Resolving Puzzles of Monetary Policy Transmission in Emerging Markets

Jongrim Ha, Dohan Kim, M. Ayhan Kose, Eswar Prasad

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Puzzles in Monetary Policy Transmission

Price and Exchange Rate Puzzles in EMEs

Price puzzle

Monetary tightening leads to an *increase* in inflation (Sims 1992; Christiano, Eichenbaum, and Evans 2005; Kim 2013)

"In a survey of 70 studies using VARs spanning 31 countries, half showed a price puzzle. This likely understates the pervasiveness of the result, since studies finding a price puzzle are less likely to get published in academic journals"
Rusnak, Havranek, and Horvath (JMCB, 2013)

Foreign exchange rate puzzle

With a positive domestic monetary shock, the currency either depreciates (*FX puzzle)* or appreciates only gradually for prolonged periods of up to a few years (*delayed overshooting)*

"Exchange rate depreciates in response to positive shocks to the interest rate differential in 37 out of 49 developing countries. Domestic currency tends to appreciate in developed countries but depreciate in developing countries"
Hnatkovska, Lahiri, and Vegh (AEJ-Macro, 2016)

Theoretical Motivation

Simple New Keynesian Model–Role of Inflation Expectations

$$R_t = \emptyset E_t \pi_{t+1} + r_t \quad (1)$$

$$y_t = E_t y_{t+1} - (R_t - E_t \pi_{t+1}) + d_t \quad (2)$$

$$\pi_t = k y_t + \beta E_t \pi_{t+1} + s_t \quad (3)$$

Where $x_t \equiv [r_t, d_t, s_t]^T$ is a vector of exogenous driving processes that follow the normal distribution of zero mean and a diagonal covariance matrix. y_t is defined as the deviation of output from its trend-path, π_t represents inflation, and R_t is the nominal interest rate. Inflation and interest rate are expressed in percentage deviations from their steady state values.

Puzzles: Interpretations and Solutions

Various Solutions Suggested in Advanced Economies; Emerging Markets?

1. **Omitted variables:** commodity prices, US/global variables, VIX, and other control variables

2. **New identification to avoid endogeneity issues**
   a) High-frequency identification (Nakamura and Stenson 2018; Gertler and Karadi 2015)
   b) Central bank information shocks (Romer and Romer 2004; Champagne and Sekkel 2020)
   c) Sign restrictions (Uhlig 2005, 2017)
   d) Cholesky with alternative ordering and other identifications (Bu et al. 2020)

3. **Sub-sample analysis:** focusing on "Periods with more aggressive policies" (Castelnuovo and Surico 2010)

4. **Cost-pushing channels:** liquidity cost, exchange-rate pass-through

5. **Emerging markets? Nascent literature with mixed results**
   - Data limitations, shorter history of inflation targeting, less developed financial markets in EMDEs
   - Specific only to county-specific evidence
   - Kohlscheen (2014, FX puzzle) vs. Solis (2023, no FX puzzle)

Research Questions

1. **Are monetary policy transmission channels consistent with theory in EMEs?** *Exchange rate and price puzzles based on conventional methodology.*

2. **What are the main causes of price and FX puzzles and what are the solutions?** *Omitted variables problem. Controlling for inflation, output, and FX expectations appears to resolve the puzzles in many EMEs.*

3. **Is there any causal relationship between price and FX puzzles?** *It appears that FX puzzle contributes to the price puzzle in EMDEs.*

4. **What are the conclusion and lessons?** *MP transmission works well in both AEs and EMEs. Identifying monetary policy shocks and forecasting price dynamics based on forward-looking variables, considering FX channel, reducing macroeconomic and financial market volatility, and anchoring inflation expectations.*

Summary of Findings

- **Monetary policy transmission works well in advanced economies as theory/literature suggests**.
  - *VAR models work well in identifying the effects of monetary policies.*

- **MP transmission in most EMEs—in particular Latin America—and some small open economies show puzzling movements of rising prices and currency depreciations based on conventional identification.**

- **Literature suggests different solutions to overcome the puzzles, and we test them in a unified framework.**
  - *Conventional solutions—different identification, FAVAR, the inclusion of commodity prices—do not overcome the puzzles.*
  - *Models augmented with forward-looking expectations appear to overcome the puzzles in many countries.*

=> ***Omitted Variables problem:*** *This indicates that the variables in the VAR system are not sufficient to capture future inflation developments, reflecting more volatile macroeconomic and financial conditions.*
  - Possibly reflecting supply-side shocks (e.g., currency depreciation), deviation from inflation expectations

- **The literature treats the price and FX puzzle separately, but a set of counter-factual-analysis and sign-restricted VARs suggest that the FX puzzle plays a key role in the price puzzle.**
  - *This supports the hypothesis that the price puzzle is driven by the cost-pushing channel of MP transmission.*

II. Empirical Methodology and Data

Empirical Framework

Country-specific Structural Vector Autoregressions with Exogenous Variables (SVAR-X)

Structural form $$AY_t = \sum_{i=1}^{p} B_i\, Y_{t-i} + \sum_{j=0}^{q} C_j\, X_{t-j} + \varepsilon_t$$

Reduced form $$Y_t = \sum_{i=1}^{p} \alpha_i\, Y_{t-i} + \sum_{j=1}^{q} \beta_j\, X_{t-j} + e_t$$

Shock Decomposition $$e_t = \begin{bmatrix} e_t^p \\ e_t^q \end{bmatrix} = S\varepsilon_t = [s^p s^q] \begin{bmatrix} \varepsilon_t^p \\ \varepsilon_t^q \end{bmatrix}$$

Workhorse: Impulse response functions on monetary policy shocks using Bayesian estimation

Main endogenous variables (6): Output (Y), price (P), monetary policy (MP), interest rates (Int), exchange rates (FX), equity prices (S)

Control variables (4+): International commodity price index (CMDT), US monetary policy instruments (USMP), VIX index (VIX), trends

Identification of Monetary Policy Shocks

Combination of Cholesky; External Instrument; Sign Restrictions

Identification	**Cholesky [baseline]**	**External instrument identification**		**Sign and zero restriction**		
Main references	Christian, Eichenbaum, Evans (2005)	Stock and Watson (2018) Gertler and Karadi (2015)	Romer and Romer (2004)	Uhlig (2005)	Forbes et al. (2018)	Kim and Lim (2018) Uhlig (2009)
Main feature	Taylor rule residual	High-frequency (Daily changes in market rates) as an external instrument for monetary policy shock	Single-equation identification with expectations for future inflation and output	Eliminate Price puzzle	Eliminate FX puzzle	Eliminate Liquidity puzzle
Y (output)	**0**	*	*	-	**0**	**0**
P (price)	**0**	*	*	-	**0**	**0**
MP (monetary policy)	+	+	+	+	+	+
FX (foreign exchange rate)	*	*	*	*	-	*
INT (short-term interest rates)	*	*	*	*	*	+
S (Equity prices)	*	*	*	*	*	*

Note: "0" indicates zero restrictions; "+" and "-"indicate sign restrictions of positive and negative responses, respectively. "*" indicate unrestricted.

Database

EMEs and Small Advanced Economies with Flexible Exchange Regime

Database: 15+ small open AEs and EMEs (inflation targeting/ flexible exchange rates),
4 EMDEs (fixed exchange rates), 5 large advanced economies (flexible exchange rates)

Sample Period: 2000-2019 as a baseline (2020-22 extension), monthly data

Country Groups

	Baseline SOEs	Alternative I	Alternative II
Income Group	EMEs + small open AEs	AEs (G5)	EMEs
Policy regime	Inflation targets + flexible Exchange	Inflation targets + flexible Exchange	Pegged exchange rate regime
List	BRA, CHL, HUN, IND, IDN, MEX, PER, PHL, POL, ROM, UKR, RUS, THA, TUR, ZAF, KOR, CHE, SWE	USA, GBR, DEU, CAN, JPN	CHN, MYS, EGY, SAU

Database

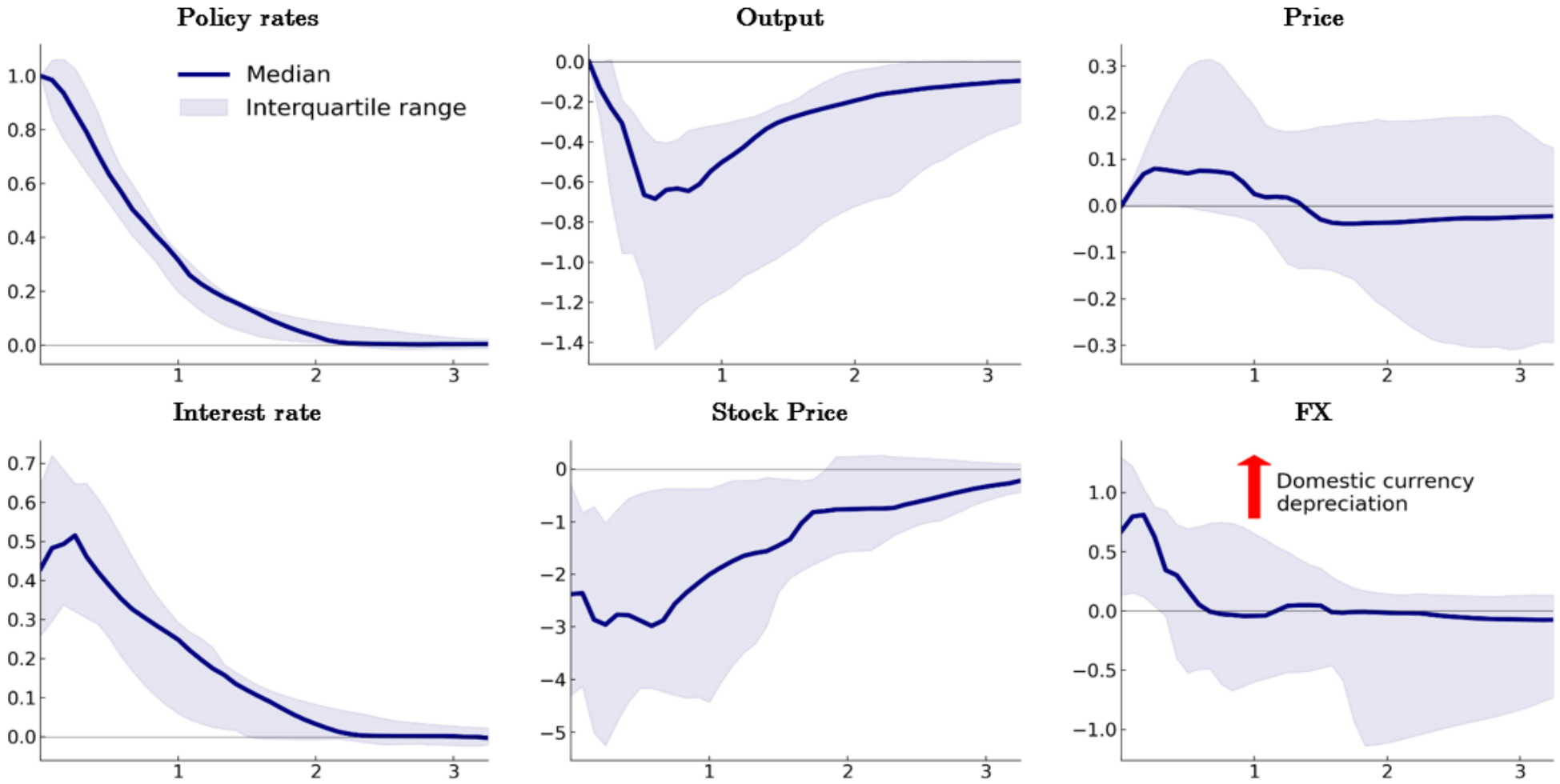
Expectations based on Professional, Consumer, and Business Surveys

Country	Market surveys and descriptions	Data sources
BRA	Expectations for output, inflation, interest rates, and FX rates, based on *Focus Market Readout* forecasts of about 160 banks, asset managers, and other institutions	Central Banco Brazil
CHL	Expectations for inflation and interest rates based on monthly surveys of academics, consultants, and executives or advisors of financial institutions and corporations.	Central Bank of Chile
HUN	Professional forecasts on future inflation, output, FX rates	Consensus Economics
IND	Professional forecasts on future inflation, output	Consensus Economics
IDN	Professional forecasts on future inflation, output, FX rates	Consensus Economics
MEX	Expectations for output, inflation, interest rates, and FX rates based on monthly surveys of private-sector economists	Bank of Mexico
PER	Median expectations for output, inflation, interest rates, and FX rates, based monthly survey of macroeconomic expectations	Central Reserve Bank of Peru
PHL	Consumer expectations surveys on future inflation and output growth	Central Bank of Philippines
POL	Consumer expectations for future Inflation and output growth	National Central Bank of Poland Central Statistical Office
ROM	Professional forecasts on future inflation and output	Consensus Economics
UKR	Professional forecasts on future inflation, output, FX rates	Consensus Economics
RUS	Monthly inflation expectations for the next year	Central Bank of the Russian Federation
TUR	Monthly survey of expectations for future output, inflation, interest rates, and FX rates,	Central Reserve Bank of Turkey
THA	Professional forecasts on future inflation and output	Consensus Economics
ZAF	Bureau of Economic Research Inflation expectations for current and next years South African Chamber of Commerce and Industry Business Confidence Index	Bureau of Economic Research South African Chamber of Commerce and Industry
KOR	Monthly consumer survey index of inflation expectations	Bank of Korea
SWE	Monthly consumer trend survey of the general economic situation and inflation	National Institute of Economic Research

III. Empirical Results

Open-economy SVAR models: Conventional Cholesky VAR

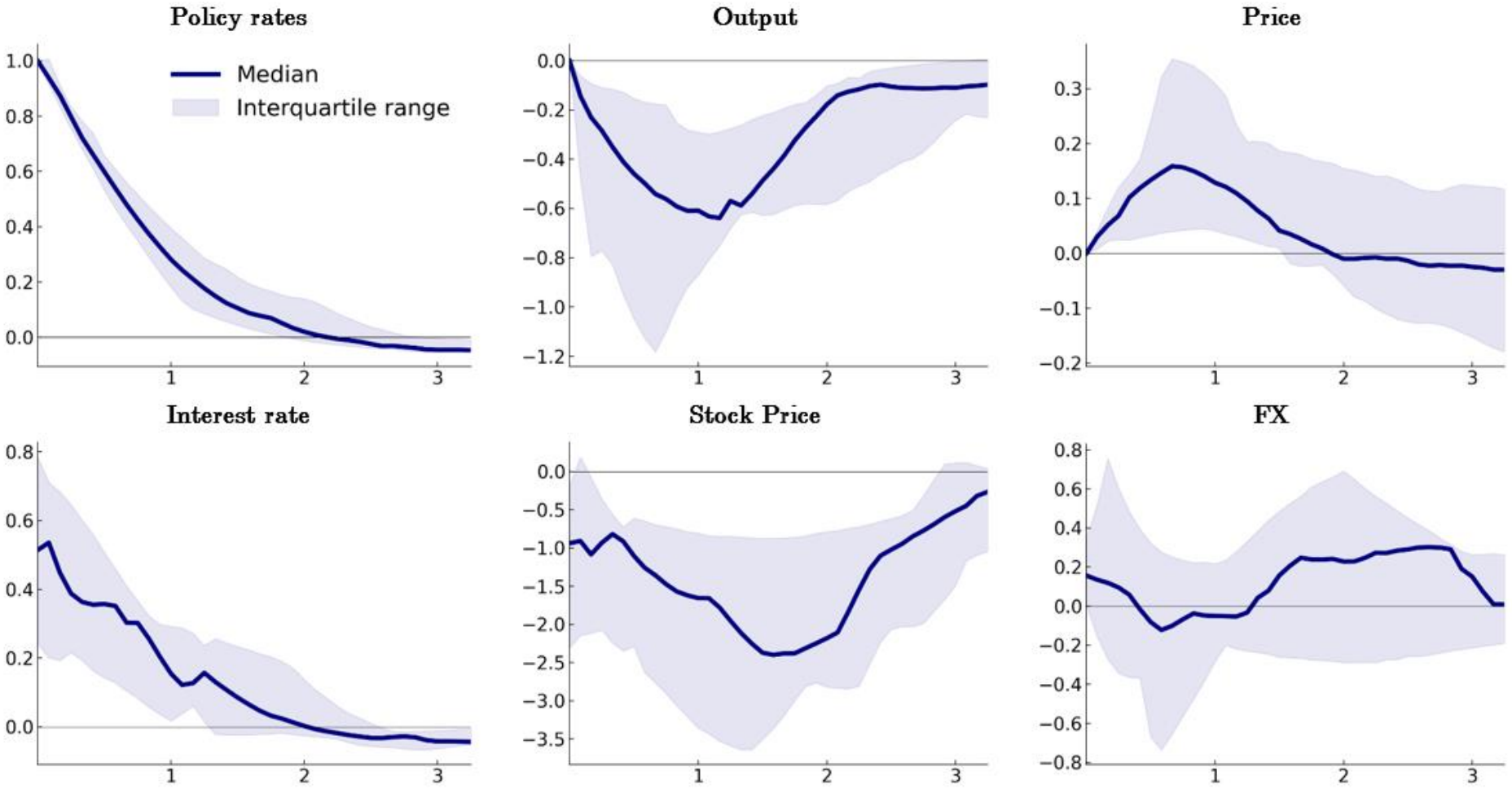
Price and FX puzzles



Note: Impulse response functions in the median country across 15 EMEs, following a 1 percentage point contractionary monetary policy shock. The monthly SVAR models include output, prices, monetary policy instruments, short-term interest rates, exchange rates (per USD), and stock prices with control variables of commodity prices, US policy rates, VIX, and deterministic trends. The shade areas indicate interquartile ranges. The Y-axis indicates percent or percentage point, and the X-axis indicates years.

Open-economy SVAR models: Factor-augmented VAR

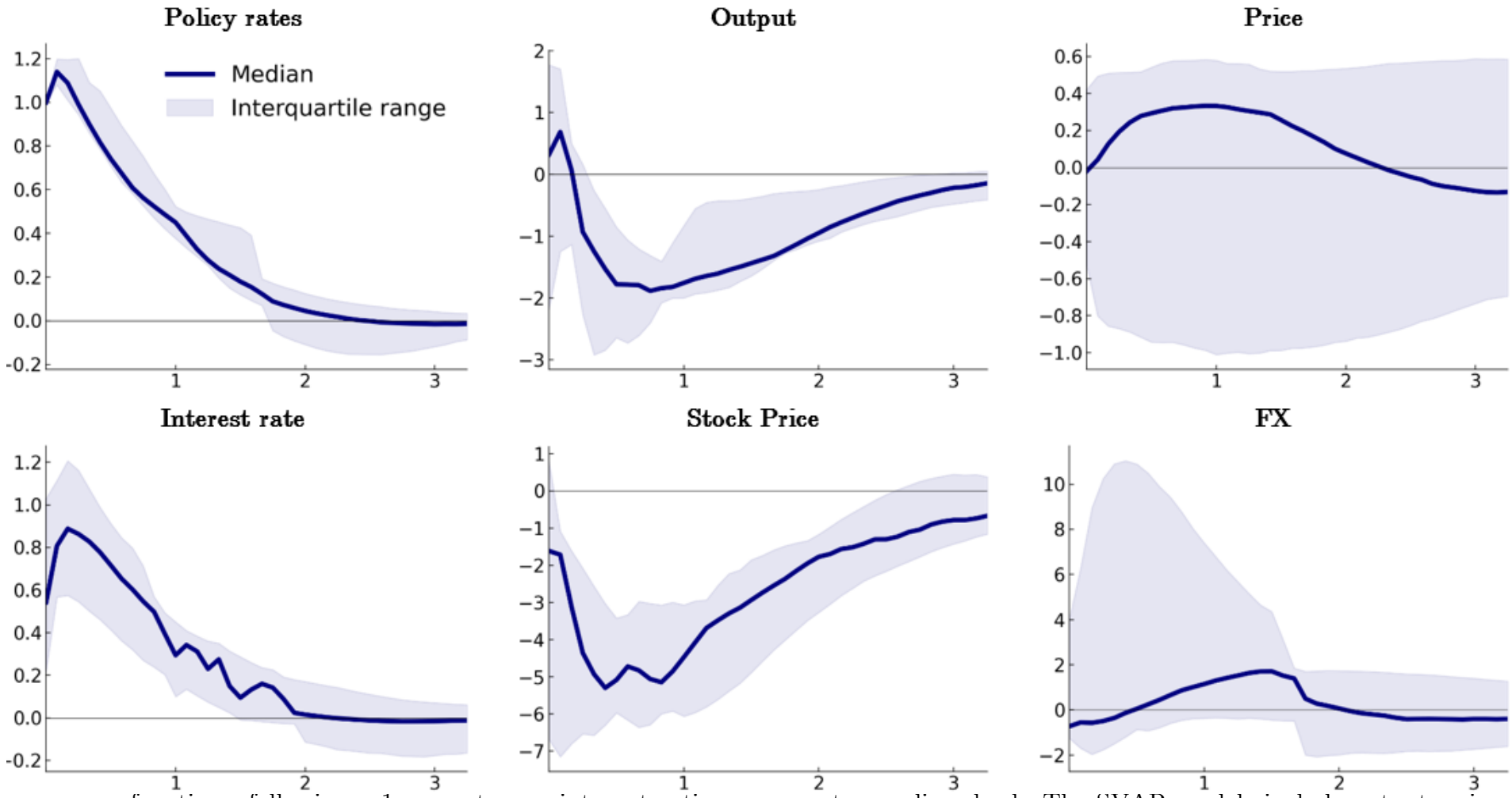
Price and FX puzzles…



Note: Impulse response functions in the median country across 15 EMEs, following a 1 percentage point contractionary monetary policy shock. The monthly factor-augmented SVAR models consist of five global and five domestic variables--output, prices, monetary policy instruments, short-term interest rates, exchange rates (per USD), and stock prices. Shaded areas indicate interquartile ranges. The Y-axis indicates percent, and the X-axis indicates years.

Open-economy SVAR models: High-frequency Proxy VAR

Price and FX puzzles…

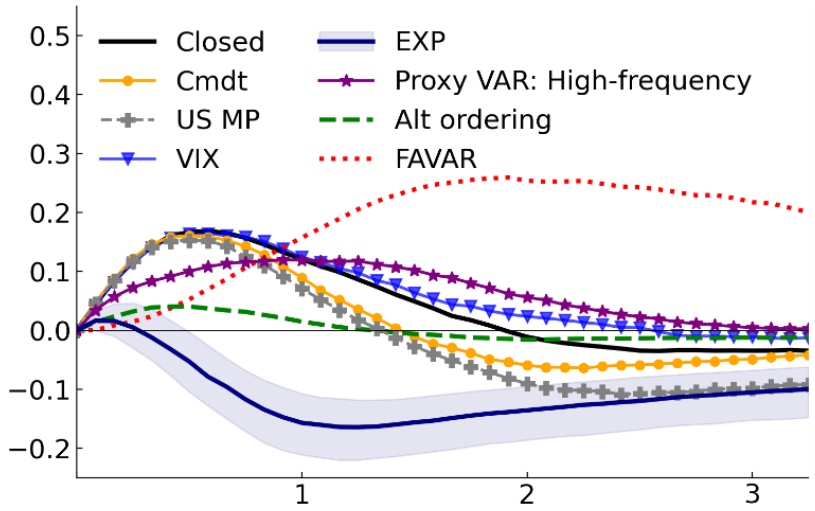


Note: Impulse response functions, following a 1 percentage point contractionary monetary policy shock. The SVAR models include output, prices, monetary policy instruments, short-term interest rates, exchange rates (per USD), and stock prices with control variables of commodity prices, US policy rates, VIX, and deterministic trends. Monetary policy shocks are identified using the external instrument (daily movements of overnight rates). Shaded areas indicate interquartile ranges. The Y-axis indicates percent, and the X-axis indicates years.

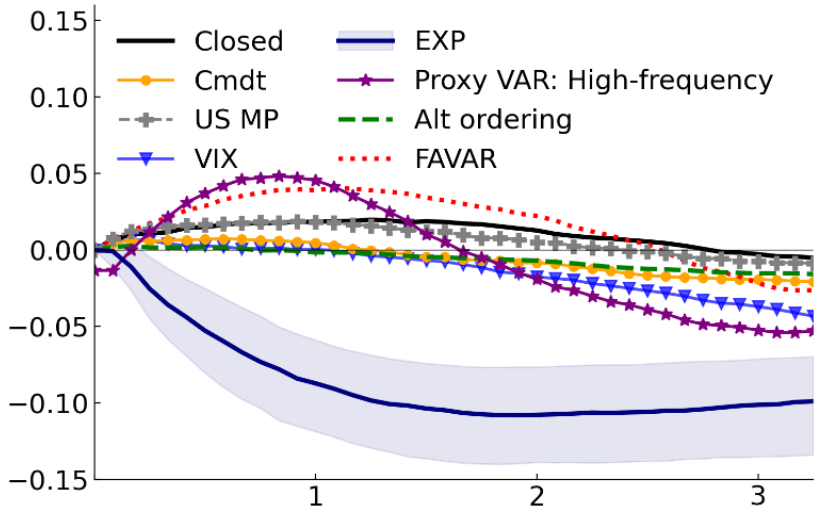
Open-economy SVAR models: Other considerations

Evidence of Price and FX puzzles

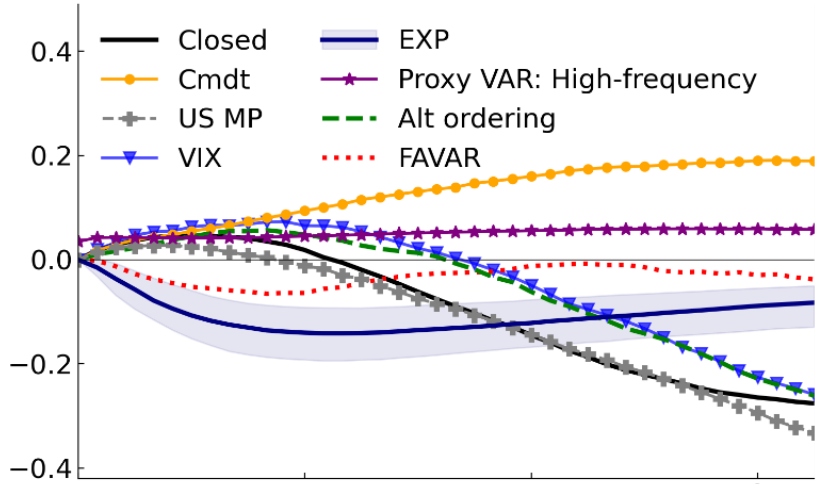
Brazil



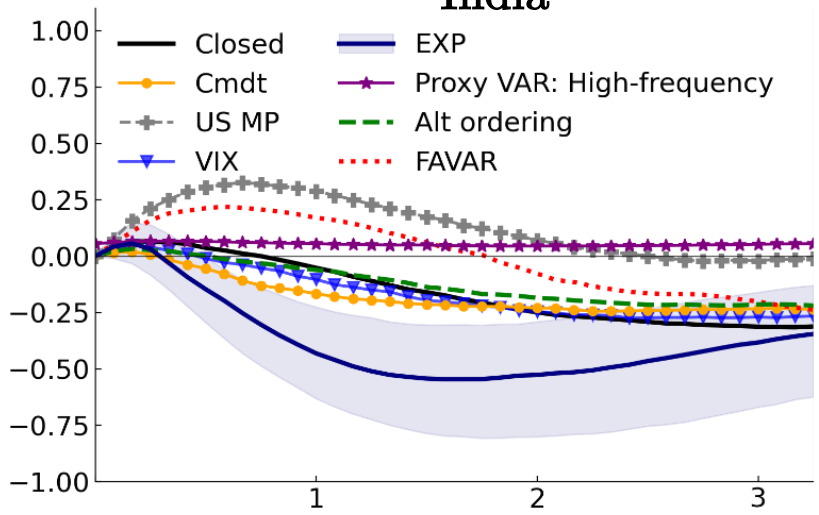
Mexico



Chile

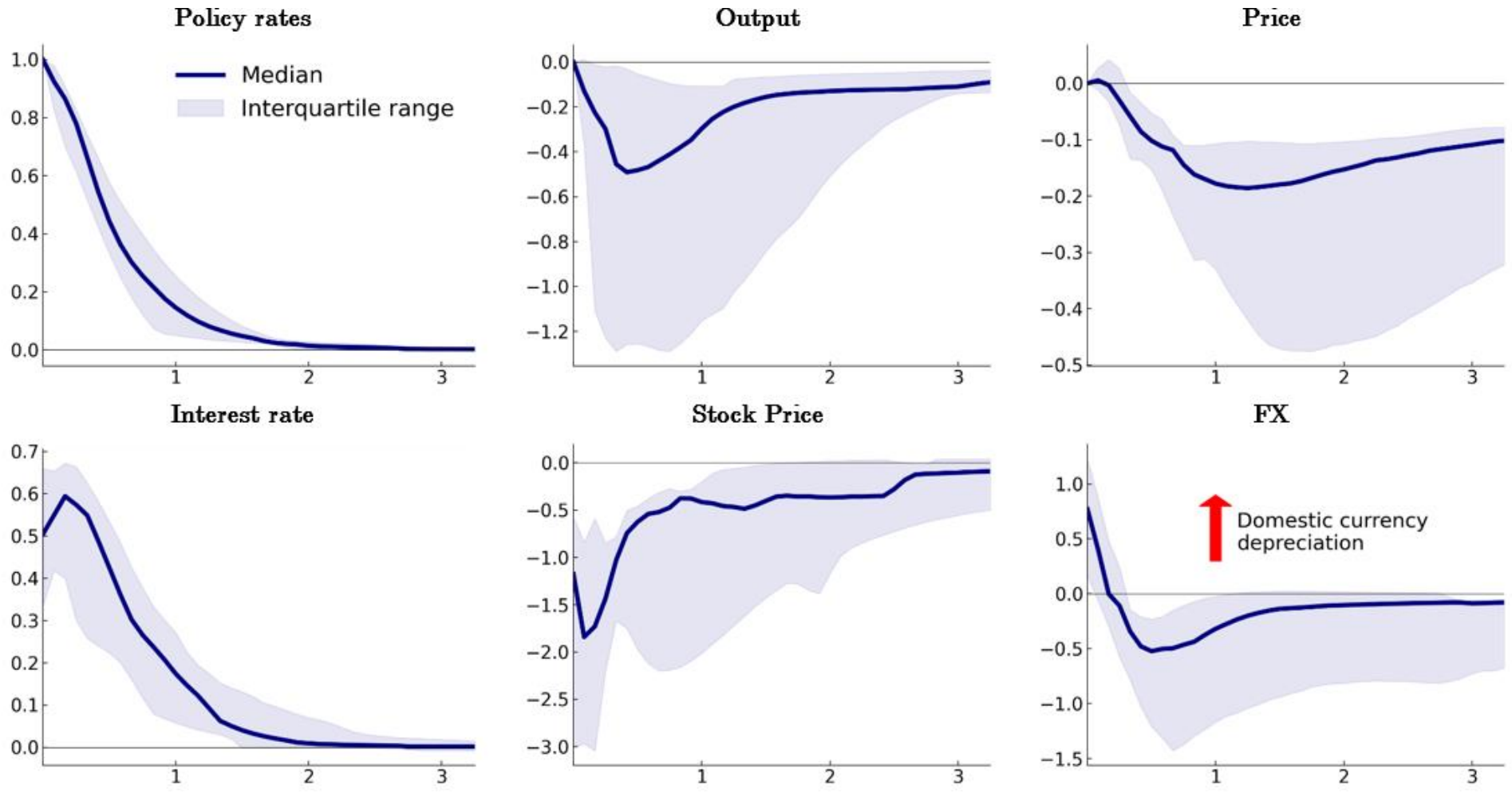


India



Open-economy SVAR models augmented with Expectations

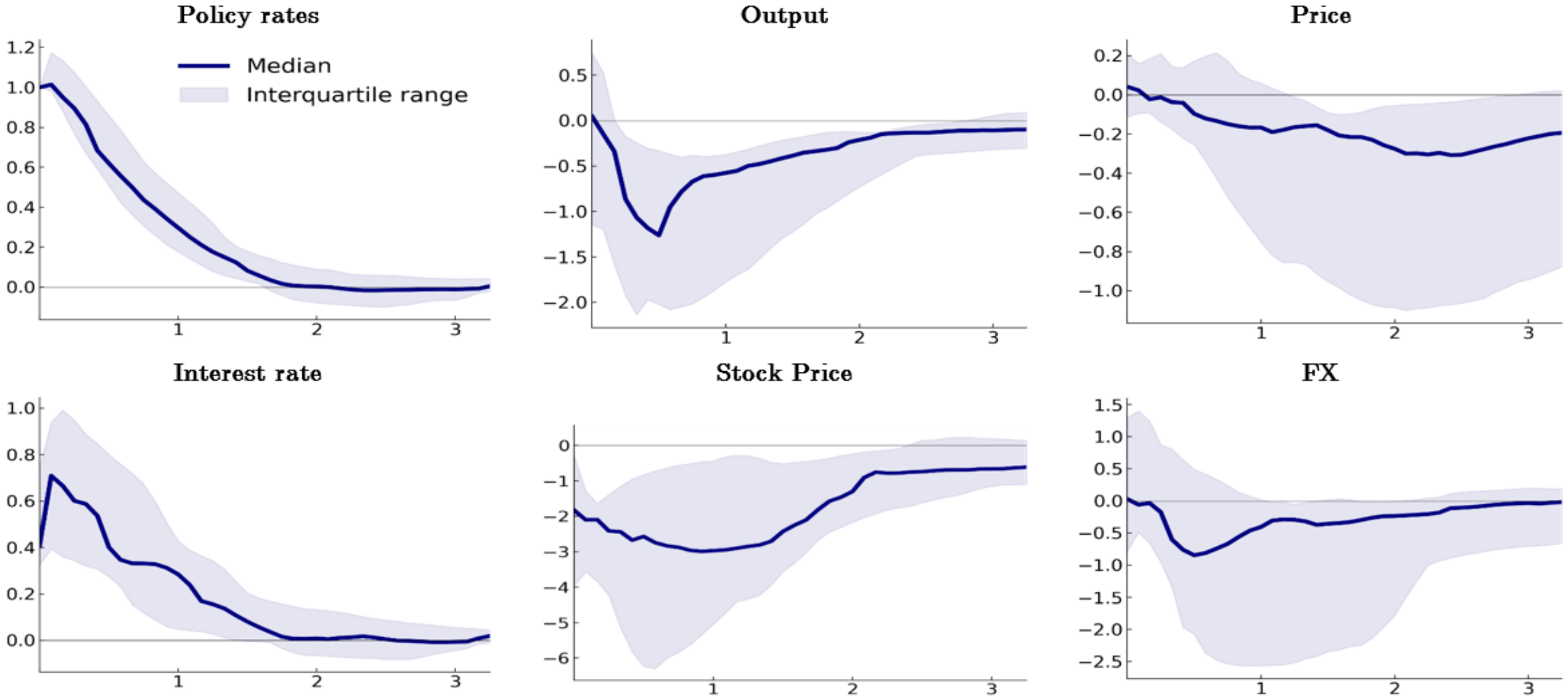
Little Evidence of Price and FX puzzles



Note: Impulse response functions in the median country across 15 EMEs, following a 1 percentage point contractionary monetary policy shock. The monthly SVAR models include output, prices, monetary policy instruments, short-term interest rates, exchange rates (per USD), and stock prices with control variables of inflation (and GDP/FX) expectations, commodity prices, US policy rates, VIX, and deterministic trends. The shade areas indicate interquartile ranges. The Y-axis indicates percent or percentage point, and the X-axis indicates years.

Robustness Check: Proxy VAR with expectations

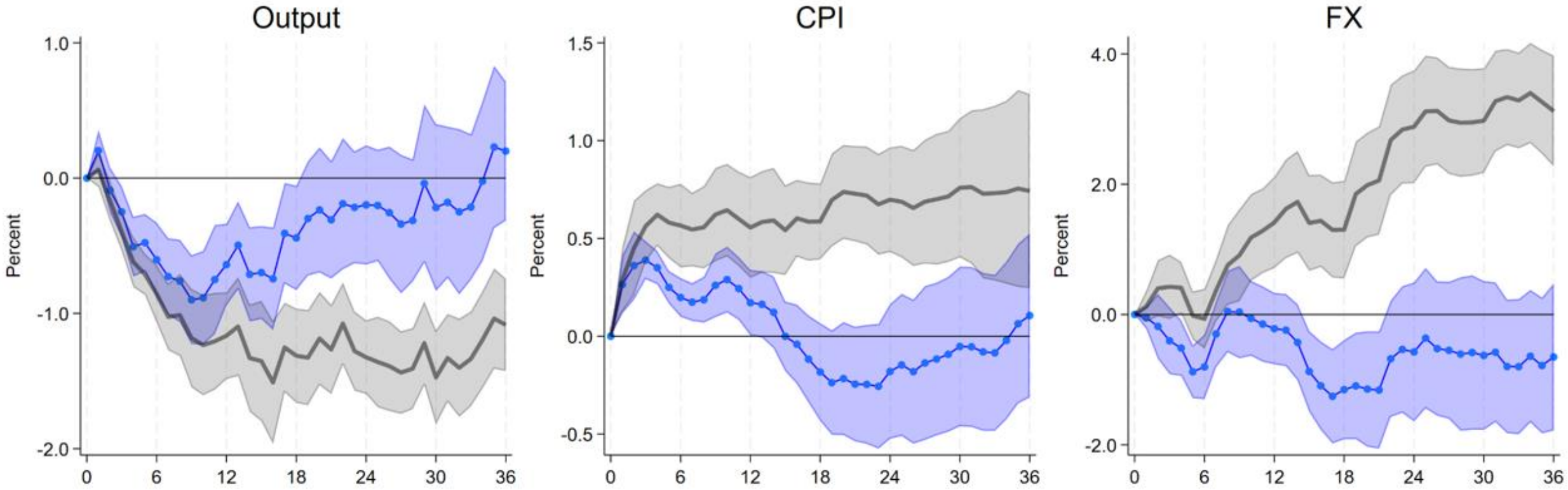
Little Evidence of Price and FX puzzles



Note: Impulse response functions in the median country across 15 EMEs, following a 1 percentage point contractionary monetary policy shock. The SVAR models include output, prices, monetary policy instruments, short-term interest rates, exchange rates (per USD), and stock prices with control variables of commodity prices, US policy rates, VIX, and deterministic trends. Monetary policy shocks are identified using the approach developed by Romer and Romer (2004). Shaded areas indicate 68% confidence intervals. The Y-axis indicates percent, and the X-axis indicates years.

Robustness Checks: Local Projections with Expectations

Little Evidence of Price and FX Puzzles



Note: Impulse response functions based on the local projections method. 15 EMEs are included. The blue dotted line represents the responses to a 1 percentage point contractionary monetary policy shock and the shaded areas are 68% confidence bands. The black lines indicate the responses to a 1 percentage point increase in the policy rate. Control variables include world commodity price index, US shadow interest rate, and CBOE volatility index. The X-axis indicates months.

III. Empirical Results (More details)

Models with expectations: More details-(1)

Inflation expectations matter more

Regression of monetary policy residuals and expectations data

	$E\pi_t$ (Inflation expectations)	Ey_t (GDP expectations)	EFX_t (FX expectations)
BRA	0.05** (0.02)	-0.003 (0.009)	-0.009 (0.02)
MEX	0.12*** (0.01)	0.01 (0.79)	-0.005* (0.003)
CHL	0.10*** (0.02)	-0.000 (0.006)	0.05 (0.07)
IND	-0.02 (0.01)	0.004 (0.005)	
HUN	-0.003 (0.003)	-0.001 (0.003)	
KOR	0.03*** (0.009)	-0.004 (0.004)	
PER	0.03*** (0.003)	0.005*** (0.001)	0.02** (0.007)
PHL	0.02** (0.005)	-0.001 (0.005)	
POL	-0.006 (0.004)	0.00 (0.08)	0.002** (0.001)
ROM	0.01*** (0.002)	0.001 (0.005)	
RUS	0.03*** (0.003)	0.002 (0.003)	0.17** (0.07)
TUR	0.05*** (0.003)	0.003 (0.008)	0.03* (0.02)

Note: This regression reports the coefficients of VAR residuals of monetary policy instruments on expectations for future output, inflation, and FX rates. *** ** * indicate statistically significant at the 1%, 5%, and 10%, respectively. The number in the parenthesis indicates robust standard errors.

Models with expectations: More details-(2)

Deviations from expectations matter

Regression of monetary policy residuals and decomposed inflation expectations

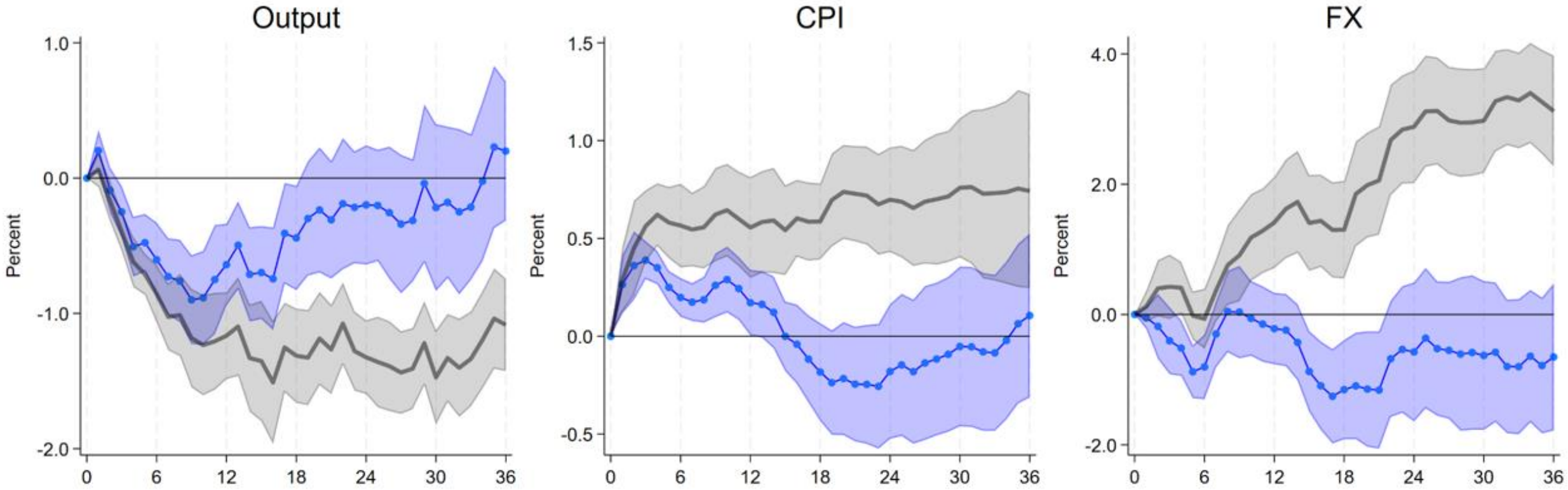
$$E\pi_t = (E\pi_t - E\pi_{t-1}) + (E\pi_{t-1} - \pi^*) + \pi^*$$

Terms	$E\pi_{t-1} - \pi^*$	$E\pi_t - E\pi_{t-1}$
countries	Deviation of inflation expectations from inflation level (LEVEL)	Time t surprise in inflation expectations (DIFFERENCE)
BRA	0.05*** (0.02)	0.12 (0.11)
MEX	0.06*** (0.01)	0.20*** (0.08)
CHL	0.11*** (0.02)	-0.06 (0.04)
PER	0.04*** (0.01)	0.21*** (0.04)
IND	-0.02 (0.01)	-0.02 (0.01)
USA	0.01 (0.02)	0.02 (0.03)
GBR	0.006 (0.005)	-0.03* (0.01)
CAN	0.10*** (0.03)	0.10 (0.08)

Note: *** ** * indicate statistically significant at the 1%, 5%, and 10%, respectively. The number in the parenthesis indicates robust standard errors.

Models with expectations: More details-(3)

Omitted variables on supply-side? Source of depreciation?



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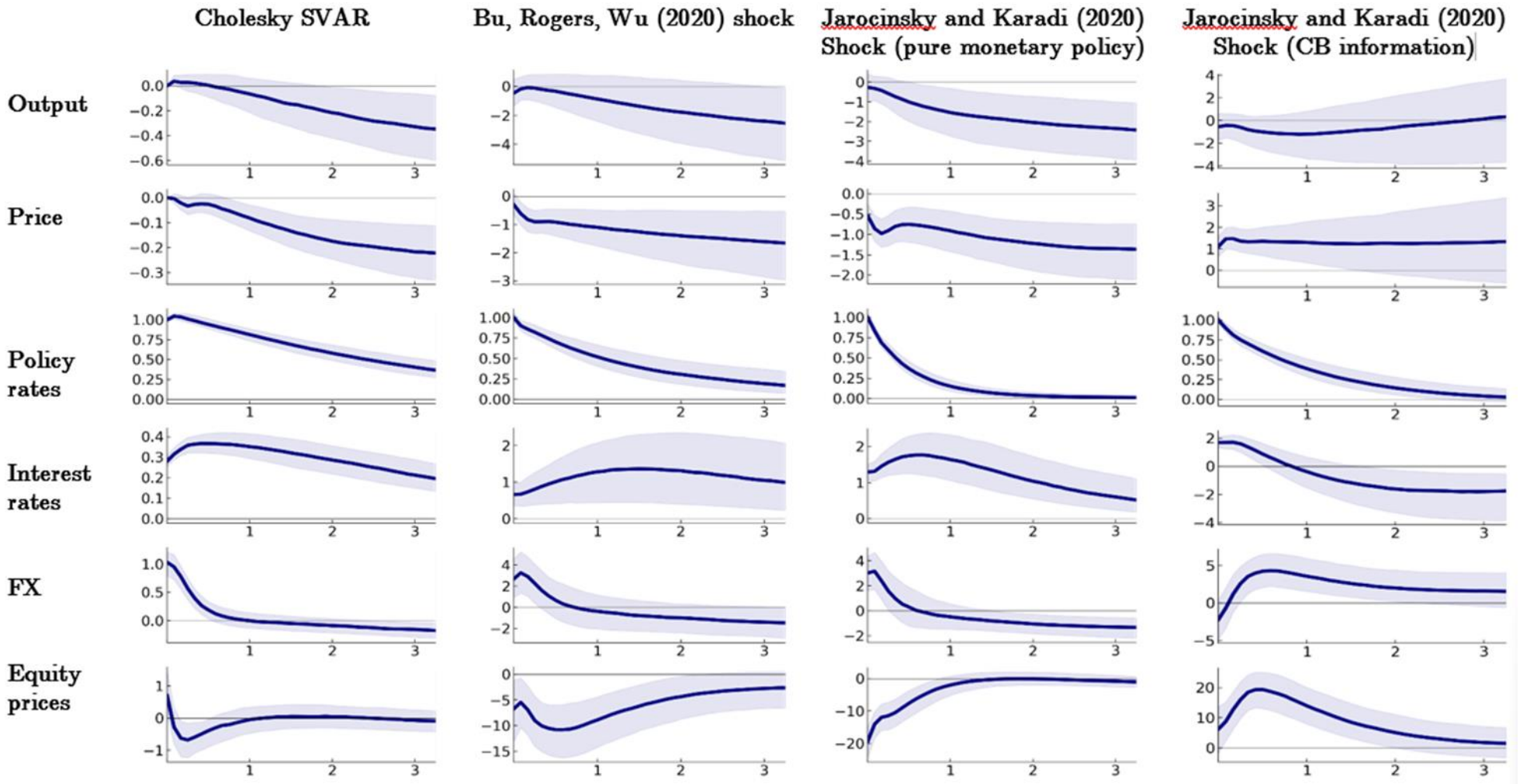
Models with expectations: Details–(4)

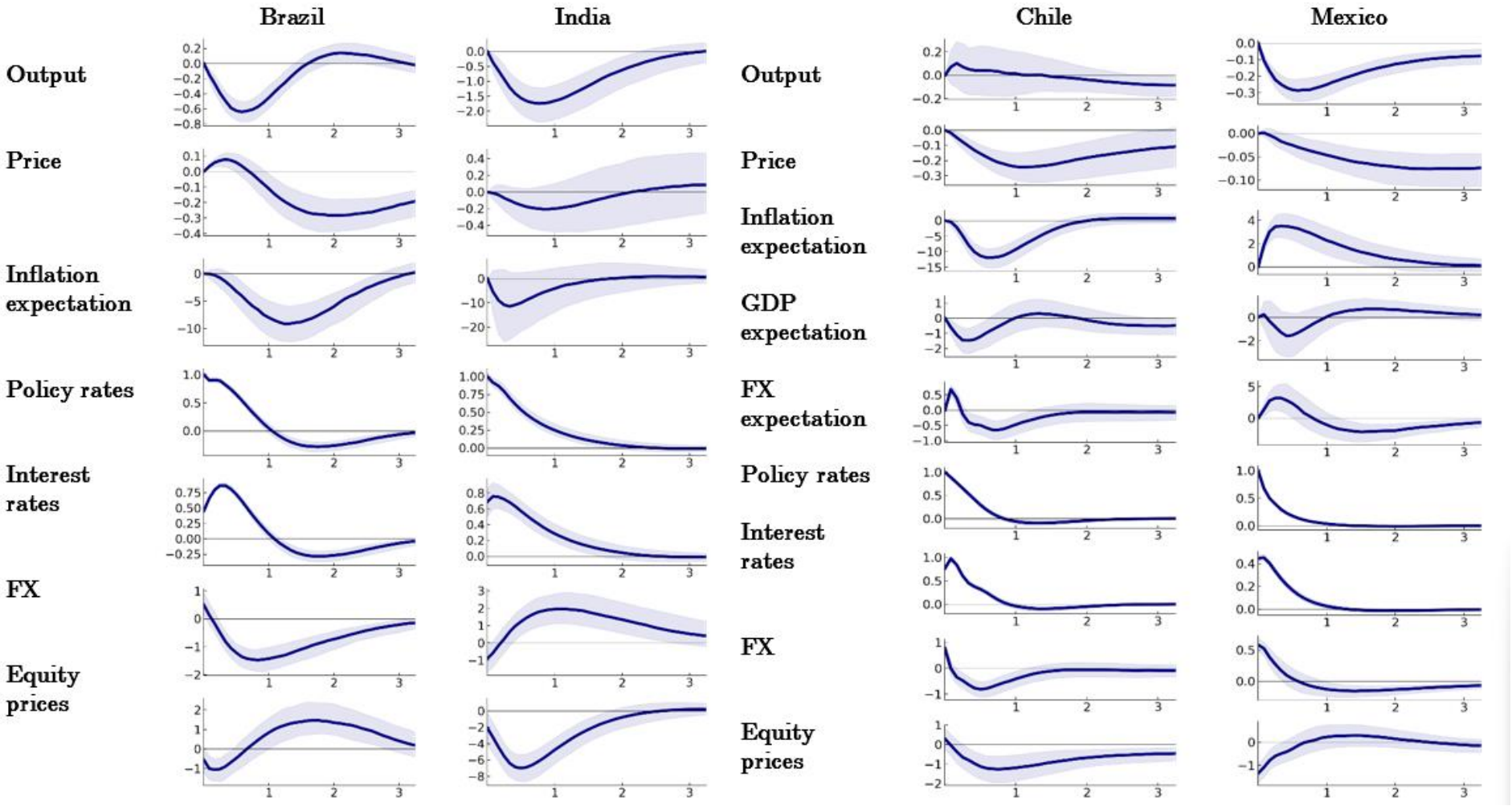
Role of expectations in the U.S.



Note: Impulse response functions, following a 1 percentage point contractionary monetary policy shock. The SVAR models include, in this order, output, prices, shadow interest rates, short-term interest rates, USD NEER, and stock prices. Monetary policy shocks are identified using Cholesky identification or taken from the literature—Bu, Rogers, and Wu (2020) and Jarocinsky and Karadi (2020). Shaded areas indicate 68% confidence intervals. The Y-axis indicates the percent or percentage point, and the X-axis indicates years.

Models with expectations: More details-(5)

Evidence of endogenous expectation channel



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Models with expectations: More details

Summary of additional findings

- **Is the evidence on the significant role of expectations on the identification broad-based?**

➢ Yes, the identification of monetary shocks improves in **almost all** EMEs and SOEs

- **What types of expectations data–among inflation, GDP, FX, and interest rates – improve most the identification?**

➢ Countries differ. While **inflation** expectations generally help, different expectations play different roles in the identification.

- **What information contents are critical in the role of expectations in the identification of MP shocks?**

➢ It appears that the **deviation from the inflation objective** (deviation from the current expectations from the inflation target) effects matter more than the differential effect (time t surprise in the expectations) in the identification.

- **Is the role of expectations significant in the identification of monetary policy shocks or as a transmission channel?**

➢ Both, the inclusion of expectations does change identification (when included as external variables) and as **transmission channels** (when included as endogenous variables)

- **Does the inclusion of expectations help in the identification of monetary policy shocks in the case of US or other AEs?**

➢ Yes, in the case of the U.S., the empirical results did not report price and FX puzzles without including expectations data. That said, controlling expectations (CB information) changed the size and significance of MP transmissions, as the literature finds.

Summary of Findings

- **Monetary policy transmission works well in advanced economies as theory/literature suggests**.
  - *VAR models work well in identifying the effects of monetary policies.*

- **MP transmission in most EMEs—in particular Latin America—and some small open economies show puzzling movements of rising prices and currency depreciations based on conventional identification.**

- **Literature suggests different solutions to overcome the puzzles, and we test them in a unified framework.**
  - *Conventional solutions—different identification, FAVAR, the inclusion of commodity prices—do not overcome the puzzles.*
  - *Models augmented with forward-looking expectations appear to overcome the puzzles in many countries.*

=> ***Omitted Variables problem:*** *This indicates that the variables in the VAR system are not sufficient to capture future inflation developments, reflecting more volatile macroeconomic and financial conditions.*
  - Possibly reflecting supply-side shocks (e.g., currency depreciation), deviation from inflation expectations

- **The literature treats the price and FX puzzle separately, but a set of counter-factual-analysis and sign-restricted VARs suggest that the FX puzzle plays a key role in the price puzzle.**
  - *This supports the hypothesis that the price puzzle is driven by the cost-pushing channel of MP transmission.*

Conclusion and Implications

- Existing literature suggests mixed results on the effectiveness of MP in EMEs.
  - Failure of monetary policies? Or failure of identification?

- Despite the puzzling movements of the key variables based on the conventional identification,

- When integrated with survey-based expectations, **empirical outcomes align with theoretical expectations for monetary policy transmission across most EMEs**.

- One percentage point MP shock => declines in output and prices (0.5 and 0.2 percent), increase in short-term interest rates (0.6 pp), currency appreciation (0.5 percent), and declines in stock prices (2 percent).

- Effective and forward-looking nature of monetary policy transmission in EMEs

- Challenges in identifying monetary policy shocks persist due to the more endogenous nature of financial and macroeconomic variables compared to advanced economies.

Additional Slides

Price Puzzle

Empirical evidence, Theories, Solutions

Rationales for the puzzle	Empirical solutions	Reference
1. Omitted variables—commodity prices, output gap, global variables	Control for commodity prices or output gaps in the VAR ; A factor-augmented VAR (FAVAR)	Sims (1992); Giordani (2004) Bernanke, Boivin and Eliasz (2005)
2. Misspecification	Alternative identification of MP shocks Sign-restricted VAR	Canova and Nicolo (2002); Uhlig (2005)
3. Monetary policy regime—Weak interest rate response to inflation	Sub-sample analysis; Impose the long run restrictions in the cointegrated structural VAR	Borys, Horvath, Franta (2009); Kim and Lim (2018)
4. Central banks setting monetary policy in a forward-looking way, using information beyond that contained in the VAR	Include inflation and GDP forecasts	Romer and Romer (2004); Chapagne and Sekkel (2020)
5. Cost-pushing-including firms costs and exchange rates (depreciation)	Including the variables for cost-pushing channels Sign-restricted VAR	Castelnuovo (2012); Henzel et al. (2008); Grilli and Roubini (1995)

Exchange Rate Puzzle

Empirical Evidence, Theories, Solutions

***Mixed* evidence on advanced economies.** Clarida & Gali 1994; Eichenbaum & Evans 1995; Scholl & Uhlig 2008.

Evidence of exchange rate puzzle in EMDEs. Sunel and Mimir (2018); Obstfeld, Ostry, and Qureshi (2017); Kohlscheen (2014); Kim and Lim (2018).

Theories	Explanations/Solutions
1. Misspecification	Alternative identification of MP shocks
2. Omitted variables problem	Include US and global variables, international commodity prices
3. Regime shift in monetary policy	Focus on inflation-targeting regime (Exclude exchange-rate targeting regime)
4. Fiscal dominance	Weakens the currency due to a greater fiscal burden of higher interest rates
5. Liquidity demand	Raises the demand for domestic currency denominated liquid assets?
6. Weak domestic interest – exchange rate nexus	Foreign exchange market inefficiencies

Literature

Exchange rate and Price Puzzles in EMDEs; Mixed Results in AEs

Dornbusch (1976): *an unexpected monetary contraction leads to an immediate appreciation of the currency, so as to create the conditions for a subsequent depreciation at a rate that equals the interest rate differential*

Clarida & Gali (1994); Eichenbaum & Evans (1995); Scholl & Uhlig (2008): *Conditional movements of foreign exchange rates exhibit puzzling deviations from the theoretical predictions*

Ha (2020); Kim and Lim (2018): *A contractionary monetary policy leads to significant exchange rate appreciation in United Kingdom, Canada, Sweden, and Australia*

Kohlscheen (2014): *even a focus on 1 day exchange rate changes following policy events – which reduces the potential for reverse causality considerably – fails to lend support for the view that associates unexpected interest rate hikes with immediate appreciations*

Brandao-Marques et al. (2020): *the effects on prices of a contractionary monetary policy shock are more muted, and only significant when they account for the exchange-rate channel*

Sign Resections on FX rates

Appreciating MP shocks—Forbes (2017) and others

Following one-standard-deviation positive (contractionary) *domestic* monetary policy shocks:

✓ Price and FX puzzles go together

Sign restrictions

	MP shock
	Appreciating MP shock
P	0
Y	0
MP	+
FX	+
R1Y (R1D)	*
S	*

Summary of IRFs

	MP shocks with appreciating FX
Output	Contractionary (consistent with NK theory)
Price	**Negative (consistent w theory)**
FX rates	Appreciation
Equity prices	Decline (consistent with NK theory)
1-year bonds	Partial transmission (consistent); heterogeneous across countries

Sign Resections on Output and Prices

Conventional Sign Restrictions (Uhlig 2005)- Contractionary MP shock

Following one-standard-deviation positive (contractionary) *domestic* monetary policy shocks:

✓ FX puzzle still exists, but somewhat dampens (some evidence of overshooting)

Sign restrictions

	MP shock
	Declining output and inflation
P	-
Y	-
MP	+
FX	*
INT	*
S	*

Summary of IRFs

	Baseline EMDEs
Output	Contractionary (By construction)
Price	Deflationary (By construction)
FX rates	**Appreciation (but delayed overshooting)**
Equity prices	Mixed across countries
Short-term interest rates	Partial transmission (consistent); heterogeneous across countries

Sign Resections on Short-term Interest Rates

Elimination of Liquidity Puzzle-Kim and Lim (2018)

Following one-standard-deviation positive (contractionary) *domestic* monetary policy shocks:

✓ Mixed results on the puzzles

Sign restrictions III

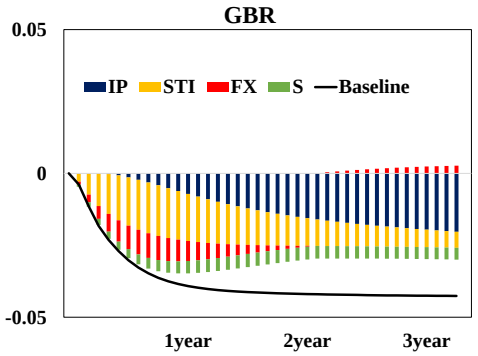
	MP shock
P	0
Y	0
MP	+
FX	*
R1Y (R1D)	+
S	*

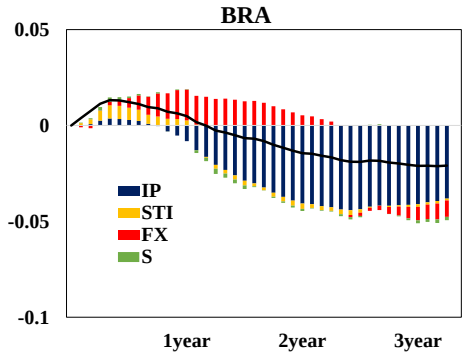
Summary of IRFs

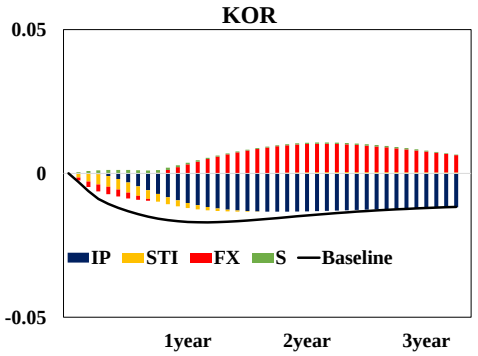
	Baseline EMDEs
Output	Contractionary (consistent with NK theory)
Price	Insignificant (Price puzzle dampens)
FX rates	Insignificant (FX puzzle dampens)
Equity prices	Decline (consistent with NK theory)
1-year bonds	Significant (by sign restriction)

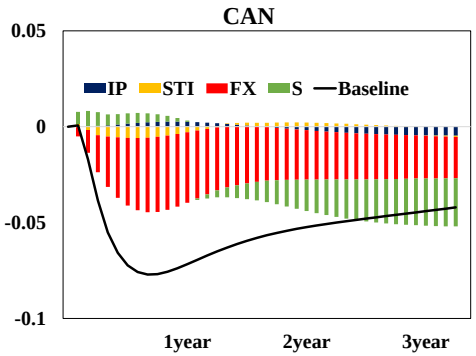
Counter Factual Analysis-Decomposition of IRF of Prices

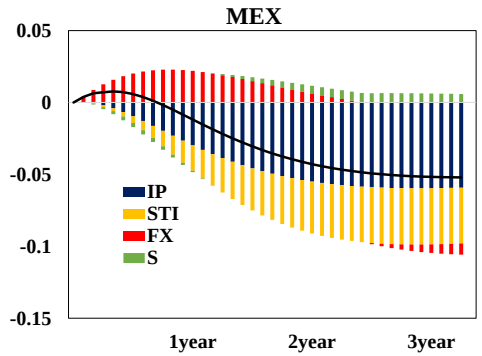
Currency Depreciation Contributing to Price Puzzle; Phillips-curve relation works

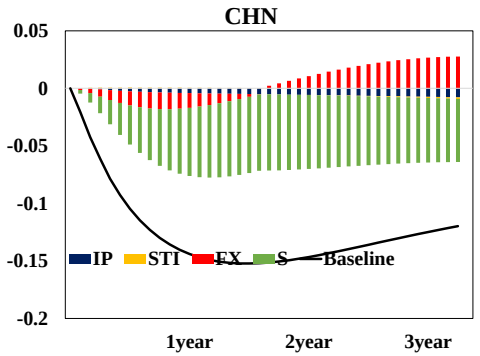


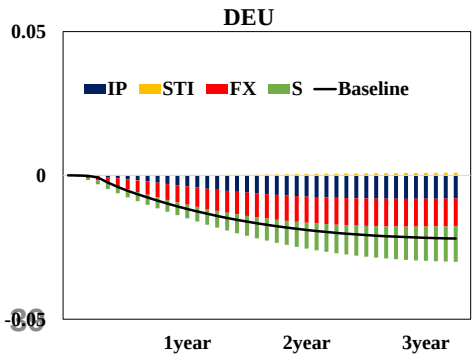


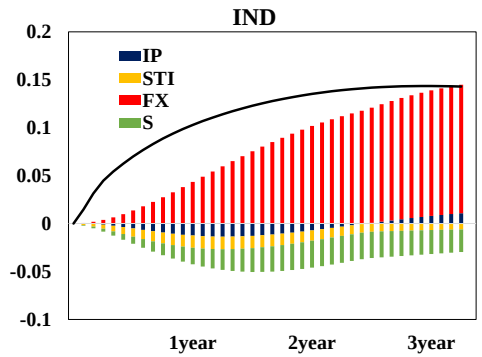


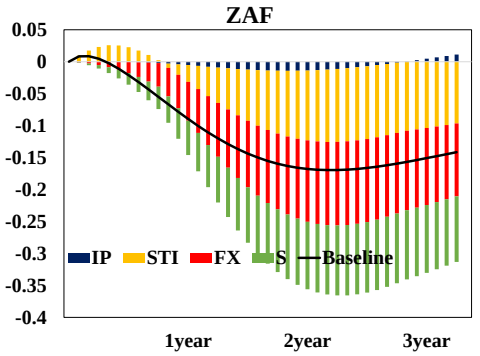






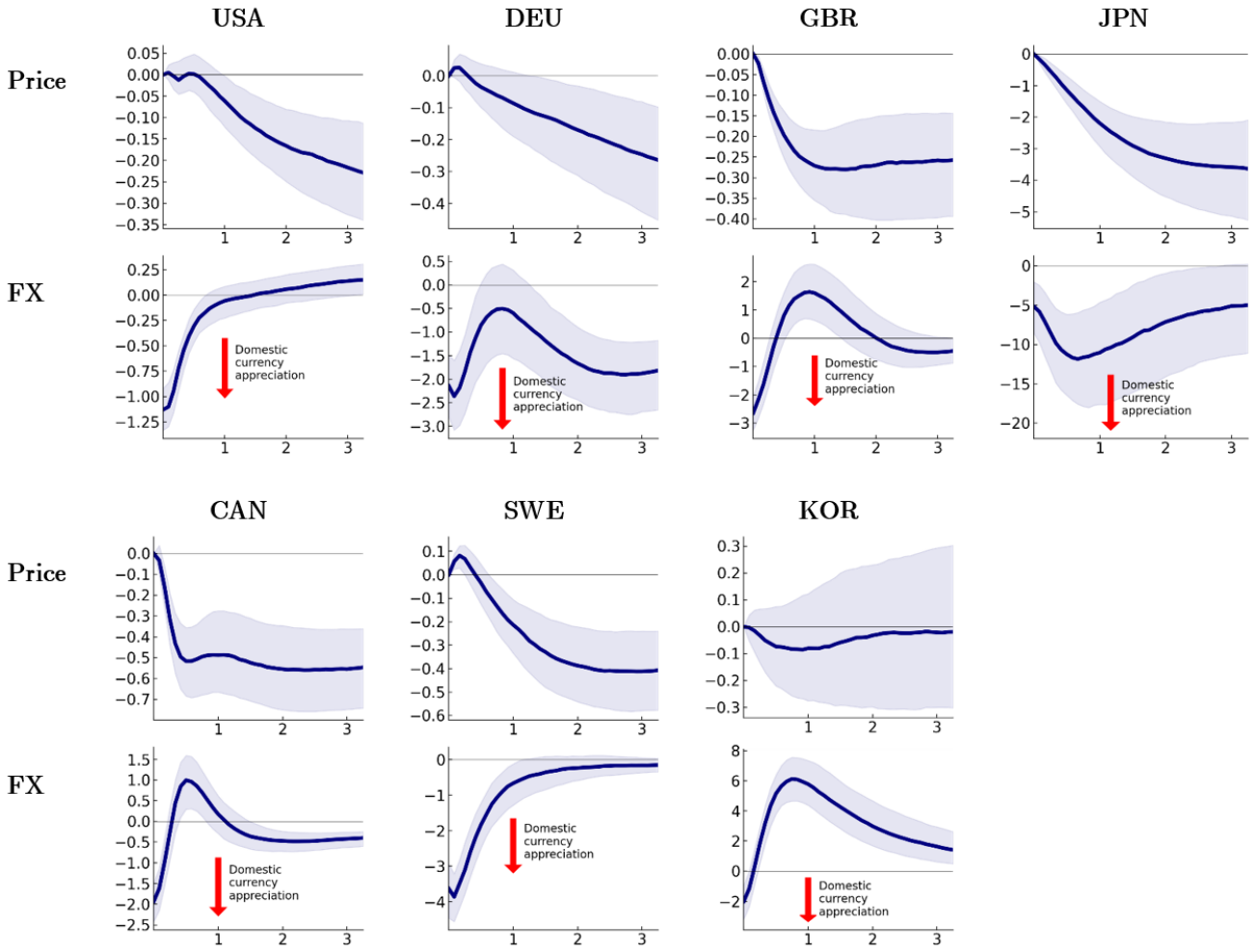






Open-economy SVAR models: Conventional Cholesky VAR

Little Evidence of Price and FX puzzles in Advanced Economies



Note: Impulse response functions in the median country across 7 AEs, following a 1 percentage point contractionary monetary policy shock. The monthly SVAR models include output, prices, monetary policy instruments, short-term interest rates, exchange rates (per USD), and stock prices with control variables of commodity prices, US policy rates, VIX, and deterministic trends. The shade areas indicate interquartile ranges. The Y-axis indicates percent or percentage point, and the X-axis indicates years.