations can provide early signals of de-anchoring or shifts in credibility (Reis, 2021; Mankiw *et al.*, 2004). A credible monetary policy regime is thought to not only stabilize the level of expected inflation but also reduce disagreement among agents' forecasts (Mankiw and Reis, 2002; Mankiw *et al.*, 2004).

A growing literature studies how different shocks affect inflation expectations. Most studies have focused on household or professional forecasters' expectations in advanced economies. For instance, Coibion *et al.* (2020) find that conventional monetary policy surprises have a moderate impact on household inflation expectations. Other works show that large *energy price shocks* can significantly raise inflation expectations (Kilian and Zhou, 2022; Mello and Ponce, 2025). Similarly, fiscal policy changes can influence expectations: D'Acunto *et al.* (2018) document that indirect tax changes pass through to consumers' inflation beliefs, and Coibion *et al.* (2021) and Brandao-Marques *et al.* (2024) report that fiscal shocks affect expected inflation, with potentially different effects in emerging versus developed countries. However, there is relatively little evidence on how *global* shocks propagate to inflation expectations in small open economies, especially from the perspective of firms.

This paper contributes in three ways. First, it studies how *global monetary, global risk, global U.S. dollar value*, and *domestic exchange-rate* shocks shift the *entire distribution* of firms' 12-month-ahead inflation expectations. Second, it documents heterogeneity by firm orientation (domestic, exporters, both markets). Third, it combines externally identified global shocks with local projections, providing policy relevant IRFs for a small open economy.

More precisely, this paper contributes to the literature by analyzing the transmission of global shocks to the distribution of firms' inflation expectations in an small open economy (Uruguay). We focus on four types of shocks: (i) a global monetary policy shock, (ii) a global financial risk shock, (iii) a global U.S. dollar value (exchange rate) shock, and (iv) a domestic exchange rate shock. We use a rich monthly survey dataset of Uruguayan firms to construct the cross-sectional distribution of expected inflation at the 12-month horizon. By examining not only the average expectation but also higher moments (such as disagreement, measured by forecast dispersion) and specific percentiles of the distribution, we can assess whether these shocks have heterogeneous effects on different segments of firms, in particular, those with higher vs. lower inflation expectations. We further distinguish firms by their market orientation: firms serving the domestic market, exporting firms, and those operating in both markets. This allows us to test whether exposure to international markets influences how firms incorporate global information into their inflation expectations.

Our empirical strategy combines structural shock identification with the local projections method to estimate impulse responses. The identified global shocks are treated as exogenous drivers, and we trace their effects on firms' expectations distribution over a one-year horizon. Briefly, we find that a contractionary global monetary shock, such as an unanticipated rise in foreign interest rates and/or unexpected contractionary communication, tends to *lower* domestic inflation expectations and compress their distribution, reducing the upper tail of expectations and the dispersion across firms. On the other hand, global financial shocks, including surges in global volatility or an abrupt appreciation of the U.S. dollar, *raise* expected inflation across virtually all firms, though with little change in dispersion in the case of a dollar shock and some increase in disagreement for a volatility shock. We also find striking heterogeneity in the case of a *domestic* currency shock. A sudden depreciation of the local currency, not related to external factors, leads to sharply higher expected inflation among domestically oriented firms, accompanied by greater forecast disagreement, whereas exporters' expectations remain largely unchanged by such a shock.

These results suggest that the nature of the shock matters greatly for how expectations respond. Credible monetary policy even if originating abroad can anchor or even lower domestic inflation expectations, aligning with sticky-information theories where more agents update their information after a clear policy signal. In contrast, external risk and exchange rate shocks tend to unanchor expectations upward, requiring careful domestic policy responses. Additionally, the differences between firm types imply that policymakers should account for heterogeneity: firms more exposed to global markets may process and react to shocks differently than those focused on the local market.

The remainder of the paper is organized as follows. Section 2 reviews related literature on expectations formation and the effects of macroeconomic shocks. Section

3 describes the data and methodology, including the identification of shocks and the empirical approach to trace their impacts. Section 4 presents the results on how each type of shock affects various moments and percentiles of the distribution of firms' inflation expectations, highlighting heterogeneity across firm groups. Section 5 presents the effect of the shocks over some relevant macro variables, section 6 analyzes the transmission channels of the shocks, and section 7 concludes with a summary of findings and policy implications.

2 Literature Review

Understanding the formation of inflation expectations and their distribution has been a key pursuit in macroeconomics. Models of *information rigidities* provide a basis for explaining why agents' expectations may diverge or adjust slowly. The sticky-information model of Mankiw and Reis (2002) argues that only a fraction of agents update their information sets at any given time. As a result, after a shock, those who update will shift their expectations while others do not, potentially reducing disagreement as more agents incorporate the new information. Mankiw *et al.* (2004) further argue that a credible and transparent monetary policy can lead to more anchored expectations and less disagreement among agents, since agents share a common understanding of policy goals and are more likely to update toward the central bank's target.

Empirically, the distribution of inflation expectations has been studied using surveys of both households and firms. Reis (2021) emphasizes that looking beyond the mean expectation to metrics like dispersion (standard deviation of forecasts) and skewness can reveal early signs of expectations becoming unanchored. In stable environments, one expects low dispersion and stable higher moments; significant changes in these can indicate that a subset of agents is altering its views in a different manner than the rest. Dovern *et al.* (2012), for example, examine professional forecasters across countries and find that disagreement tends to rise with inflation uncertainty. Coibion *et al.* (2018) document that in the United States, dispersion and other second-moment measures of inflation expectations increased when the inflation target was perceived as less explicit or credible, consistent with the notion that loss of anchoring shows up in higher disagreement.

Several studies have analyzed how specific types of shocks influence expectations. For monetary policy, the evidence often comes from advanced economies: Coibion *et al.* (2020) find that unexpected monetary policy changes (e.g., surprise interest rate hikes or cuts) have limited effects on the average household inflation expectation. They tend to be sluggish and may even move in counter intuitive directions in the very short run. However, more noticeable effects can occur in subgroups or at longer horizons. On the other hand, Candia *et al.* (2022) show that firms in the U.S. can respond to Federal Reserve communications about monetary policy, indicating that firm expectations might be more responsive under certain conditions than household expectations.

Beyond monetary policy, oil and commodity price shocks have been shown to influence inflation expectations. Kilian and Zhou (2022) find that increases in oil prices can lead to higher household inflation expectations, especially when inflation is already elevated. Mello and Ponce (2025) study global energy price shocks and find a significant pass-through to firms' inflation expectations in Uruguay, reflecting the importance of imported energy costs for production. Fiscal policy is another domain: D'Acunto *et al.* (2018) provide evidence that value-added tax (VAT) changes in Germany had direct effects on consumers inflation expectations, aligning with actual price movements. More broadly, Coibion *et al.* (2021) and Brandao-Marques *et al.* (2024) examine how large fiscal expansions or consolidations affect expectations, noting that in emerging markets these shocks can have larger and more persistent impacts on inflation expectations than in advanced economies, likely due to credibility issues or different monetary-fiscal frameworks.

Despite these insights, most existing studies concentrate on either the mean of expectations or specific populations (households in developed economies). There is limited evidence on firm expectations in emerging economies. Firms are important because their price-setting behavior ultimately drives inflation; understanding their expectations can shed light on potential pricing trends. Moreover, firms often have more at stake and possibly better information than households regarding future inflation, especially firms engaged in importing or exporting who directly experience exchange rate fluctuations and global cost changes. Our study addresses this gap by focusing on firms' expectations in a small open economy and by explicitly accounting for heterogeneity in those expectations across the entire distribution and across different types of firms.

3 Methodology

3.1 Data on Firms' Inflation Expectations

We use micro data from the Uruguayan *Business Expectations Survey* (BES), a monthly survey of firms conducted by the National Institute of Statistics on behalf of the

Central Bank of Uruguay (BCU). The survey has been carried out since October 2009 and covers a representative sample of private sector firms. Initially, it included firms with more than 50 employees (up to September 2020), and thereafter it was resampled to firms with more than 100 employees. The BES collects firms' expectations on a range of economic variables. In particular, it asks firms for inflation and costs expected increases over different horizons.

In our analysis, we focus on the survey questions regarding expected inflation. Each month, firms report their expectations for the percentage change in the consumer price index over several horizons (the remainder of the current year, 12 months ahead, and 24 months ahead). Concretely, the question asks: *What do you think will be the average variation of the Consumer Price Index (CPI) over the next 12 months?*, with responses given in percentage terms. We concentrate on the 12-month-ahead CPI inflation expectation, as this horizon is commonly used to gauge medium-term expectations and provides a sufficient window for the effects of shocks to materialize. By collecting all individual firms' responses each month, we can construct the cross-sectional distribution of 12-month inflation expectations among firms.

We analyzed the period October 2009-September 2024, as a result, we have an unbalanced data panel of 60,629 observations, in which responses from 1,034 firms are compiled. We examine several statistics of this cross-sectional distribution at each point in time: the mean, median, and mode of expected inflation, the standard deviation of expectations (as a measure of *disagreement*), the skewness and kurtosis (to capture asymmetry and tail behavior), and selected percentiles (the 10th, 20th, ..., 90th percentiles) which indicate the lower and upper segments of expected inflation. The use of these distributional measures allows us to assess not only whether expectations on average move up or down after a shock, but also whether, for example, only the most pessimistic (high-expectation) firms change their beliefs or whether the entire distribution shifts.

In addition to looking at the aggregate distribution of all firms, we split the sample of firms based on their market orientation. Specifically, we classify firms into three categories: (i) firms that primarily operate in the **domestic market** selling goods or services within Uruguay only, this are *39,367 observations* (*65.28%*); (ii) **exporting firms**, those that sell predominantly to foreign markets, *2,192 observations, (3.63%)*; and (iii) firms serving **both domestic and foreign markets**, which are *18,679 observations (30.97%)*. We then compute the distribution of expected inflation within each subgroup separately for each month. This yields, for example, a mean expected inflation among domestic-market firms, a mean among exporters, and so on, along with each subgroup's dispersion, percentiles, etc. This segmentation enables us to test for heterogeneity in shock transmission: e.g., do exporters adjust their expectations differently than purely domestic firms when a global shock occurs?

3.2 Descriptive statistics

Table 1 presents the descriptive statistics of the variables used in the econometric analysis. These variables are all the sample moments of the distribution function of inflation expectations, the mode, the kurtosis, the skewness and all its deciles. Also included are the control variables used in the estimations.

Variable	Mean	Std. dev.	Min	Max
$E_t^{mean}(\pi_{t+12})$	8.735	0.928	6.199	10.903
$E_t^{mode}(\pi_{t+12})$	8.254	1.044	6.000	10.000
$E_t^{Std.Dv.}(\pi_{t+12})$	1.738	0.261	1.176	2.532
$E_t^{p10}(\pi_{t+12})$	7.152	0.960	4.750	9.000
$E_t^{p20}(\pi_{t+12})$	7.528	0.944	5.000	9.510
$E_t^{p30}(\pi_{t+12})$	7.806	0.898	5.500	10.000
$E_t^{p40}(\pi_{t+12})$	8.120	0.910	6.000	10.000
$E_t^{p50}(\pi_{t+12})$	8.408	0.920	6.000	10.000
$E_t^{p60}(\pi_{t+12})$	8.764	0.871	6.500	11.000
$E_t^{p70}(\pi_{t+12})$	9.145	0.879	7.000	11.000
$E_t^{p80}(\pi_{t+12})$	9.817	0.892	7.000	12.000
$E_t^{p90}(\pi_{t+12})$	10.672	0.996	8.000	13.000
$E_t^{Skewness}(\pi_{t+12})$	1.528	0.973	-0.374	6.282
$E_t^{Kurtosis}(\pi_{t+12})$	8.130	7.557	2.387	56.184
$Inflation\ rate$	7.851	1.530	3.675	11.051
$\Delta\ (Peso/USD)$	0.379	2.273	-5.141	13.857
$\Delta\ (USD\ global\ value)$	0.161	1.214	-2.782	3.714
VIX	18.453	6.411	10.130	57.740
$GDP\ Growth$	2.447	4.712	-17.566	12.916
$Policy\ rate$	9.222	2.595	4.481	15.655
$Debt/GDP$	58.200	7.801	44.400	72.800
$EMBI$	157.000	50.800	70.000	304.000
$Number\ Obs.$	181			
$Sample$	October 2009-September 2024			
$Share\ of\ domestic\ firms$	65.28%			
$Share\ of\ exporters$	3.63%			
$Share\ of\ both\ markets\ firms$	30.97%			

Table 1: Descriptive statistics

On average, the mode is below the mean in the distribution function of firms' 12-month expectations. Likewise, the skewness is 1.528 and the kurtosis is 8.13, all of which suggests a distribution function that differs from the normal distribution, with asymmetry towards the right side and heavy tails on both sides.

The table also presents the main control variables used in the econometric estimates. Inflation during the period averaged 7.85% per year. Monthly variations in the domestic *Nominal Exchange Rate* (NER) were on average greater than variations in the global value of the USD, measured through the *Nominal Broad Dollar Index* (NBDI). Likewise, *International Financial Volatility* (VIX) averaged 18.453 but with a high dispersion, reaching a maximum value of 57.74 during the COVID-19 pandemic. Average annual GDP growth was 2.45%, the average monetary policy rate for the period was 9.22%, the debt-to-GDP ratio was 58.2%, and the average sovereign risk was 157 basis points.

Table 2 presents the distribution moments and deciles of 12 months inflation expectations for the different type of firms in function of the market in which they mostly operate. **Domestic market** firms record the highest average inflation expectation at 8.761% , while exporters display the lowest mean of 8.331% and mixed firms fall in between at 8.707%. **Exporters** series are the most stable over time, with a variance of 1.533, compared to 1.745 for domestic and 1.693 for mixed firms. The **distribution shapes** diverge markedly across groups: *domestic firms* exhibit a strong right skew (1.891) and heavy tails (kurtosis = 13.138), reflecting frequent extreme upside forecasts; *exporters* approximate symmetry (skewness = 0.389) and mesokurtic behavior (kurtosis = 3.348), signaling a more anchored outlook; *mixed firms* take an intermediate stance (skewness = 1.528, kurtosis = 8.130). Across all percentiles (10th through 90th), exporters inflation expectations remain consistently lower than those of domestic and mixed firms, confirming their more conservative stance. Mixed firms align closely with domestic firms in higher deciles but moderate their lower percentiles slightly, revealing a nuanced, intermediate profile. These heterogeneities suggest that policy communication and anchoring efforts by the central bank should focus on domestic firms, where expectations are both more volatile and prone to extreme values.

	Domestics firms				Exporters				Both markets firms			
Variable	Mean	Std. dev.	Min	Max	Mean	Std. dev.	Min	Max	Mean	Std. dev.	Min	Max
$E_t^{mean}(\pi_{t+12})$	8.761	0.922	6.204	10.915	8.331	0.978	5.883	10.813	8.707	0.976	6.145	10.992
$E_t^{mode}(\pi_{t+12})$	8.304	1.034	6.000	10.000	8.425	1.244	5.000	12.000	8.193	1.101	6.000	10.000
$E_t^{Std.Dv.}(\pi_{t+12})$.	1.745	0.309	1.155	2.768	1.533	0.539	0.518	3.323	1.693	0.328	1.127	2.835
$E_t^{p10}(\pi_{t+12})$	7.180	0.977	4.500	9.000	6.534	1.317	0.800	9.500	7.105	0.970	4.000	9.200
$E_t^{p20}(\pi_{t+12})$	7.559	0.944	5.000	9.500	7.270	1.097	4.000	10.000	7.494	0.936	5.000	9.570
$E_t^{p30}(\pi_{t+12})$	7.834	0.906	5.550	10.000	7.611	1.046	4.210	10.000	7.771	0.928	5.000	10.000
$E_t^{p40}(\pi_{t+12})$	8.154	0.930	6.000	10.000	7.931	1.024	4.210	10.200	8.074	0.914	5.900	10.000
$E_t^{p50}(\pi_{t+12})$	8.430	0.915	6.000	10.200	8.212	1.002	5.855	10.500	8.382	0.943	6.000	10.500
$E_t^{p60}(\pi_{t+12})$	8.806	0.847	6.500	11.000	8.506	0.973	6.000	10.500	8.724	0.956	6.000	11.000
$E_t^{p70}(\pi_{t+12})$	9.154	0.864	7.000	11.000	8.829	1.019	6.000	12.000	9.135	0.966	6.300	11.500
$E_t^{p80}(\pi_{t+12})$	9.803	0.876	7.000	12.000	9.332	1.047	6.500	13.000	9.735	1.070	7.000	12.000
$E_t^{p90}(\pi_{t+12})$	10.669	1.017	8.000	13.000	10.333	1.479	7.000	15.000	10.718	1.095	8.000	13.500
$E_t^{Skewness}(\pi_{t+12})$	1.891	1.470	-0.525	7.728	0.389	0.881	-1.345	3.677	1.528	0.973	-0.374	6.282
$E_t^{Kurtosis}(\pi_{t+12})$	13.138	14.210	3.008	95.037	3.348	1.987	1.000	17.059	8.130	7.557	2.387	56.184

Table 2: Distribution of inflation expectations by types of firms

3.3 Identification of Global and Domestic Shocks

Our empirical strategy requires identifying exogenous shocks in four dimensions: global monetary policy, global risk appetite, global U.S. dollar value, and the domestic exchange rate. We take the global monetary shock from the literature, and obtain measures of other three shocks as the residual innovations from a small structural vector autoregressive (SVAR) model for the vector of variables Y_t, and:

$$A_0 Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + b_0 x_t^{\epsilon_m} + \varepsilon_t, \tag{1}$$

where ε_t is the vector of structural shocks. In our baseline specification we selected two lags, as suggested by information criteria. The vector Y_t includes three variables, the VIX index, the first difference of Nominal Broad Dollar (NBDI) and the first difference of the domestic exchange rate (NER), ordered as follows[1]:

1. **Global risk shock** proxied by the VIX index (a measure of global financial market volatility). We include the VIX to capture global risk appetite or aversion shocks; an unexpected jump in VIX indicates a global risk-off event. We measure the shock as the residual of the monthly change in VIX.

2. **Global U.S. dollar value shock** proxied by the Nominal Broad Dollar Index (NBDI)[2]. This index measures the value of the U.S. dollar against a broad bas-

[1] The NBDI and NER time series are non-stationary, so we include them in differences in the VAR.

[2] This index is published by the Economic Research Division of the Federal Reserve Bank of St. Louis under the code DTWEXBGS.

ket of foreign currencies. A shock here represents an exogenous appreciation or depreciation of the U.S. dollar. Such movements can be driven by various factors (including foreign economic developments or global investor preferences) and are important for an open economy like Uruguay (which trades and prices many goods in dollars). We obtain monthly changes in the NBDI from the Federal Reserve Economic Data (FRED) and use the VAR innovation as the shock measure.

3. **Domestic exchange rate shock** proxied by the change in the UYU/USD nominal exchange rate (Uruguayan peso per U.S. dollar). This captures idiosyncratic fluctuations in the peso's value that are not explained by global monetary, risk, or broad dollar movements. By including the peso after the global variables in the VAR ordering, we allow global shocks to have immediate effects on the peso, while any remaining unexpected change in the peso (the residual) is interpreted as a domestic exchange rate shock, potentially due to country-specific factors (e.g., local political news or domestic financial conditions).

And, $x_t^{\epsilon m}$, is the **global monetary policy shock** for which we use the high-frequency identified monetary policy shock series of Jarocinski and Karadi (2020). This series, captures unexpected changes in U.S. monetary policy (Fed funds rate) purged of central bank information effects. It is derived from the co-movement of interest rates and stock prices in a narrow window around Federal Reserve announcements, and thus isolates a pure policy shock (as opposed to changes reflecting central bank private information about the economy). We treat this series as an exogenous variable in the VAR (effectively, it enters first and is not influenced contemporaneously by the other variables due to the timing assumption).

We achieve identification through a Cholesky decomposition (recursive ordering) of A_0 in Eq. (3) consistent with the above ordering. Intuitively, the ordering assumes that the global risk shock (VIX) can contemporaneously affect all other variables (dollar, peso) within the month, but is not affected by them within the same month. Additionally, the global monetary policy shock, treated as exogenous, can affect all variables contemporaneously. The dollar shock can contemporaneously affect the peso but not the previous two. Finally, the peso's own innovation is last, meaning it is influenced contemporaneously by all global factors but its residual represents a domestic exchange rate shock, potentially due to local and idiosyncratic conditions.

We estimate this VAR using monthly data from September 2009 to the September 2024. From the estimated VAR, we extract the sequence of structural shocks ε_t for each of the three endogenous variables[3]. These shock series and the monetary global shock are then used in the next step of our analysis to assess their impact on inflation expectations.[4].

Figure 1 plots the time series of the identified shocks. Panel (a) shows the global monetary policy shock series of Jarocinski and Karadi (2020), which is measured in percentage points (an increase indicates an unexpected tightening). Notable spikes correspond to major Fed policy surprises. Panel (b) shows the global volatility (VIX) shock. The COVID-19 crisis in early 2020 is clearly visible as a very large volatility shock. Panel (c) shows the NBDI shock, in percentage change terms; positive values indicate an unanticipated broad dollar appreciation. Panel (d) depicts the domestic peso (NER) shock (percentage change in USD/UYU), where positive values mean an unexpected depreciation of the peso.

[3]In Appendix A.1 we provide a methodological explanation for the identification and recovery of SVAR errors.

[4]It is clear that global shocks affect the domestic exchange rate in a small, open economy such as Uruguay's, so in the order of the VAR variables, there is no doubt that the domestic exchange rate should come third. However, the order among the global shocks is not so clear, since on a monthly basis, the effects of volatility shocks and the value of the dollar could materialize simultaneously. In view of this, we re-estimated the shocks by reversing the order between the NBDI and the VIX in the VAR, and compared these new shocks with those presented in Figure 1. As shown in Table 9 in the Appendix, the correlations between these estimates are 0.941, 0.937, and 1, so we can conclude that the order chosen for global shocks does not affect the determination of the shocks used in the estimates.

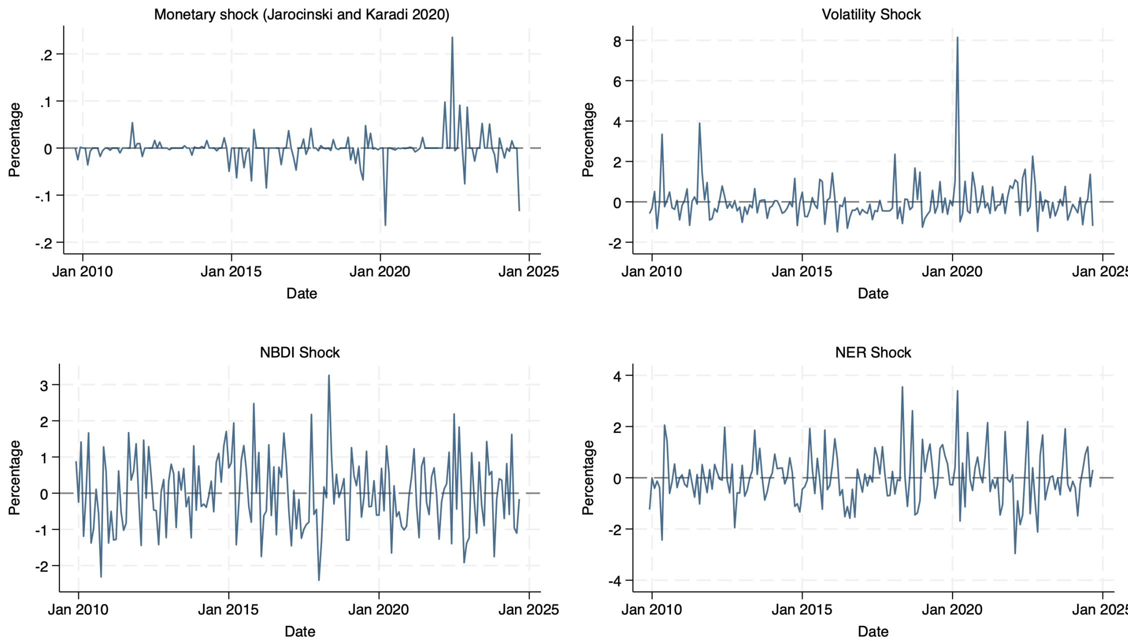

Figure 1: Time series of identified shocks. (a) Monetary policy shock (Jarociski and Karadi, 2020) in percentage points. (b) Global volatility (VIX) shock in percentage points. (c) Broad dollar (NBDI) shock in percent. (d) Domestic peso (NER) shock in percent. Source: Author's calculations using data from Marek Jarocinski web page, FRED and BCU.

3.4 Local Projections for Impulse Responses

To estimate the impact of these shocks on firms' inflation expectations, we employ the *local projections* method of Jordà (2005). Local projections allow us to directly compute impulse response functions (IRFs) by regressing future values of the outcome on the current shock, without imposing the restrictions of a VAR on the propagation dynamics. This method is well-suited given our interest in potentially non-linear responses (especially when examining different distribution quantiles) and the relatively small sample size for each subgroup of firms.

For each horizon $h = 0, 1, \ldots, 12$ months ahead, we estimate regressions of the form:

$$Z_{i,t+h} = \alpha_{t+h} + \beta_h \varepsilon_t + \sum_{j=0}^{k} \theta_j X_{j,t-1} + \mu_{i,t+h} \tag{2}$$

Where Z_{t+h} represents our variables of interest: ***mean, mode, standard deviation, kurtosis, skewness and each of the deciles*** of the distribution function of firms'

12-month inflation expectations. ε_t represents the shock, these are: monetary shock, NBDI shock, NER shock and global volatility shock. $X_{j,t-1}$ is a vector of control variables: the lagged inflation expectation moment (ΔZ_{t-1}), the lagged change in global dollar value ($\Delta NBDI_{t-1}$), the lagged change in the consumer price index (ΔCPI_{t-1}), the lagged change in the country risk ($\Delta EMBI_{t-1}$), the lagged change in economic activity (ΔGDP_{t-1}), the lagged in the debt to GDP ratio ($Debt/GDP_{t-1}$), the lagged monetary policy rate (i_{t-1}), and the lagged exchange rate interventions of the Central Bank (FXI_{t-1}).

By estimating (2) for each horizon h, we trace out the path of the response over the year following the shock.

We run these local projection regressions separately for each expectations distribution metric (Z) and for each firm group i (local, exporters, both markets, and all firms). This yields, for each shock ε_t, a set of impulse responses for, say, the mean expected inflation of local firms, the median expected inflation of local firms, etc., and similarly for exporters and so on. We construct confidence intervals using Newey-West standard errors to account for serial correlation in the local projection regressions. We consider a response statistically significant if the 95% confidence interval does not include zero at a given horizon.

4 Results

Key magnitudes. A one-standard-deviation contractionary global monetary shock lowers the median by about 0.2 pp.; volatility and broad-dollar shocks raise the mean/-median by roughly 0.1 pp.; a domestic peso depreciation increases non-exporters´ expectations by up to 0.1 pp., with exporters largely unaffected. Disagreement falls after monetary shocks and rises (or stays unchanged) after risk and domestic-currency shocks.

4.1 Global monetary policy shock

Figures 2, 3, 4 and 5 show the impulse responses of various measures of the expectations distribution to a **contractionary global monetary shock**, for each group of firms. Table 3 provides a summary of the significance and persistence of these responses.

A global monetary tightening shock leads to a *decline* in Uruguayan firms' inflation expectations. This effect is most pronounced in the upper segments of the distribution of expectations.

For **local-market firms** (Figure 2), the reaction is modest. The global monetary shock has no effect on the average expectations of firms, although it does have an effect on the median in the distribution function. The effect on the mode of the distribution is lagged and sporadical ($h = 6$ and $h = 11$), while the effect on the median and the lowest percentiles is ephemeral, with an effect not exceeding $h = 1$.

Table 3: Global Monetary Policy Shock – Summary of Effects

	Local firms	Exporters	Both markets	All firms
Mean	No effect	No effect	⇓ (h=0)	No effect
Mode	⇓ (h=6,11)	⇓ (h=2,5)	⇓ (h=3,9,11)	⇓ (h=0,3,6,11)
Median	⇓ (h=0,1)	No effect	⇓ (h=0)	⇓ (h=0,1)
Disagreement	⇓ (h=3)	⇓ (h=0,9,12)	⇓ (h=5,6,7,12)	⇓ (h=3,6)
Low percentiles	⇓ (h=0)	No effect	⇓ (h=0)	No effect
High percentiles	No effect	⇓ (h=7,9,11)	⇓ (h=0,...,12)	⇓ (h=0,3,6)
Skewness	No effect	No effect	No effect	No effect
Kurtosis	No effect	No effect	No effect	No effect
Timing	Immediate	Lagged	Immediate	Immediate
Persistence	Ephemeral	Persistent	Persistent	Persistent

The *disagreement* among **local firms** (measured by the standard deviation of their inflation forecasts) decreases after the shock. There is a significant reduction in dispersion by the third month after the shock. The decline in disagreement suggests that a greater proportion of firms update their expectations in response to the monetary shock, bringing their forecasts closer together. This finding aligns with sticky-information theory: when a clear monetary policy signal is received, many firms incorporate it, reducing the variance in beliefs (Mankiw and Reis, 2002). We see no significant changes in skewness or kurtosis for local firms, indicating that aside from the shift downwards and compression, the overall symmetry and tail thickness of the distribution remain roughly unchanged.

Exporting firms (Figure 3) also end up reducing their inflation expectations after the global monetary shock, but their response is notably slower. Initially, exporters show virtually no change in their expectations (mean or median). However, a few months after the crisis, the highest percentiles of the distribution show a significant and persistent reduction in expected inflation. Therefore, exporters adjust to tighter global monetary conditions, but with a delay. Interestingly, the average expectation of exporters never shows a significant change, indicating that perhaps only a subset of exporters (those with initially higher expectations) revise downward, while others do not, resulting in a smaller change in the mean.

Disagreement among exporters falls significantly, consistent with a lower and more aligned expectations in the face of global shock. In contrast with local firms, exporters' expectations react more slowly, but they do so persistently in the face of monetary shock.

In the case of the firms operating in **both markets** (Figure 4) expectations drop immediately at impact for certain percentiles and remain lower for several months for high percentiles. In fact, for both-market firms, the median expected inflation decreases significantly at $h = 0$, similar to local firms. The upper tail (high percentiles) also declines across all horizons, while the mode presents significant drops. Disagreement in this group falls at some intermediate horizons, suggesting that these firms generalize update expectations after the shock. Overall, both-market firms react a bit more like local firmslikely because a portion of their business is domestic, they remain sensitive to local monetary credibility signals, although they present higher persistence for high percentiles.

Finally, considering **all firms** together (Figure 5), the aggregate impact of the global monetary shock is an immediate and persistent slight decline in expected inflation. The median of the overall distribution drops on impact and one month after, and the mode drops at multiple horizons. The high end of the distribution for all firms falls (significant declines in the 90th percentile at $h = 0, 3, 6, 11$), indicating that some of the most extreme inflation expectations are tempered by the shock. The mean of all firms does not show a significant change, reflecting that while the upper tail falls, the lower tail stays anchored near the inflation target. Disagreement among all firms declines at a few points, implying a temporary tightening of the distribution. Taken together, these results for the full sample combine the immediate reaction of domestic-oriented firms and the slower reaction of exporters. The overall effect is a modest but persistent reduction in expected inflation and a reduction in dispersion.

From a policy perspective, the results for the global monetary shock suggest that when global monetary conditions tighten unexpectedly, it can actually reinforce domestic anti-inflation credibility. Local businesses anticipate lower inflation, perhaps expecting weaker demand or appreciating local currency as a result of the foreign tightening. Moreover, the finding that disagreement falls supports the idea that such a shock conveys clear information to agents. This underscores the benefit of well communicated monetary policy: even external credible policy moves can anchor domestic expectations if the regime is trusted.

4.2 Global volatility shock

A global volatility shock, can be interpret as a sudden increase in global risk aversion. Figures 6, 7, 8 and 9 display the impulse responses to a volatility shock of different type of firms, and Table 4 summarizes the effects. In contrast to the monetary shock, a global volatility shock causes a *rise* in expected inflation for all groups of firms.

Table 4: Global Volatility Shock – Summary of Effects

	Local firms	Exporters	Both markets	All firms
Mean	⇑ (h=0,...,10)	⇑ (h=1,2,3,5,8,...,12)	⇑ (h=0,...,11)	⇑ (h=0,...,11)
Mode	⇑ (h=1,3,...,12)	⇑ (h=1,2,5,6,12)	⇑ (h=2,4,6,7,9,10)	⇑ (h=1,2,5,...,12)
Median	⇑ (h=0,...,12)	⇑ (h=1,2,3,5,10,11,12)	⇑ (h=4,5)	⇑ (h=5,6,8,11)
Disagreement	No effect	⇓ (h=1,7)	⇑ (h=2,4)	⇑ (h=0,2,6)
Low percentiles	⇑ (h=0,...,10)	⇑ (h=1,...,6)	⇑ (h=0,...,10)	⇑ (h=0,...,11)
High percentiles	⇑ (h=0,...,10)	⇑ (h=1,2,3,5,9,11,12)	⇑ (h=0,...,6)	⇑ (h=0,...,12)
Skewness	No effect	No effect	No effect	No effect
Kurtosis	No effect	No effect	No effect	No effect
Timing	Immediate	Lagged	Immediate	Immediate
Persistence	Persistent	Persistent	Persistent	Persistent

Following a volatility shock, the *mean* expected inflation of **local firms** rises considerably (Figure 6). Table 4 indicates an upward arrow for the mean of local firms for almost a year. In fact, the effect is immediate and persistent: local firms' mean expectation jumps significantly in the month of the shock and remains elevated for at least a year. The median and mode for local firms similarly increase significantly and persistently during the 12 months after the shock. High and low percentiles both increase as well, indicating that even firms with the lowest initial expectations adjust upward. Skewness and kurtosis do not register significant changes; thus, the distribution essentially shifts upward in a roughly parallel fashion, retaining its shape but at a higher level of inflation expectation.

Exporters (Figure 7) also experience an increase in inflation expectations, though the timing is slightly lagged compared to local firms. The mean expected inflation for exporters rises significantly at almost all first year horizons. The immediate impact ($h = 0$) on exporters' mean is not significant, but by one month later there is a notable rise. This indicates exporters might wait for confirmation or additional information before adjusting their expectations. The median and mode for exporters show a pattern of increase at select horizons. For instance, exporters' mode is significantly higher at months 2, 5, 6, and 12. Both low and high percentiles for exporters increase. These results suggest that while they might not react instantaneously, they do end up raising their inflation forecasts in response to a global risk shock, and by the end of the first year virtually all measures (mean, median, tails) have moved up. Firms act similarly in response to the volatility shock, reducing disagreement. The overall magnitude for exporters tends to be slightly smaller and more delayed, but directionally the same.

Firms in **both markets** (Figure 8) show behavior that largely mirrors local firms for this shock. They respond immediately: at $h = 0$, their mean, and several percentiles are already significantly higher, likely reflecting the domestic side of their business feeling the impact. These increases remain for multiple periods. By and large, the both-market group combines the immediate response of domestic-focused firms with the persistence that is common across all groups here.

Aggregating **all firms** (Figure 9), we see a clear surge in inflation expectations following the volatility shock. The mean expected inflation for all firms jumps on impact and stays significantly elevated persistently. The median and mode for all firms also rise at essentially every horizon within the year. The low and high percentiles of the aggregate distribution both show sustained increases (with most horizons significant). Thus, the volatility shock causes a broad-based upward shift in the distribution of inflation expectations for the Uruguayan firm sector as a whole.

One notable difference from the monetary shock case is the behavior of *disagreement*. In contrast to the monetary shock (which reduced dispersion), the volatility shock does not produce a uniform effect on disagreement. For local firms, we find no significant change in the standard deviation of expectations. For exporters, interestingly, there is a mix: a couple of horizons (1 and 7) show a slight *decrease* in dispersion (perhaps early on, a few exporters react similarly, briefly compressing their distribution), but by and large no sustained effect. For both-market firms, we actually see a *increase* in disagreement at some horizons. And for all firms combined, disagreement increases at horizons 0, 2, and 6, signifying that at certain points in time following the shock, the spread between firms' expectations widened. Overall, the evidence on disagreement suggests that a volatility shock might cause some divergence in views, especially across the heterogeneous population: some firms might project a large inflationary impact, perhaps those more sensitive to financial conditions or exchange rate risk, while others might expect the central bank to counteract the shock, leading to a more modest inflation outcome. The net result is that disagreement either stays the same or even rises slightly in the aggregate, unlike in the monetary shock scenario where it uniformly fell.

Local and both-market firms react *immediately* to the volatility shock, whereas exporters have a *lagged* initial response. All groups, however, exhibit *very persistent* increases in expectations; the effect does not dissipate within the one-year horizon. Indeed, given the magnitudes involved, this suggests a volatility shock can have a long-lasting effect on inflation expectations, potentially unanchoring them upward for quite some time.

These findings are consistent with the intuition that a global risk shock would put pressure on emerging market currencies and economies. In Uruguay's case, a global risk-off event could lead to capital outflows or depreciation of the peso as investors seek safe assets. Firms, raise their inflation expectations, probably anticipating higher import costs and perhaps some loss of policy control if the central bank is forced to accommodate. The broad based nature of the response indicates that nearly all firms, from most optimistic to most pessimistic, adjust upward, which underscores how pervasive the impact of such a shock is. Unlike a clear monetary tightening signal, which might uniformly reassure firms of low inflation, a volatility shock injects uncertainty and expectations of higher inflation, but not in a way that unifies their forecasts. In summary, global volatility shocks appear to *unanchor* inflation expectations to the upside, a concerning outcome for central banks.

4.3 Global U.S. dollar value shock

A **global U.S. dollar value shock**, is an exogenous appreciation of the U.S. dollar on world markets. For Uruguay, such a shock often implies pressure on its currency (the Uruguayan Peso) to depreciate and potentially higher imported inflation. Figures 10, 11, 12 and 13, and Table 5 present the findings.

Table 5: Global Exchange Rate (USD) Shock – Summary of Effects

	Local firms	Exporters	Both markets	All firms
Mean	⇑ (h=1,...,12)	⇑ (h=1,7,...,12)	⇑ (h=4,...,12)	⇑ (h=0,...,12)
Mode	⇑ (h=0,10,11,12)	⇑ (h=7,9,10,12)	⇑ (h=4,6,9,12)	⇑ (h=10,11,12)
Median	⇑ (h=5,...,12)	(h=10,12)	⇑ (h=0,1,2,4,5,6,9,...,12)	⇑ (h=1,...,7,9,...,12)
Disagreement	No effect	No effect	No effect	No effect
Low percentiles	⇑ (h=0,...,12)	⇑ (h=5,7,8,12)	⇑ (h=1,...,12)	⇑ (h=0,...,12)
High percentiles	⇑ (h=9,10,11)	⇑ (h=7,9,10,12)	⇑ (h=9,11,12)	⇑ (h=5,...,12)
Skewness	No effect	No effect	⇑ (h=8)	No effect
Kurtosis	No effect	⇑ (h=2)	No effect	No effect
Timing	Immediate	Lagged	Immediate	Immediate
Persistence	Persistent	Persistent	Persistent	Persistent

A global USD appreciation shock leads to a significant *increase* in expected inflation among Uruguayan firms, although the dynamics are slightly different than the volatility shock. For **local firms** (Figure 10), the mean expected inflation rises, but not instantaneously. Table 5 shows that for local firms the mean is significantly from the first month after shock. The median follows a similar pattern: it becomes significantly higher mainly from month 5 onwards through the end of the year. In contrast to the volatility shock, local firms did not show a jump at $h = 0$ for the median here, only at longer horizons does the median clearly rise. Both low and high percentiles for local firms move upward: the lower part of the distribution rises immediately at $h = 0$ and remains elevated thereafter, while the upper percentiles rise with lag, significant increases since the 9th month. The fact that the low percentile increases right away suggests that even the most optimistic firms quickly revise up when the dollar strengthens, presumably anticipating costlier imports or pass-through to prices. The upper percentiles increases are lagged, perhaps because those firms already expected relatively high inflation to begin with, and the shock pushes them even higher only after some time.

Disagreement among local firms shows **no effect**, meaning the spread of expectations remains roughly the same. The distribution essentially shifts upward in unison for local firms, with no clear narrowing or widening. Skewness mostly shows no significant change except at one horizon. Kurtosis remains unaffected across groups except one minor case.

Exporters (Figure 11) react to the global USD shock with a *delayed* and somewhat smaller increase in expected inflation. Their mean expected inflation rises, but only significantly at scattered horizons. The median for exporters shows a significant increase only at the very end of the first year after the shock, and even then relatively small. The mode of exporters' expectations increases significantly at a few of the later horizons. Lower percentiles among exporters do rise with delay. The upper percentiles of exporters' distribution also rise, indicating eventually even the high expectation exporters raise further. However, compared to local firms, exporters clearly adjust more slowly and the changes appear at fewer horizons. The *disagreement* among exporters remains unchanged. Thus, similar to local firms, exporters more or less shift their forecasts upward without a clear effect on dispersion. Exporters' skewness and kurtosis each show one horizon of significance, kurtosis at $h = 2$ is up for exporters, perhaps an outlier.

Firms operating in **both markets** (Figure 12) show a combination of immediate and lagged effects. The mean of both-market firms goes up but more noticeably from the forth month onward. The median for this group rises significantly at multiple horizons, including early and later periods. The high and low percentiles for both-market firms both go up across many horizons. Although the low percentiles react immediately, the high percentiles do so with a significant delay. In all cases, the effects are long-lasting. Disagreement in this group does not react.

Considering **all firms** (Figure 13), the global USD shock produces an unambiguous *persistent increase* in inflation expectations. The aggregate mean expected inflation rises significantly since the impact all through the first year after the shock. The median for all firms increases significantly at many horizons, the low percentiles of the overall distribution climb in all horizons, and the high percentiles also climb, from the fifth month onward significantly. The pattern suggests a slightly lagged response in the upper tail relative to the lower tail, but ultimately a generalized upward shift for the entire distribution. Importantly, disagreement for the full sample remains unchanged, indicating that firms largely share a similar view on the implications of the USD shock.

Overall, the global USD shock behaves somewhat similarly to the global volatility shock in terms of raising expectations, but with difference in disagreement. In the event of an appreciation shock of the USD, the opinion on its inflationary effect is widespread, while in the case of inflation, opinions are much more varied, both in terms of direction and magnitude, reflecting greater uncertainty for the local economy.

4.4 Domestic nominal exchange rate shock

A domestic nominal exchange rate shock in our context is an idiosyncratic depreciation of the Uruguayan Peso that is not directly caused by the global factors already discussed. Figure 14, 15, 16 and 17 presents the impulse responses for each firm group, and Table 6 summarizes the effects.

Table 6: Domestic Exchange Rate Shock – Summary of Effects

	Local firms	Exporters	Both markets	All firms
Mean	⇑ (h=0,...,7,9,10)	No effect	⇑ (h=0,...,12)	⇑ (h=0,...,10)
Mode	⇑ (h=11)	⇑ (h=6,12)	⇑ (h=1,5,9)	⇑ (h=0,10,12)
Median	⇑ (h=5,6,10,11,12)	No effect	⇑ (h=1,...,6,9,...,12)	⇑ (h=1,...,6,10,...,12)
Disagreement	⇑ (h=0,1,3,5,9,12)	No effect	⇑ (h=0)	⇑ (h=0,1,3,5,...,9,12)
Low percentiles	⇑ (h=2,...,7)	⇓ (h=0)	⇑ (h=1,...,6,9,...,12)	⇑ (h=1,...,6)
High percentiles	⇑ (h=0,...,12)	No effect	⇑ (h=0,...,6,9,...,12)	⇑ (h=0,...,12)
Skewness	No effect	No effect	No effect	⇓ (h=1)
Kurtosis	⇓ (h=1)	No effect	⇓ (h=5)	⇓ (h=1)
Timing	Immediate	No effect	Immediate	Immediate
Persistence	Persistent	No effect	Very persistent	Very persistent

A stark heterogeneity emerges in response to the domestic currency shock. **Local firms** (Figure 14) react with an immediate and significant jump in expected inflation. The mean expected inflation of local firms increases on impact and remains higher for many subsequent months. The median of local firms' expectations also rises significantly at horizons 5 and beyond. Importantly, the entire distribution of local firms shifts up: low percentiles increase from the second month and ahead, as do high percentiles for all horizons. In fact, the response of the upper tail is especially strong and persistent for local firms. This suggests that those firms who were initially expecting higher inflation increase their expectations even further after the shock, contributing significantly to the rise in the mean.

In contrast, **exporters** (Figure 15) show virtually *no change* in their inflation expectations following the peso depreciation. The mean and median of exporters' expectations exhibit no statistically significant movement at any horizon. The mode for exporters has a couple of isolated increases, but these are relatively modest and not part of a broader pattern. The lower percentile of exporters' expectations interestingly shows a small *decline* at $h = 0$. But that effect is short-lived, and no other declines are noted. Essentially, exporters treat the domestic currency shock as a non-event for their inflation outlook. They likely reason that because they operate globally, a peso movement is either hedged or seen as temporary, and thus they largely maintain their previous inflation forecasts.

Firms in **both markets** (Figure 16) respond in a similar way to the purely domestic firms. Their mean expected inflation jumps immediately and remains significantly elevated through the entire year. Their median rises significantly from $h = 1$ through $h = 6$ and again from $h = 9$ to $h = 12$, indicating a sustained upward shift. Both low and high percentiles of this group's distribution increase significantly at practically every horizon. Thus, like local firms, firms active in both markets incorporate the currency depreciation into higher expected inflation almost across the board. The magnitude for some metrics is slightly moderated compared to local-only firms, but overall the pattern is of a strong and persistent rise in expectations.

For **all firms** (Figure 17), the aggregate outcome of the domestic shock is a clear increase in expected inflation, but with a notable widening in disagreement. The mean expected inflation for all firms rises immediately and stays significantly higher through about 10 months. The median of all firms also keeps high for practically the whole year after the shock. Both the low and high percentiles for all firms increase, but high percentiles show more persistence in the response.

However, because exporters did not move, while domestic firms did, the *dispersion* among all firms grows significantly. The standard deviation of expectations for all firms increases at nearly all horizons. This rise in disagreement reflects the diverging responses: domestic oriented firms raising their expectations versus exporters that have no response. We see evidence of this in the changes in distribution shape for all firms: skewness decreases at $h = 1$ and kurtosis decreases at $h = 1$ as well, which can occur if one tail of the distribution (the high side) moves more than the other, making the distribution less skewed but also less peaked (more spread out). Indeed, the high percentiles move a lot, whereas the low percentiles, anchored by exporters, move comparatively less beyond initial periods, reducing skewness.

This finding that exporters' expectations are unresponsive while others react strongly suggests that firms with international exposure might have better access to information or hedging strategies that insulate their inflation outlooks from domestic shocks. It could also indicate that exporters place greater weight on global factors.

In practical terms, a domestic currency shock might call for a policy response or at least a communication response aimed at the domestic sector. For instance, the central bank could emphasize its commitment to the inflation target to reassure firms that the depreciation will not lead to runaway inflation, thereby trying to temper the jump in expectations among local firms.

5 Effect of global shocks on macro variables

To approximate to the channels we estimate the impulse response functions of the shocks over the monetary policy rate (MPR), the nominal exchange rate (NER), the country risk (EMBIuy), the GDP, the debt/GDP ratio and the inflation rate (CPI). These were the control variables in previous estimations. Table 7 summarizes the responses to the four shocks of relevant variables used as controls in our previous estimations.

Table 7: Impact of global shocks over macro variables – Summary of Effects

	Global monetary shock	Volatility shock	USD shock	NER shock
$NBDI$	No effect	⇑ (h=0,...,4)	⇑ (h=0,...,12)	
MPR	⇑ (h=5)	⇑ (h=0,...,4)	⇑ (h=2,5,7)	No effect
NER	⇓ (h=2,...,7,9,...,12)	⇑ (h=0,...,4)	⇑ (h=0,...,12)	⇑ (h=0,...,12)
$EMBIuy$	⇓ (h=2, 5)	⇑ (h=0,...,11)	⇑ (h=0,...,12)	⇑ (h=0,...,10,12)
GDP	⇓ (h=8,9)	⇓ (h=5)	No effect	⇓ (h=12)
$Debt/GDP$	No effect	No effect	No effect	⇑ (h=10,11,12)
CPI	⇑ (h=9)	⇑ (h=1,4,...,8)	No effect	⇑ (h=0,1,4,7,...,12)
$E_t^{p50}(\pi_{t+12})$	⇓ (h=0,1)	⇑ (h=5,6,8,11)	⇑ (h=1,...,7,9,...,12)	⇑ (h=1,...,12)
$E_t^{Std.Dv.}(\pi_{t+12})$	⇓ (h=3,6)	⇑ (h=0,2,6)	No effect	⇑ (h=0,1,3,5,...,9,12)

The global monetary shock (Figure 18) exerts no influence on the global value of the USD. The Central Bank of Uruguay takes an average of five months to raise its monetary policy rate. However, the impact on the local exchange rate manifests more rapidly, with the Uruguayan peso demonstrating an appreciation beginning in the second month following the shock and persisting thereafter. In a similar vein, the country risk (EMBI) index demonstrates a substantial decline within the two- to five-month period following the initial shock.

The shock has a contractionary effect on economic activity, which manifests itself in h=5 and h=6, and has no significant effect on the debt-to-GDP ratio. The shock has a lagged effect on inflation, at h=9.

A **global volatility shock** (Figure 19 exerts a markedly distinct effect compared to a global monetary shock. The impact of this phenomenon is immediate and far-reaching, encompassing the global value of the USD (NBDI), the local nominal exchange rate, and the country risk. The monetary authority's reaction of raising the monetary policy rate is immediate. The repercussions of the shock on these variables persist for a period of four months, with the exception of the EMBI, where they are characterized by heightened persistence. The level of activity exhibits a decline at h=5, which is likely attributable to the rise in the monetary policy rate. The Consumer Price Index (CPI) demonstrates a delayed response to changes in monetary policy, particularly following the conclusion of the policy's effect on the rate.

As in the case of volatility shock, a **shock to the global value of the USD** has an immediate impact on Uruguay's external financial variables, both on the value of the Uruguayan peso and on country risk. The central bank's reaction to this shock is more delayed, with the monetary policy rate increasing in response to a global appreciation of the USD starting in the second month after the shock. This shock has no effect on economic activity, indebtedness, or inflation.

In the case of a nominal exchange rate shock not caused by external factors (Figure 21), there is no effect on the monetary policy rate. However, there is a permanent increase in the nominal exchange rate, country risk, and inflation. Likewise, there is an increase in the debt-to-GDP ratio, probably due to the increase in the value of foreign currency debt and a decline in economic activity at the end of the first year after the shock.

Ultimately, the different shocks have heterogeneous effects on the variables relevant to the formation of expectations, with different timing and duration. This highlights the need to consider them when studying the reaction of inflation expectations to different external shocks.

6 Which is the transmission channel of the shocks to the firms´ inflation expectation distribution?

The nominal exchange rate (NER) consistently leads the response of expectations across shocks. Depreciations are followed by broad-based upward shifts in beliefs, while appreciations compress the upper tail. Exporters muted response to domestic NER shocks supports a currency cost insulation mechanism.

This section synthesizes the evidence from Section 4 (distributional responses of inflation expectations) and Section 5 (macroeconomic impulse response functions) to identify the variable that conveys global shocks to firms' inflation expectations. The macroeconomic variable that react most to shocks, and therefore seem to be relevant in the transmission of shocks, is the nominal exchange rate (NER), which is consistent with economic intuition in a small, open economy. We analyze the timing, signs, and magnitudes of the effects on the NER with respect to firms' responses, with the aim of approximating an explanation of the channel through which shocks are transmitted.

6.1 Exchange-Rate Channel Linking Global Shocks to Inflation Expectations

All four shocks analyzed share a strikingly consistent pattern: movements in the nominal exchange rate precede and match changes in expectations both in sign and timing. Table 8 summarizes the joint dynamics.

Table 8: Alignment between Exchange-Rate Movements and Inflation-Expectation Responses

Global shock	**NER response**	**Inflation-expectation response**	**Coincidence logic**
Contractionary global monetary policy	Peso appreciation beginning at $h = 2$	Immediate drop, stronger in upper percentiles	Stronger domestic currency ⇒ cheaper imports ⇒ lower expected inflation
Global volatility spike (VIX)	Immediate peso depreciation	Immediate, persistent rise across the distribution	Weaker currency ⇒ dearer imports ⇒ higher expected inflation
Global USD appreciation	Immediate and sustained peso depreciation	Sustained upward shift (mean, median, tails)	Same pass-through logic as above
Idiosyncratic peso depreciation	Permanent peso depreciation	Sharp jump for domestic-oriented firms; negligible effect for exporters	Exchange-rate pass-through muted for USD-hedged exporters

(i) Temporal Sequence: For every shock except the contractionary monetary surprise, both the NER and inflation expectations adjust in the contemporaneous month ($h = 0$). Other macroeconomic aggregates—CPI, GDP, EMBI—react only after several months, implying they cannot be the first informational signal or the firms. In the monetary shock, expectations decline in $h = 0{,}1$ while the NER appreciates from $h = 2$ onwards, suggesting that firms anticipate the exchange rate movement once the external policy signal is observed.

(ii) Sign and Magnitude Patterns: Across shocks, an *appreciation* of the peso uniformly reduces expected inflation, while a *depreciation* raises it. The magnitudes vary—larger for high-percentile expectations and when depreciation is sudden—but the sign never flips, underscoring the robustness of the exchange-rate pass-through.

(iii) Heterogeneity Across Firms: Distributional estimates reveal that exporters barely adjust to an idiosyncratic peso depreciation, whereas purely domestic firms respond sharply. This finding corroborates a currency-cost channel: exporters earn USD revenues and are therefore insulated from local-currency cost changes.

(iv) Complementary Amplifiers: The sovereign-risk spread (EMBI) moves in tandem with the NER in all but the monetary shock, potentially amplifying depreciation episodes via capital outflows. However, its movement is neither as immediate nor as universal as that of the exchange rate, pointing to a secondary rather than primary role in shaping expectations.

(v) Proposed transmission channel:

Global shock → *NER adjustment* → *expected import prices and marginal costs* → *firms inflation expectations*

The NER is observed daily and incorporated rapidly into firms pricing plans. Survey evidence shows that expectations update before realized CPI can reflect the shock, making the exchange rate the most plausible *leading* variable. This transmission is similar to the proposed by Frache and Lluberas (2019).

Joint examination of Sections 4 and 5 highlights the peso dollar nominal exchange rate as the dominant conduit through which global shocks influence firms inflation expectations. Policymakers aiming to anchor expectations must therefore monitor, explain, and where feasible stabilize the exchange rate, recognizing that monetary tightening or communication strategies will be less credible if exchange-rate pressures point in the opposite direction.

7 Conclusions

Global economic shocks can significantly influence domestic inflation expectations. This paper shows that the nature of the shock and the characteristics of firms matter for the transmission. Using Uruguayan firm survey data, we find that a credible, contractionary global monetary policy shock can actually *reduce* expected inflation domestically and align firms' forecasts more closely together. This suggests that when monetary policy is perceived as credible and well communicated, even if it is abroad, agents update their information in a way that reinforces the inflation target, consistent with sticky-information theories and the importance of policy credibility.

In contrast, global financial shocks tend to *unanchor* domestic inflation expectations upward, transmitted through the nominal exchange rate. After these shocks, firms broadly raise their inflation forecasts, posing a challenge for the central bank as even well anchored expectations can drift higher.

We also found important heterogeneities in how different firms respond. Domestically oriented firms react to shocks more immediately and strongly, whereas exporting firms often adjust with a delay or, in the case of a purely domestic currency shock, hardly at all. This implies that exporters either have buffers against domestic price fluctuations or greater confidence that such shocks are have transitory effects. Domestic market firms promptly incorporate a currency depreciation into higher inflation expectations, and their disagreement increases, indicating uncertainty about the magnitude of pass-through.

These differences mean that aggregate measures can mask divergent dynamics: for instance, after a global monetary shock, the aggregate persistence in lowered expectations is driven in part by exporters, even as local firms' responses are ephemeral.

From a policy perspective, our findings highlight the value of maintaining credibility and clear communication. A strong nominal anchor, and a credible monetary policy regime are essential when external shocks materialize: firms' expectations remain contained in response to a tightening abroad and disagreement can diminish as agents collectively trust the policy stance. However, global risk and exchange rate shocks require vigilance; policymakers might need to counteract the inflationary expectations pressure through communication or policy action to prevent a temporary shock from leading to a sustained shift in the expected inflation path. Additionally, the heterogeneity we document suggests that policymakers should tailor their communication to different audiences, in line with Medina *et al.* (2024). For example, after a large exchange rate movement, outreach to domestically focused firms might be important to reinforce the transitory nature of the shock and prevent an overreaction in inflation expectations.

In conclusion, examining the distribution of inflation expectations provides a richer picture of the expectation formation process in an open economy. Both the central tendency and the dispersion (and higher moments) of expectations yield insights into the state of anchoring. Moreover, distinguishing between types of firms reveals that global shocks do not affect all agents uniformly. Overall, our results highlight that strong monetary policy frameworks can mitigate the impact of global shocks, but continuous efforts are needed to communicate and uphold credibility, especially in the face of volatile global financial conditions. Keeping a close eye on the entire distribution of expectations can help central banks detect early signs of de-anchoring and address them before they become permanent.

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Appendix

A.1 identification of financial shocks

7.1 Reduced Form VAR Specification

Let

$$Y_t = \begin{pmatrix} \text{vix}_t \\ \text{dnbdi}_t \\ \text{dtc}_t \end{pmatrix}$$

be the 3×1 vector of endogenous variables, where:

- vix_t is the monthly VIX index, capturing market volatility;
- dnbdi_t is the change in the Nominal Broad Dollar Index, reflecting the global USD value;
- dtc_t is the monthly log change in the nominal exchange rate.

We augment this system with an exogenous global monetary policy proxy, mp_pm_t, which captures contemporaneous shifts in policy surprises. The reduced form VAR of order $p = 2$ is specified as:

$$A_0 Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + b_0 x_t^{\epsilon_m} + \varepsilon_t, \tag{3}$$

$$Y_t \;=\; A_1 \, Y_{t-1} \;+\; A_2 \, Y_{t-2} \;+\; C \, \text{mp\_pm}_t \;+\; u_t, \quad u_t \sim \mathcal{N}(0, \Sigma_u), \tag{4}$$

where $A_1, A_2 \in \mathbb{R}^{3\times3}$ capture the lagged inter dependencies, $C \in \mathbb{R}^{3\times1}$ measures the contemporaneous impact of the exogenous policy proxy, and u_t denotes the vector of reduced form residuals with covariance matrix Σ_u.

Estimation obtains estimates of A_1, A_2, and C, as well as the residuals u_t.

7.2 Identification of Structural Shocks

The reduced form residuals in (4) are generally contemporaneously correlated, preventing direct economic interpretation. To recover economically meaningful, orthogonal shocks, we impose a recursive (Cholesky) identification scheme. Specifically, we factorize the residual covariance matrix:

$$\Sigma_u \;=\; P \, P', \tag{5}$$

where P is a lower triangular matrix:

$$P = \begin{pmatrix} p_{11} & 0 & 0 \\ p_{21} & p_{22} & 0 \\ p_{31} & p_{32} & p_{33} \end{pmatrix}.$$

The implied structural form is obtained by pre multiplying the reduced form by P^{-1}:

$$P^{-1} Y_t \; = \; \sum_{i=1}^{2} (P^{-1} A_i)\, Y_{t-i} \; + \; P^{-1} C \,\mathrm{mp\_pm}_t \; + \; \varepsilon_t, \tag{6}$$

with structural shocks defined as

$$\varepsilon_t = P^{-1} u_t, \quad \mathrm{Var}(\varepsilon_t) = I_3. \tag{7}$$

By construction, the ordering

$$\mathrm{vix} \;\rightarrow\; \mathrm{dnbdi} \;\rightarrow\; \mathrm{dtc}$$

implies that contemporaneous innovations in the VIX affect the other variables within the same period, while shocks to the exchange rate do not feed back to VIX or DNBDI contemporaneously.

7.3 Recovery Procedure

The practical implementation consists of the following steps:

1. **Estimate reduced form VAR.** Obtain residuals u_t via separate predictions for each equation.
2. **Compute residual covariance.** Set $\widehat{\Sigma}_u = e(\Sigma)$.
3. **Cholesky decomposition.** Factorize $\widehat{\Sigma}_u = \widehat{P}\, \widehat{P}'$ using a lower triangular $\widehat{P}$.
4. **Invert $\widehat{P}$.** Compute $\widehat{B} = \widehat{P}^{-1}$.
5. **Recover shocks.** For each date t, form $\widehat{\varepsilon}_t = \widehat{B}\, u_t$ and store as new series.

This yields orthogonal structural innovations $\widehat{\varepsilon}_t = (\hat{\varepsilon}_{\mathrm{vix},t}, \hat{\varepsilon}_{\mathrm{dnbdi},t}, \hat{\varepsilon}_{\mathrm{dtc},t})'$ which are suitable for subsequent impulse response analysis or as exogenous instruments in local projection and instrumental variable frameworks.

By articulating the SVAR identification in this manner, we ensure a transparent and replicable procedure for isolating pure monetary policy surprises and tracing their propagation through volatility, global and domestic exchange rate dynamics.

7.4 Sensibility to global shocks order in VAR

Table 9: Correlation matrix between shocks generated in reverse global variables' order

	$\hat{\varepsilon}_{\text{vix},t}$	$\hat{\varepsilon}_{\text{dnbdi},t}$	$\hat{\varepsilon}_{\text{dtc},t}$	$\hat{\varepsilon}^{R}_{\text{dnbdi},t}$	$\hat{\varepsilon}^{R}_{\text{vix},t}$	$\hat{\varepsilon}^{R}_{\text{dtc},t}$
$\hat{\varepsilon}_{\text{vix},t}$	1.000					
$\hat{\varepsilon}_{\text{dnbdi},t}$	-0.018	1.000				
$\hat{\varepsilon}_{\text{dtc},t}$	-0.004	0.006	1.000			
$\hat{\varepsilon}^{R}_{\text{dnbdi},t}$	0.322	**0.941**	0.005	1.000		
$\hat{\varepsilon}^{R}_{\text{vix},t}$	**1.000**	-0.018	-0.004	0.322	1.000	
$\hat{\varepsilon}^{R}_{\text{dtc},t}$	0.018	-0.345	**0.937**	-0.320	0.018	1.000

A.2 Impulse responses to global monetary shock

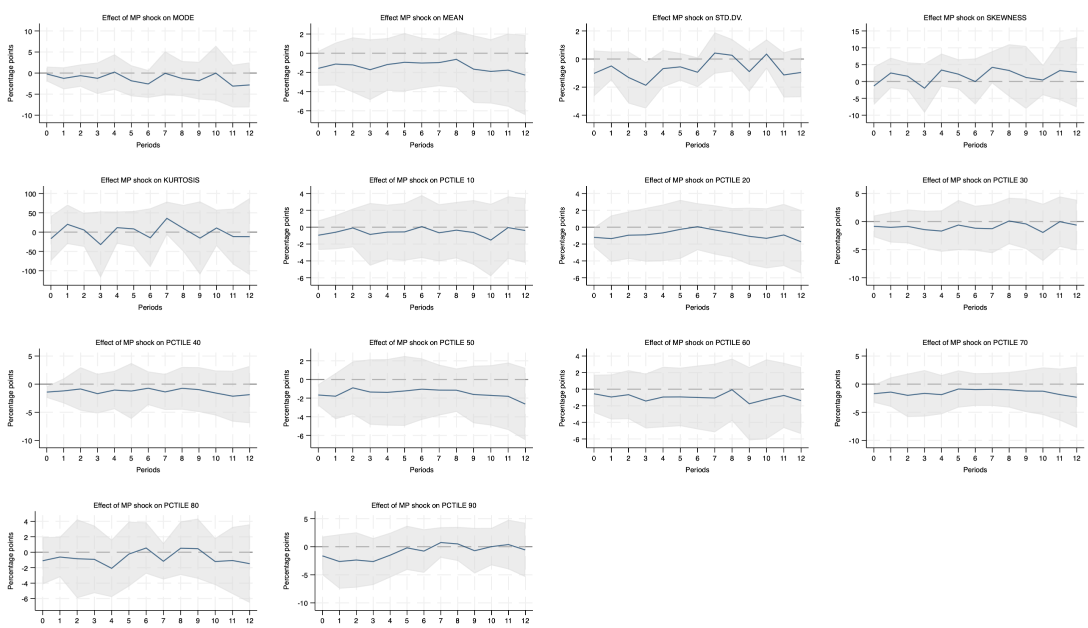

Figure 2: Impulse responses of **domestic firms'** inflation expectations to a global monetary policy shock

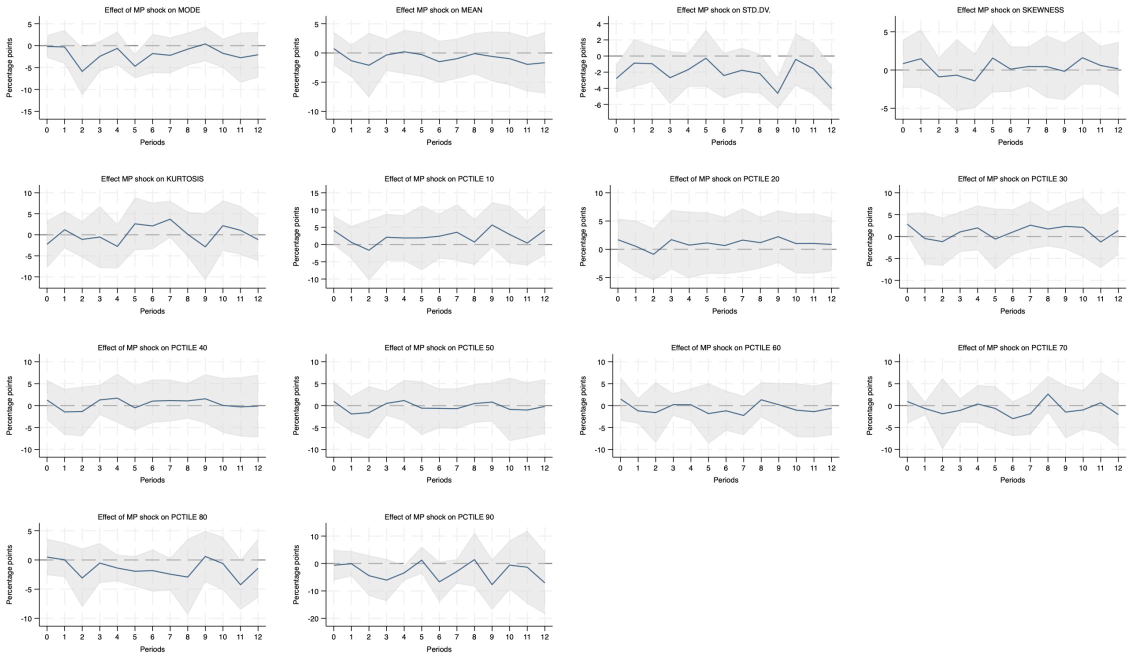

Figure 3: Impulse responses of **export firms'** inflation expectations to a global monetary policy shock

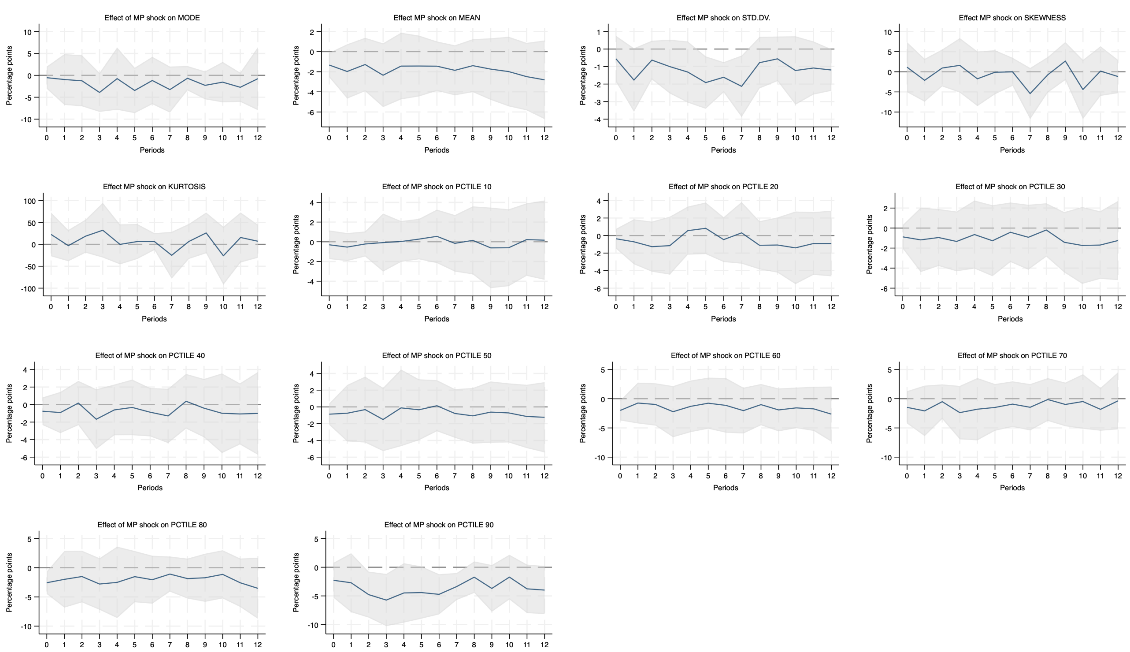

Figure 4: Impulse responses of **both markets firms'** inflation expectations to a global monetary policy shock

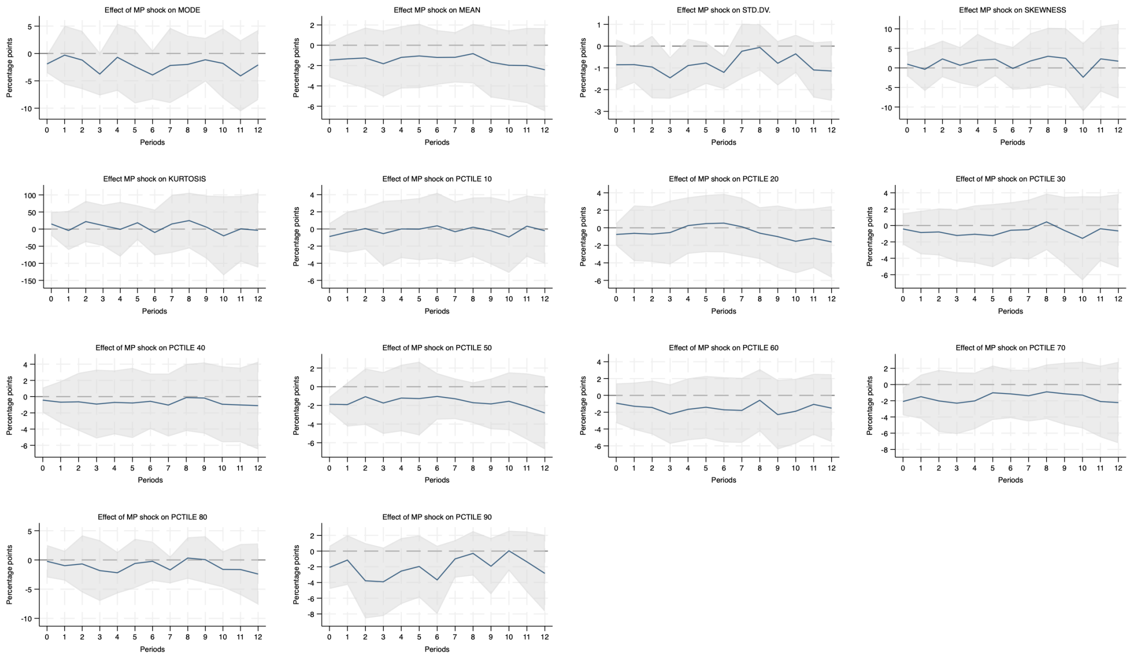

Figure 5: Impulse responses of **all firms'** inflation expectations to a global monetary policy shock

A.3 Impulse responses to global volatility shock

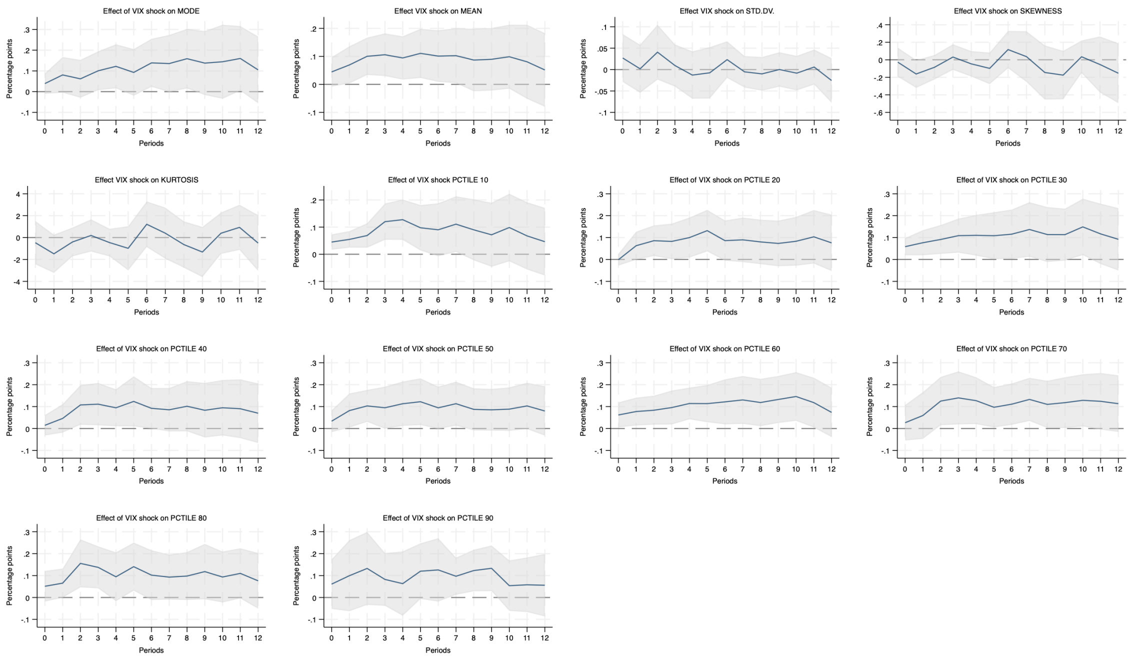

Figure 6: Impulse responses of **domestic firms'** inflation expectations to a global volatility shock

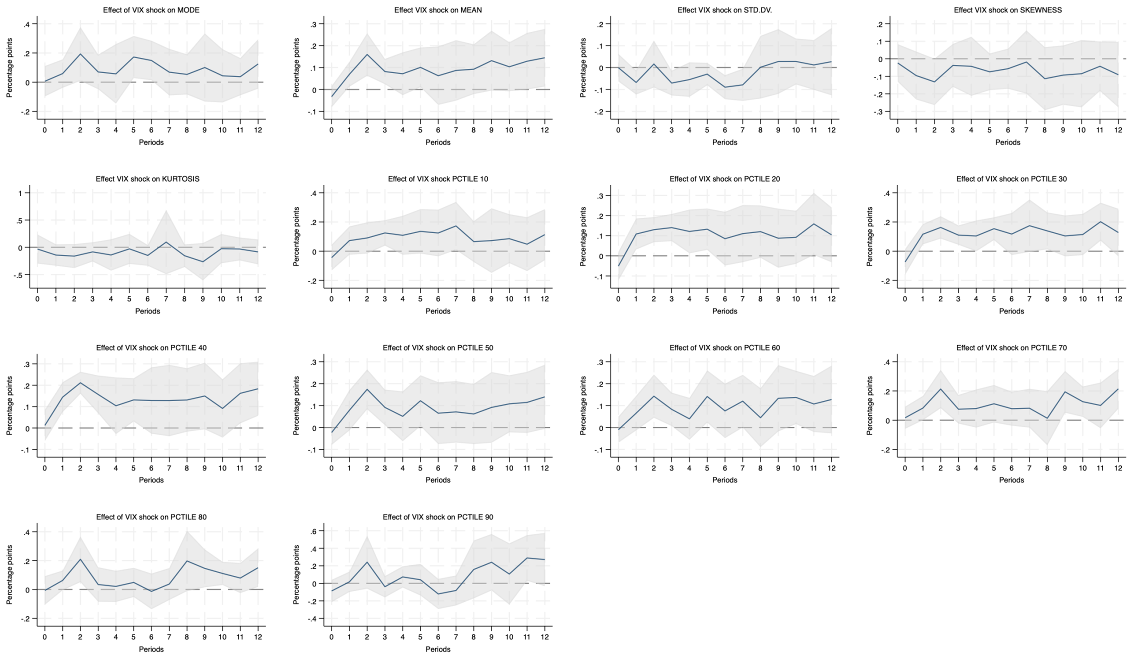

Figure 7: Impulse responses of **export firms'** inflation expectations to a global volatility shock

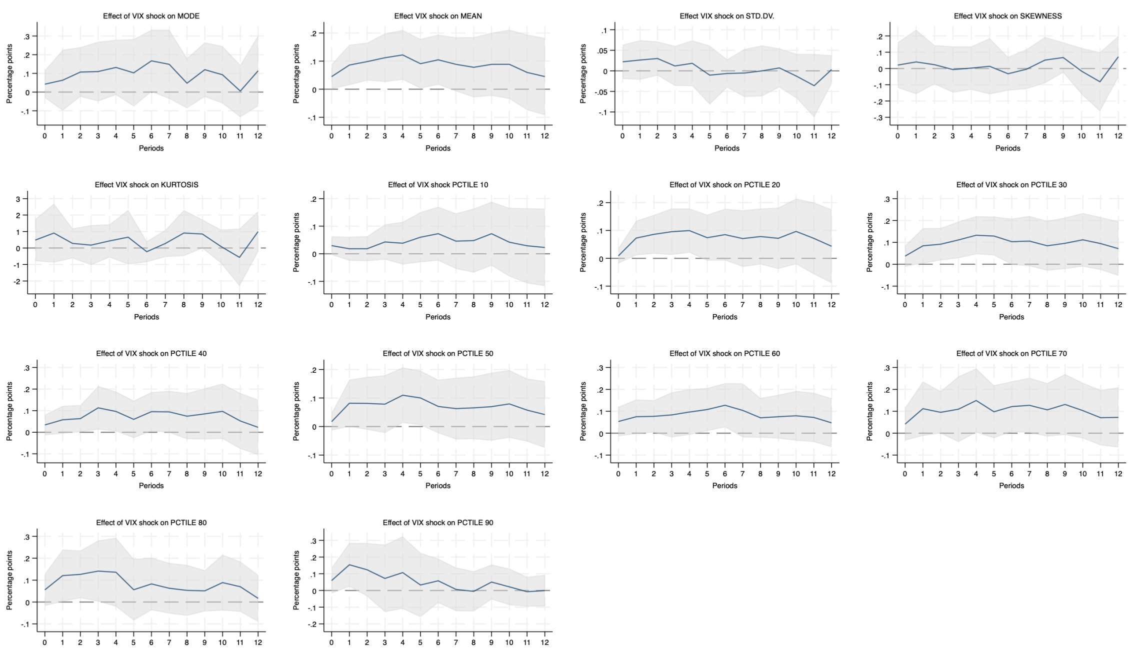

Figure 8: Impulse responses of **both markets firms'** inflation expectations to a global volatility shock

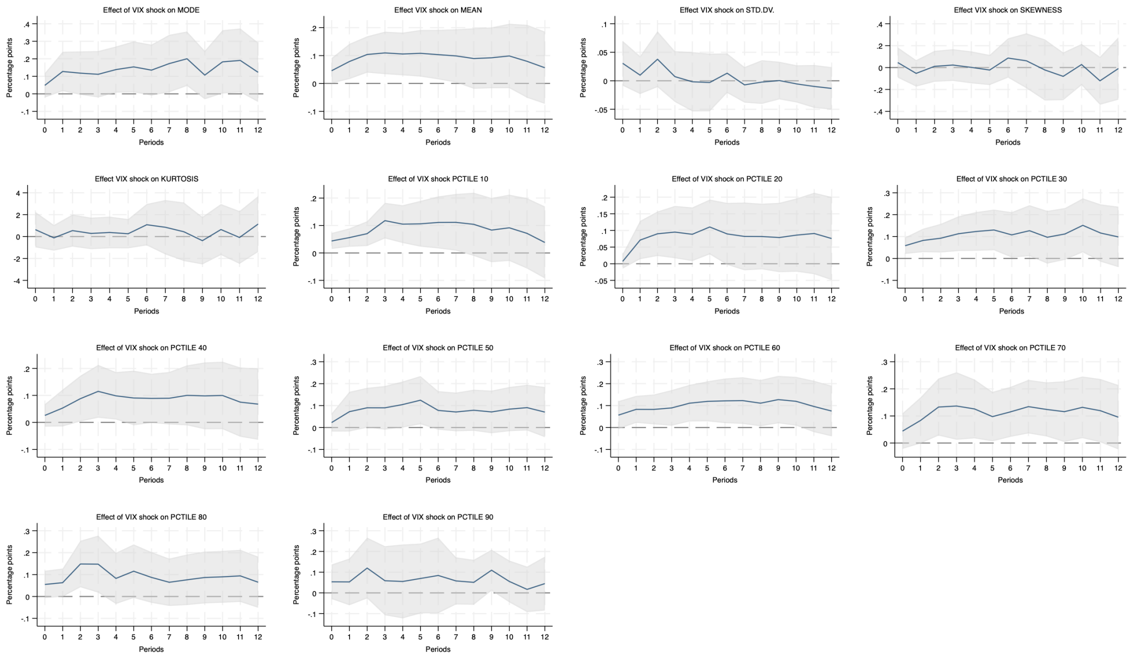

Figure 9: Impulse responses of **all firms'** inflation expectations to a global volatility shock

A.4 Impulse responses to global US Dollar

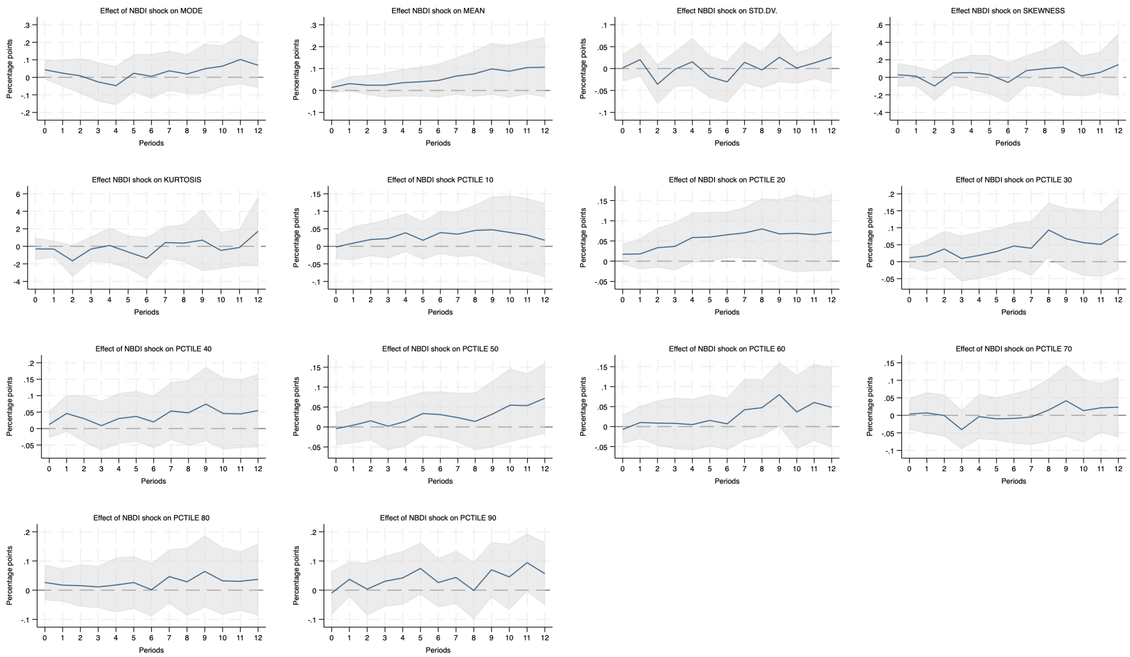

Figure 10: Impulse responses of **domestic firms'** inflation expectations to a global US Dollar shock

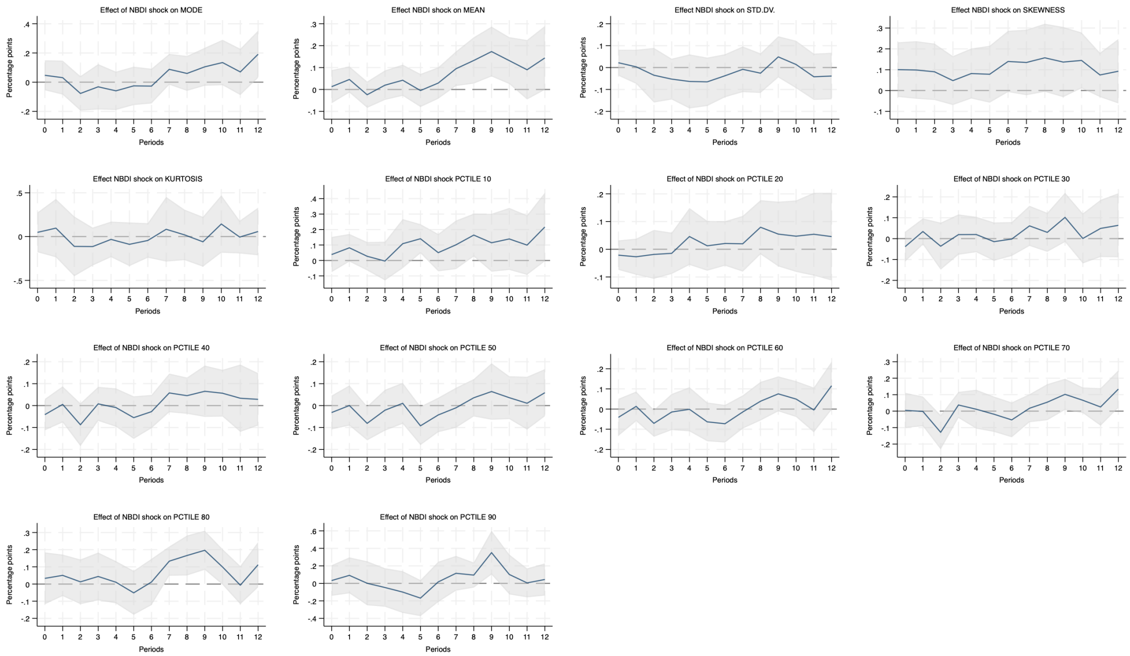

Figure 11: Impulse responses of **export firms'** inflation expectations to a global US Dollar shock

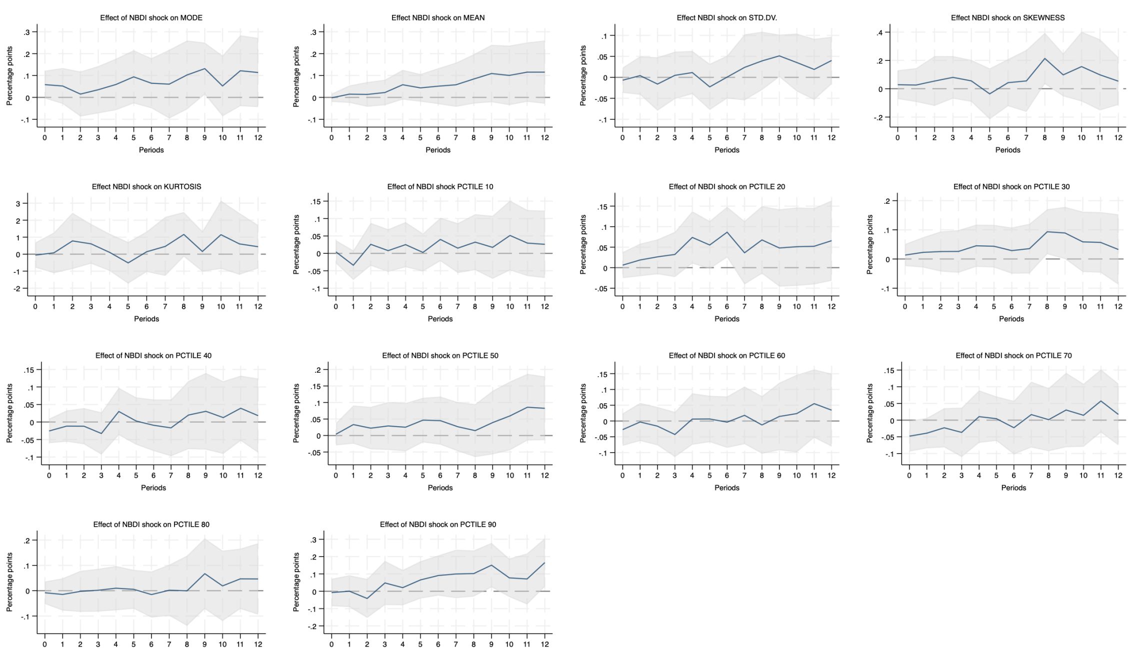

Figure 12: Impulse responses of **both markets firms'** inflation expectations to a global US Dollar shock

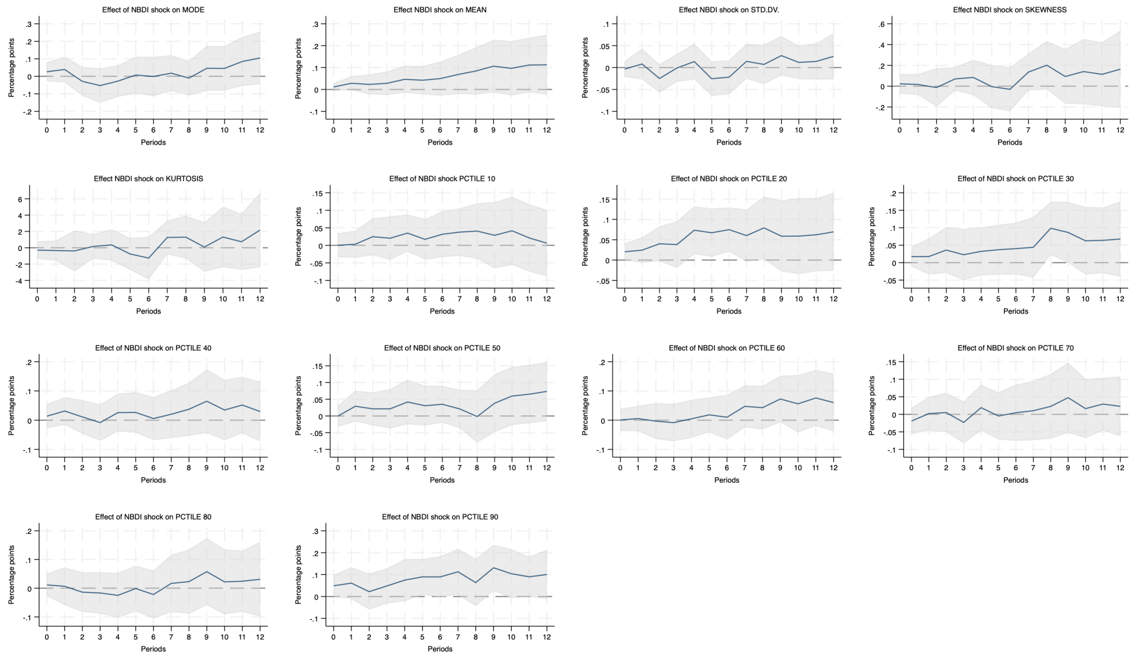

Figure 13: Impulse responses of **all firms'** inflation expectations to a global US Dollar shock

A.5 Impulse responses to global nominal exchange rate shock

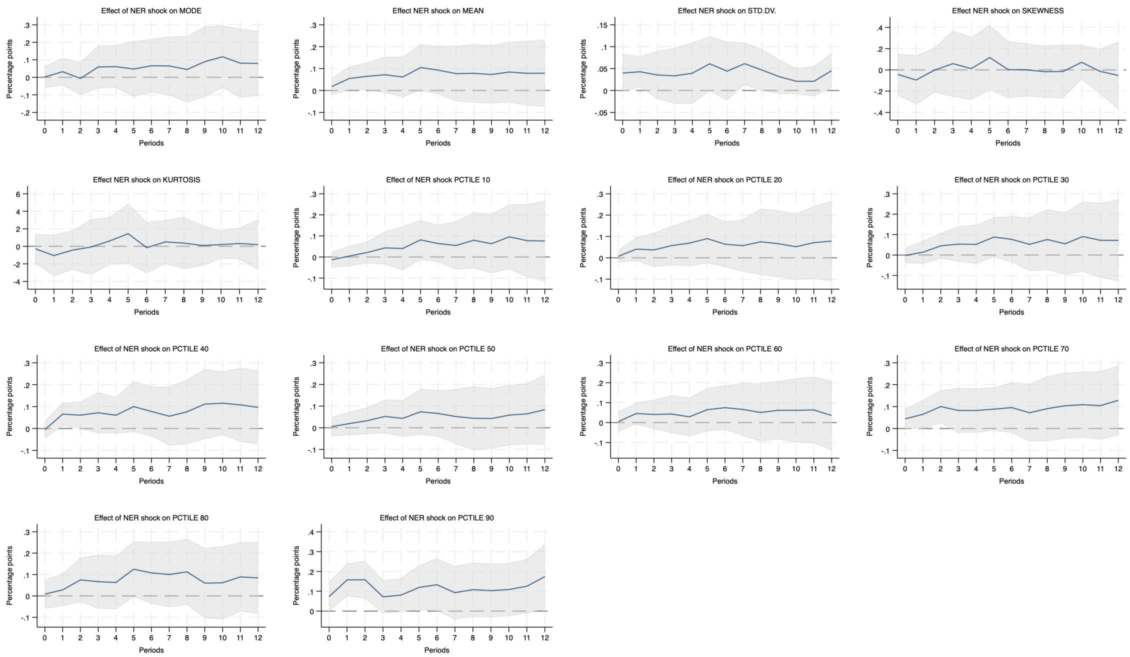

Figure 14: Impulse responses of **domestic firms'** inflation expectations to a nominal exchange rate shock

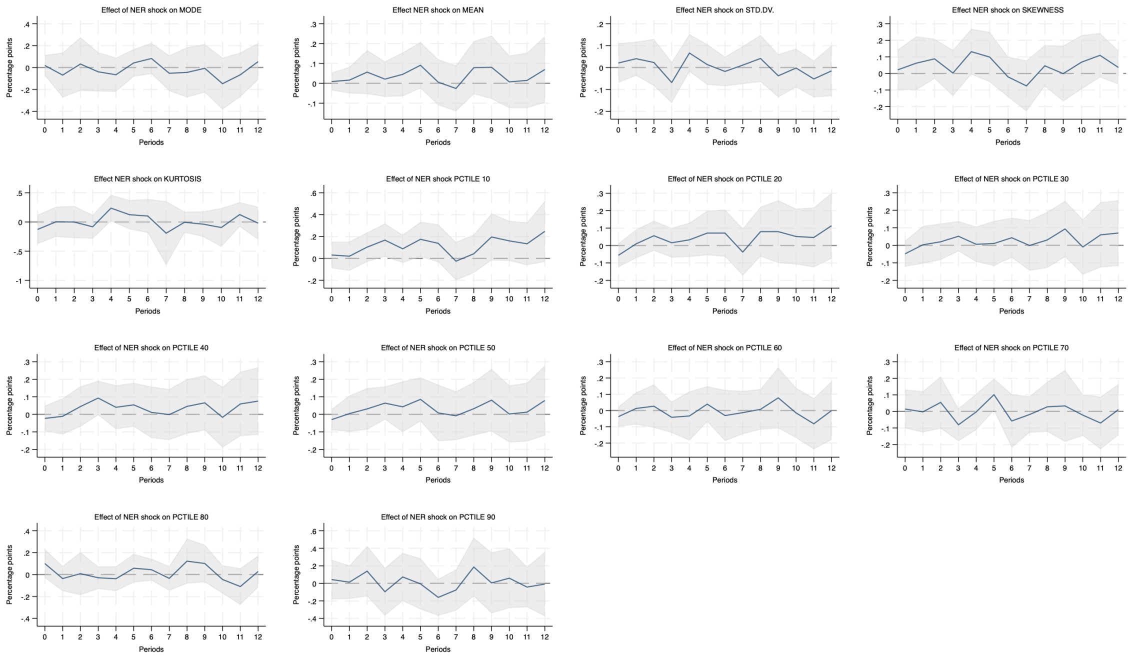

Figure 15: Impulse responses of **export firms'** inflation expectations to a nominal exchange rate shock

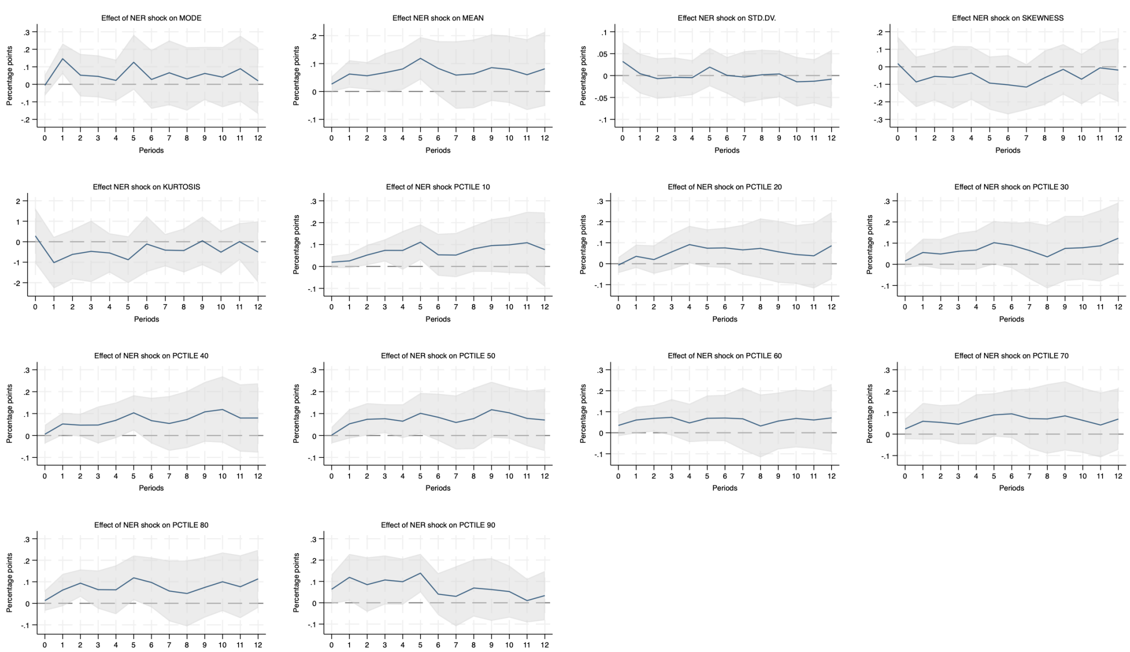

Figure 16: Impulse responses of **both markets firms'** inflation expectations to a nominal exchange rate shock

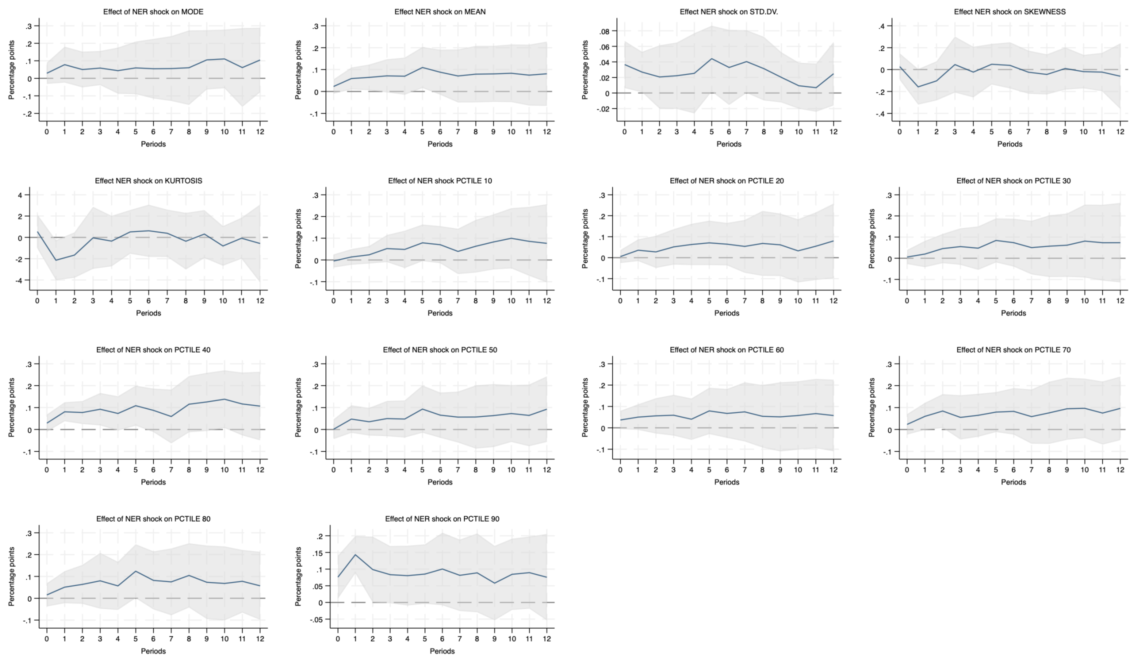

Figure 17: Impulse responses of **all firms'** inflation expectations to a nominal exchange rate shock

A.6 Impulse responses of macro variables to global shocks

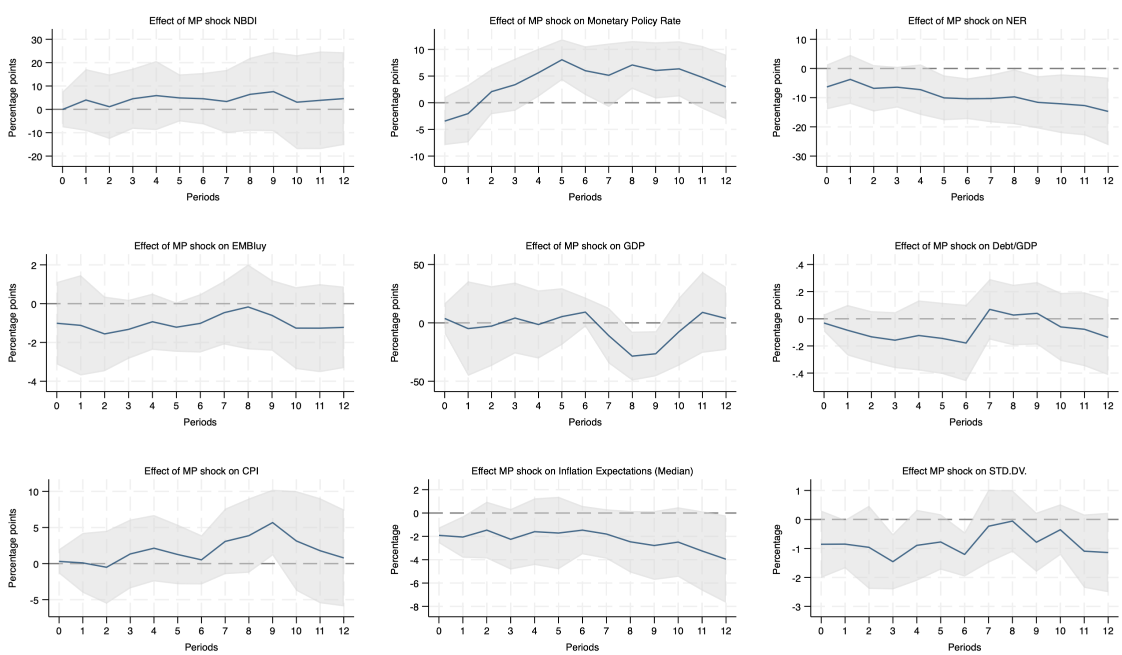

Figure 18: Impulse responses of macro variables to **global monetary shock**

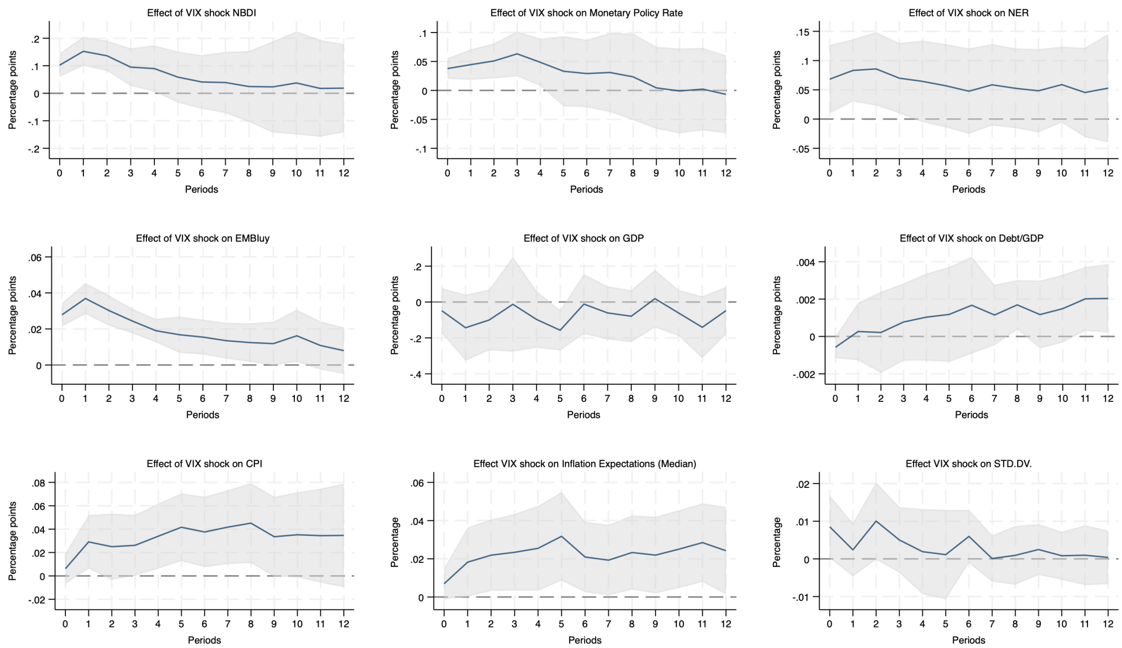

Figure 19: Impulse responses of macro variables to **volatility shock**

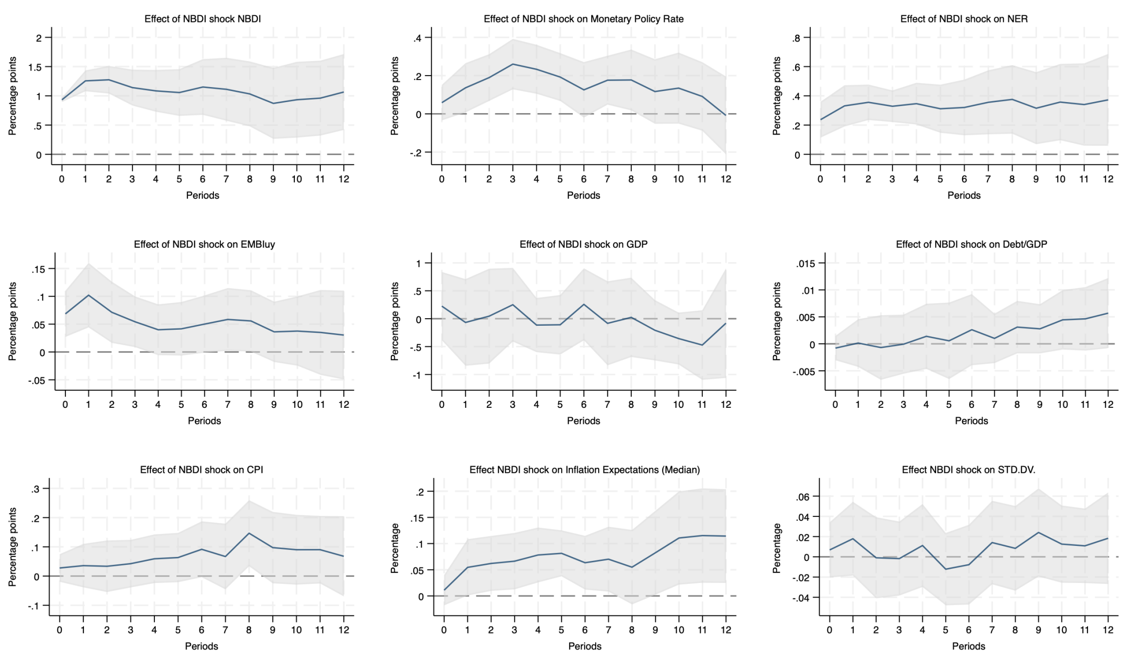

Figure 20: Impulse responses of macro variables to a **global US Dollar shock**

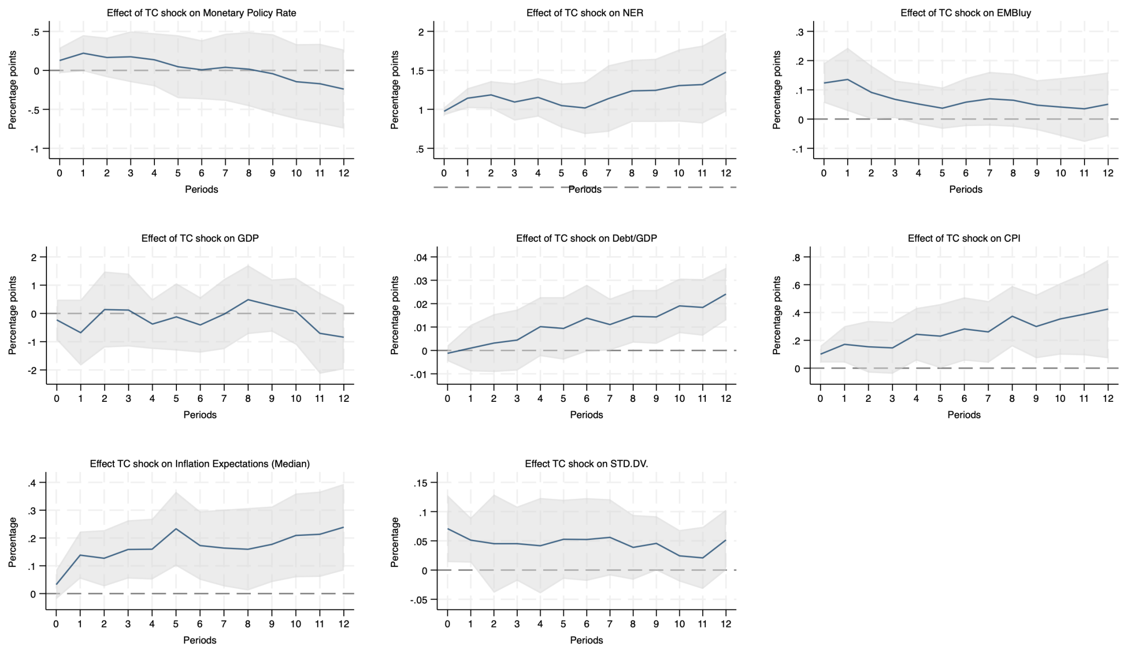

Figure 21: Impulse responses of macro variables to **nominal exchange rate shock**