Central banks and the absorption of international shocks (1890s to today)

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Motivation

- Is autonomous monetary policy possible in financially open economies?

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- *Trilemma* (Mundell 1963, Obstfeld-Taylor 2004) or *dilemma* & global financial cycle (Rey 2013, Kalemli-Ozcan 2020)?

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- how do domestic *interest rates* react to an exogenous increase in the dominant international monetary policy rate (i.e. US today)?

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  2. Expansion of domestic assets (loans & securities) to stabilize the money market rate ('*elastic currency*')

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  2. Expansion of domestic assets (loans & securities) to stabilize the money market rate ('*elastic currency*')
- 2) might 'sterilize" 1), but not only
- Possible only if UIP does not hold

Contribution

- Test if - and how - central bank foreign and domestic assets have responded to international interest rate shocks
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- Has it contributed to the autonomy of monetary policy?
- Revisit the history of international monetary system /trilemma since the late 19th century

New Data

- Monthly balance sheet of 23 central banks since 1891. + other monthly macro-financial variables.
- Why monthly? because effects of international shocks within 1 year (Miranda-Aggripino & Rey 2021, Bazot et al. 2022).
- Hand-collected. Primary sources (except US, UK, France). Need detailed & standardized categories.

New Exogenous Monetary Policy Shocks

- Bauer-Swanson (2023): US Fed, 1989-2019
- Lennard (2018): Bank of England, 1880-1913 — Romer-Romer (2004), US Fed since 1969
- for other periods, we build our own shock, based on "'high-frequency identification"' (daily interest rates, stock market price, and exchange rate) and purged from monthly macro variables (as in Cloyne et al. 2022).

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Results

- Systematic increase in domestic assets to stabilize domestic money market, in both floating & pegged countries (not only sterilization of FX interventions)
- Key to relax constraints of fixed exchanged rates (Gold standard: response to $\uparrow$ BoE 100bps was 20bps. — 40bps in full sample). CBs not playing 'rules of the game'.
- Key to tame global financial cycle in recent times (CB rate remain stable or decrease, while asset returns rise, Miranda-Agrippino & Rey 2020)

Implications

- Key to reintroduce central bank balance sheets in literature on trilemma and global financial cycle
- Deepening of international financial markets increases the reliance on the absorbing role of central bank balance sheets (*elastic currency*)

Data

- Annual balance sheets of central banks always published in annual report, for the State or shareholders. Often retrospective series built by CBs or historians. Low level of aggregation. See Ferguson et al. 2023 (17 countries since 16th century).
- Monthly (or higher frequency) balance sheets more difficult to find.
- Sources: BdF archives for dozen central banks until 1950s; CB publications & archives; (IMF for international reserves since 1956.)

Banque impériale d'Allemagne -

Dates (1898)	Encaisse	Billets de l'Etat	Billets des autres Banques	Total	Circulation	Réserve de Billets	Comptes Cts et autres Engagts à Vue	Portefeuille	Avances	Taux de l'Escompte	Cours des Actions
1898 Janvier 7	848.5	16.5	14.2	879.2	1.233.1	− 60.5	393.5	672.5	128.1	5%	160..
15	883.0	18.3	14.0	915.3	1.151.9	+ 56.9	400.2	582.6	108.2	.	159.75
22	915.2	19.8	13.7	948.7	1.096.3	+ 145.9	443.4	564.4	82.2	4% (20 Janvier)	159.70
31	913.4	19.7	12.6	945.7	1.090.8	+ 148.4	436.0	568.7	87.7	.	159.30
Février 8	926.3	20.5	11.6	958.4	1.056.5	+ 195.4	430.7	535.0	82.6	.	159.50
15	951.4	22.1	14.5	988.0	1.012.9	+ 263.6	466.4	512.2	83.2	.	159.70
22	983.6	22.9	11.5	1.018.0	990.0	+ 321.5	518.1	531.2	73.3	3% (18 février)	159.60
28	963.1	22.4	12.7	998.2	1.021.9	+ 269.8	494.1	548.9	85.6		159.70
Mars 7	959.8	22.9	12.0	994.7	1.021.2	+ 267.0	491.2	562.2	74.9	.	160.40

Saldos semanales de los rubros más importantes del Activo y Pasivo del Banco Central de Chile durante el año 1937

Redescuentos a los Bancos Accionistas	Descuentos al público	Préstamos al Fisco	Préstamos a Municipalidades	Préstamos con garantía de productos	Préstamos a la Caja de Empleados Particulares D. L. N.° 182	Préstamos a Instituciones Hipotecarias	Préstamos y Descuentos a Instituciones de Fomento	Redescuentos a Caja Créd. Agrario Ley 4.806 y 6.006	Préstamos y Descuentos a la Industria Salitrera	Descuentos D. L. N.° 364	Préstamos Caja Crédito Popular Ley 5.398
17.140.887	19.313.626	690.147.676	8.339.780	1.617.544	1.000.000	10.491.065	57.330.122	9.208.437	54.472.827	69.690	3.750.000
11.150.436	20.318.008	690.147.676	8.339.780	1.401.900	1.000.000	10.491.065	57.208.122	9.713.524	55.184.038	69.690	4.000.000
1.885.226	19.557.029	690.174.676	8.339.780	1.216.095	1.000.000	10.491.065	57.170.122	8.914.393	55.659.849	69.690	4.000.000
29.377.963	18.687.278	690.147.676	8.339.780	1.216.760	1.000.000	10.491.065	57.124.122	8.351.563	50.936.970	69.960	4.000.000
33.727.083	16.661,939	690.147.676	8.339.780	1.266.750	1.000.000	10.491.065	52.557.987	12.259.166	53.300.201	69.690	3.975.000
7.029.391	16.072.210	690.147.676	8.339.780	954.200	1.000.000	10.491.065	51.411.323	11.468.008	71.349.639	69.690	3.975.000
4.598.872	15.970.274	690.147.676	8.339.780	961.290	1.000.000	10.491.065	54.371.323	10.972.824	98.165.952	69.960	3.975.000
11.572.514	16.080.114	690.147.676	8.339.780	1.569.850	1.000.000	10.491.065	54.360.323	10.144.572	115.673.432	69.690	3.975.000
20.377.038	13.560.265	790.147.676	8.339.780	2.226.350	1.000,000	10.491.065	52.166.681	13.325.682	15.767.193	69.690	3.950.000
15.829.513	15.056.943	790.147.676	8.339.780	2.194.550	—	10.451.065	52.107.116	10.952.717	15.631.726	69.690	3.950.000
6.956.199	15.281.155	790.147.676	8.339.780	4.655.830	—	10.491.065	50.125.833	10.952.717	15.000.000	69.960	3.950.000
13.222.940	16.310.582	790.147.676	8.339.780	4.688.700	—	10.491.065	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

.Y 1954 JANUARY 1954

BANK OF CANADA

	ASSETS							
				Securities				
				Govt. of Canada and Provincial				
Total Liabilities or Assets	Gold	Silver	Foreign[1] Exchange	Under 2 yrs.	Over 2 yrs.	Ind. Dev. Bank Cap. Stock	Other Securities	Total
307.7	180.5	1.6	4.2	30.9	83.4	–	–	114.3
390.3	179.8	3.0	14.9	82.3	91.6	–	12.2	186.1
527.2	225.7	–	64.3	181.9	49.9	–	–	231.8
	*							
1,948.6	–	–	1.0	1,197.4	708.2	15.0	–	1,920.6
1,926.2	–	–	2.0	1,022.0	858.5	25.0	–	1,905.6
2,058.6	–	–	.5	1,233.7	779.1	25.0	–	2,037.7
2,125.9	–	–	74.2	1,781.4	227.8	25.0	5.5	2,039.7
2,350.3	–	–	111.7	1,229.3	712.5	25.0	247.9	2,214.7
2,444.1	–	–	117.9	1,141.8	1,049.3	25.0	89.0	2,305.1
2,381.4	–	–	77.2	1,459.8	767.2	25.0	13.0	2,265.0
2,437.2	–	–	55.1	1,376.6	893.7	25.0	23.4	2,318.6
2,329.0	–	–	42.9	1,286.7	896.1	25.0	35.8	2,243.6
2,311.4	–	–	67.6	1,214.3	957.3	25.0	12.4	2,208.9
2,381.4	–	–	77.2	1,459.8	767.2	25.0	13.0	2,265.0

Standardized central bank balance sheet

ASSET	**LIABILITY**
1. International portfolio	3. Circulation (banknotes)
1.1 Metallic reserves: gold and silver	
1.2 Foreign exchange reserves	4. Deposits
1.3 Other international reserves	**4.1 Deposits of financial institutions**
2. Domestic portfolio	4.2 Deposits of non-financial institutions
2.1 Discount loans	4.3 Deposits of the government
2.2 Advances and other collateralized lending	
2.3 Open market operations	
2.4 Special loans	
2.5 Direct loans to the government	

Sample of countries

Countries covered since 1891 (twelve)	**Year**
Austria	1891
Belgium	1891
Denmark	1891
Finland	1891
France	1891
Germany	1891
Netherlands	1891
Norway	1891
Portugal	1891
Spain	1891
Sweden	1891
United Kingdom	1891
Pre-World War I additions due to later foundation (four)	**Year**
Italy	1894
Japan	1897
Switzerland	1908
United States	1914
Interwar additions (seven)	**Year**
South Africa	1922
Chile	1926
Mexico	1926
Colombia	1929
Argentina	1935
Canada	1935
India	1935

New Exogenous Monetary Policy shocks

- A interest rate change is exogenous if: i) not anticipated by markets (interbank & exchange) *the day before* (and change between board meetings); ii) unrelated to contemporary macro-financial developments observed by the central bank.
- in spirit of Bauer & Swanson (2023) (but not intraday data...). Close to Cloyne et al. (2022) on Bundesbank 1974-1998.

$$\Delta r_d^{\text{ref}} = \beta_0 + \beta_1 r_{d-1}^{\text{ref}} + \beta_2 \Delta r_{d-1}^{\text{ref}} + \sum_j \gamma_{j,p} y_{d-1}^j + \sum_j \phi_j \Delta_{d-1 \to d-T} y^j + \epsilon_d \tag{1}$$

$$\Delta r_m^{\text{ref}} = \sum_k \sum_{p=1}^{4} \theta_{k,p} x_{m-p}^k + \sum_k \sum_{p=1}^{4} \mu_{k,p} \Delta x_{m-p}^k + \epsilon_m \tag{2}$$

Theoretical framework

- The (simplified) central bank balance sheet:
- $D + I = L$
- with D the domestic portfolio (loans and securities), I international reserves L short-term liabilities
- Objective of the central bank: $i_t = i^T$
- Stabilize money market rate: $D \uparrow, L \uparrow$ if $i_t > i^T$
- Stabilize exchange rate through $I \downarrow$ (D offsets I and $L \rightarrow$ if sterilized FX interventions)
- If UIP perfectly holds, no need for movement in D and I. But UIP wedge (Kalemli-Ozcan 2020; Jeanne 2023):$i_t = i_t^* + E(e_{t+1} - e_t) + \sigma_t$

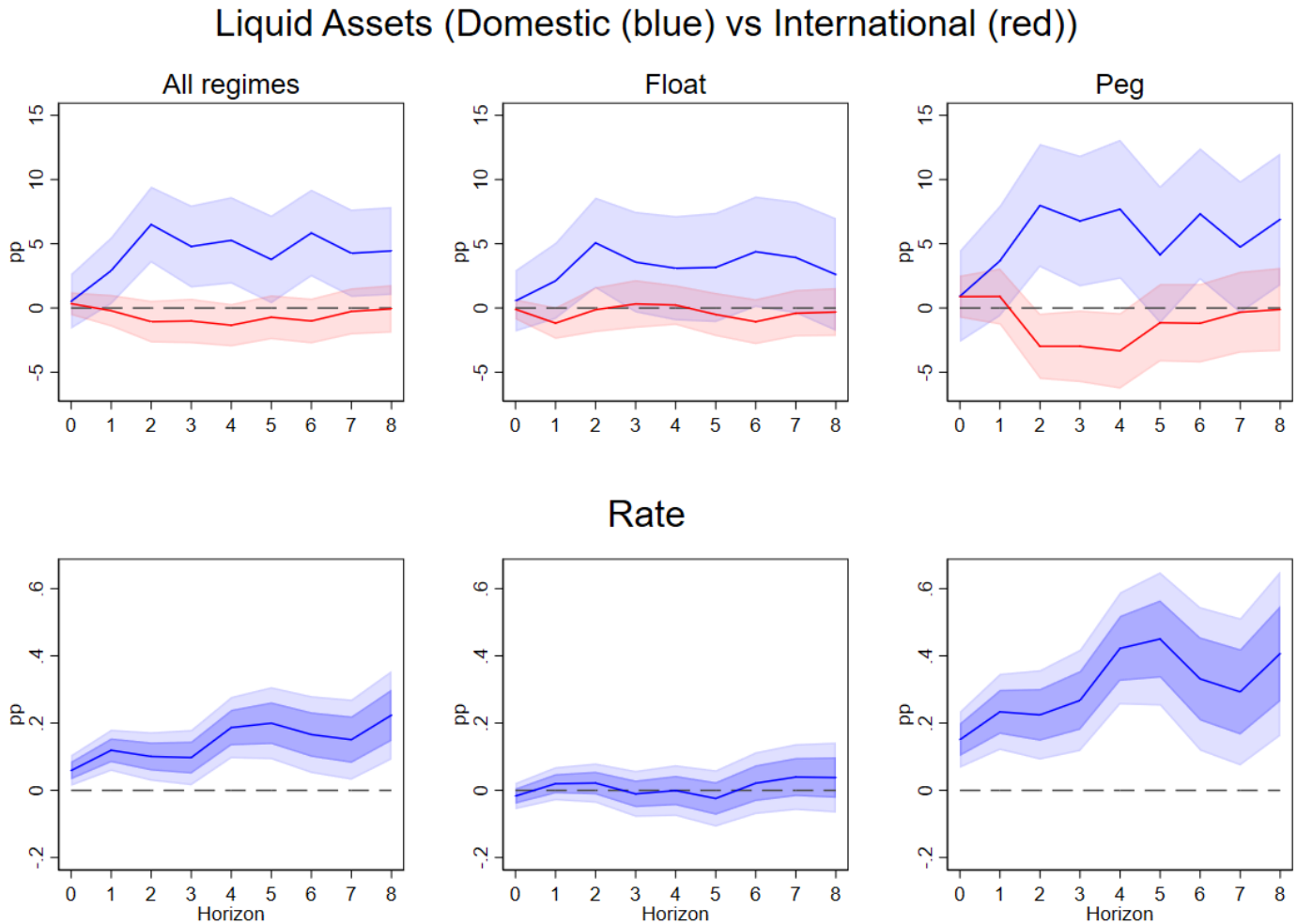
Estimations

- Local projections
- $y^{k}_{i\in g,t+h} = \alpha_{i\in g} + \Phi_h(L)Y_{t-1} + \beta_h \Delta r^*_t + \Psi_h(L)X_t + month + trend + \epsilon_{h,i\in g,t}$

- for a country i in group g
- year-on-year change for CB variables to account for seasonality.
- Benchmark case: England leading country until 1931; US from 1945.
- Many controls for domestic & international business cycles (output, consumer and asset prices)
- Full sample: standardized shocks over different periods as an IV (Romer-Romer 1969-1988; Bauer-Swansson 1989-2019; our shock otherwise)

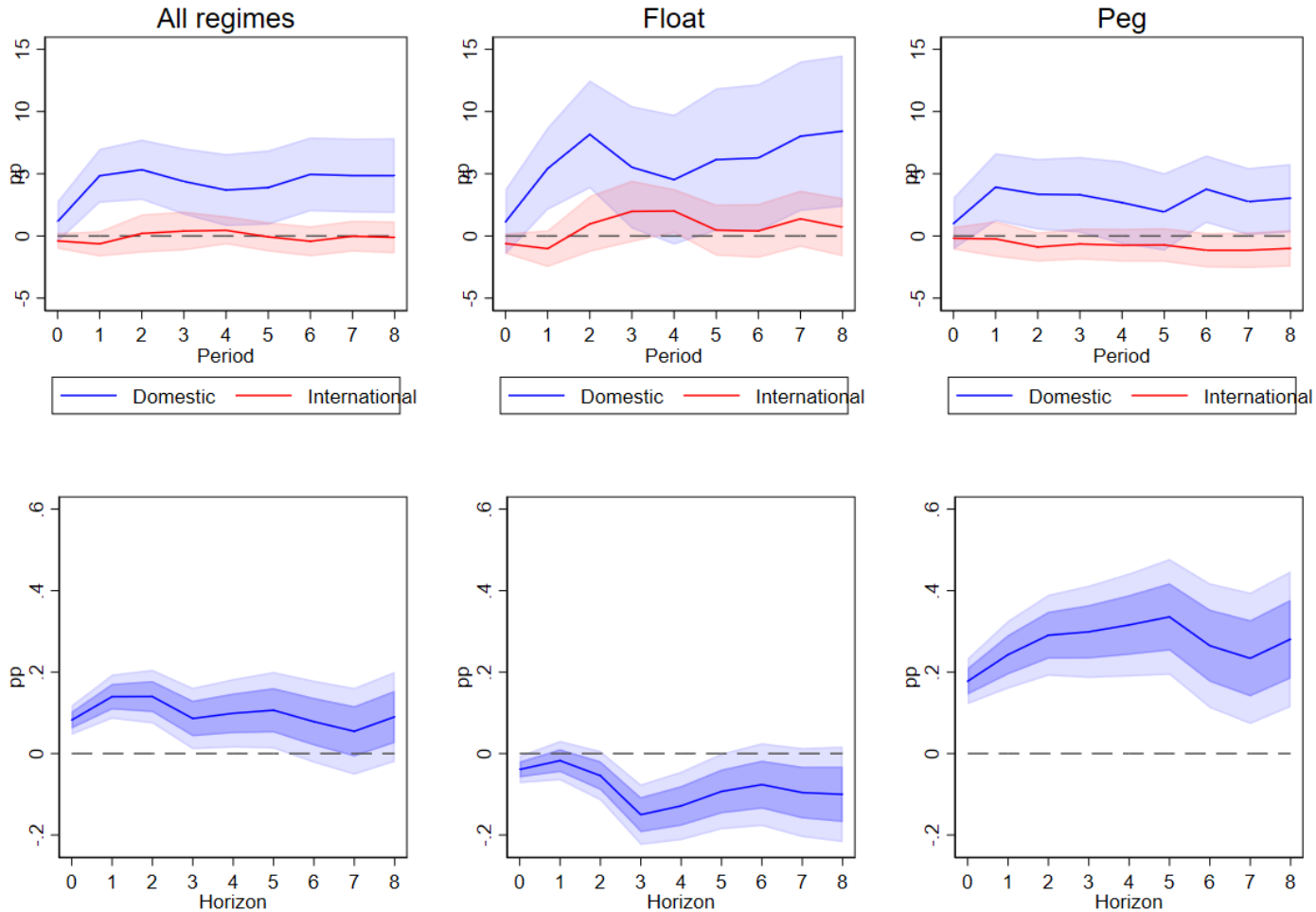
Benchmark case: full sample (open economies)

without foreign exchange control (IRR).



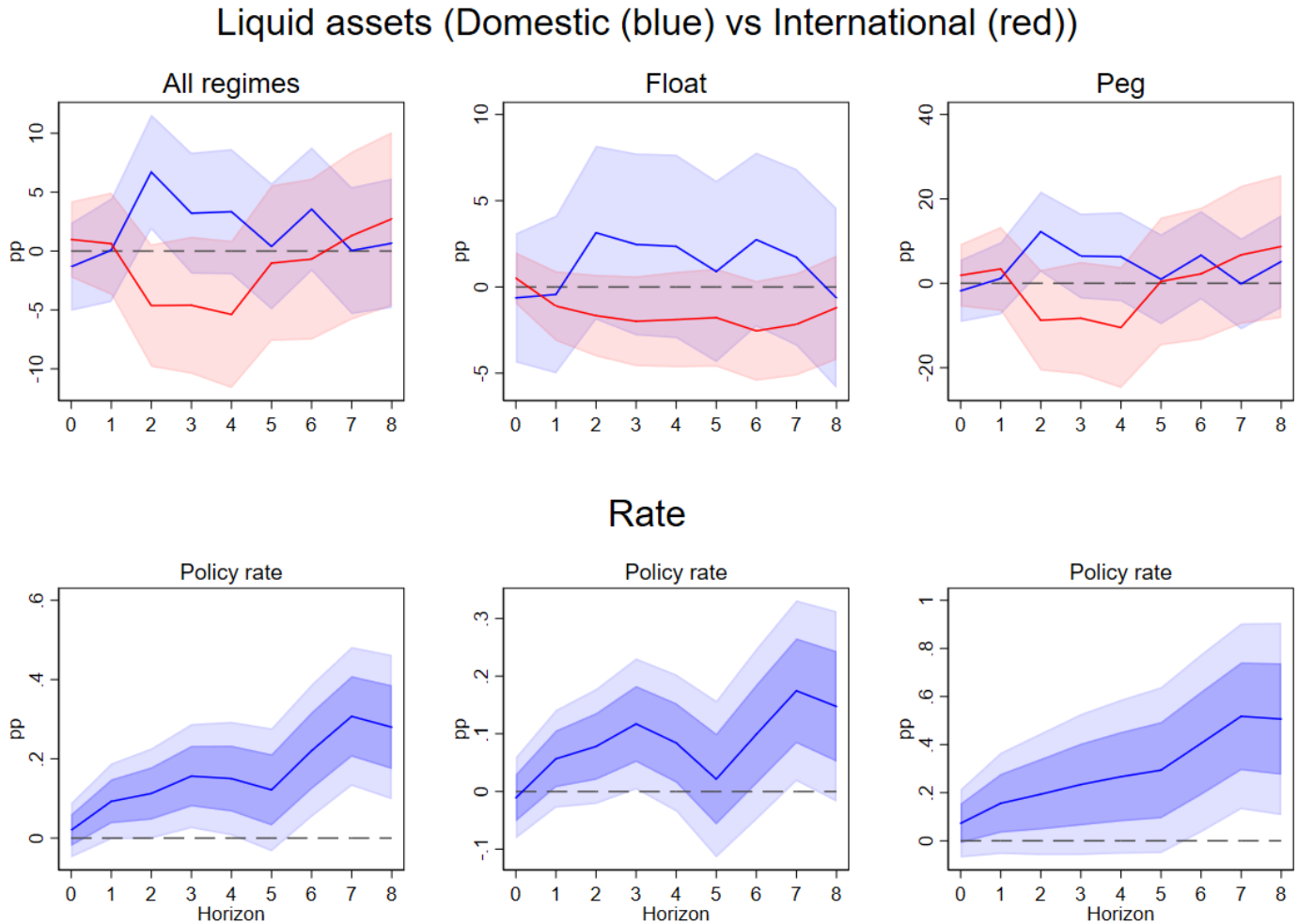
Benchmark case: full sample (open economies)

"without de jure capital control (QT-CI)".



Closed economies

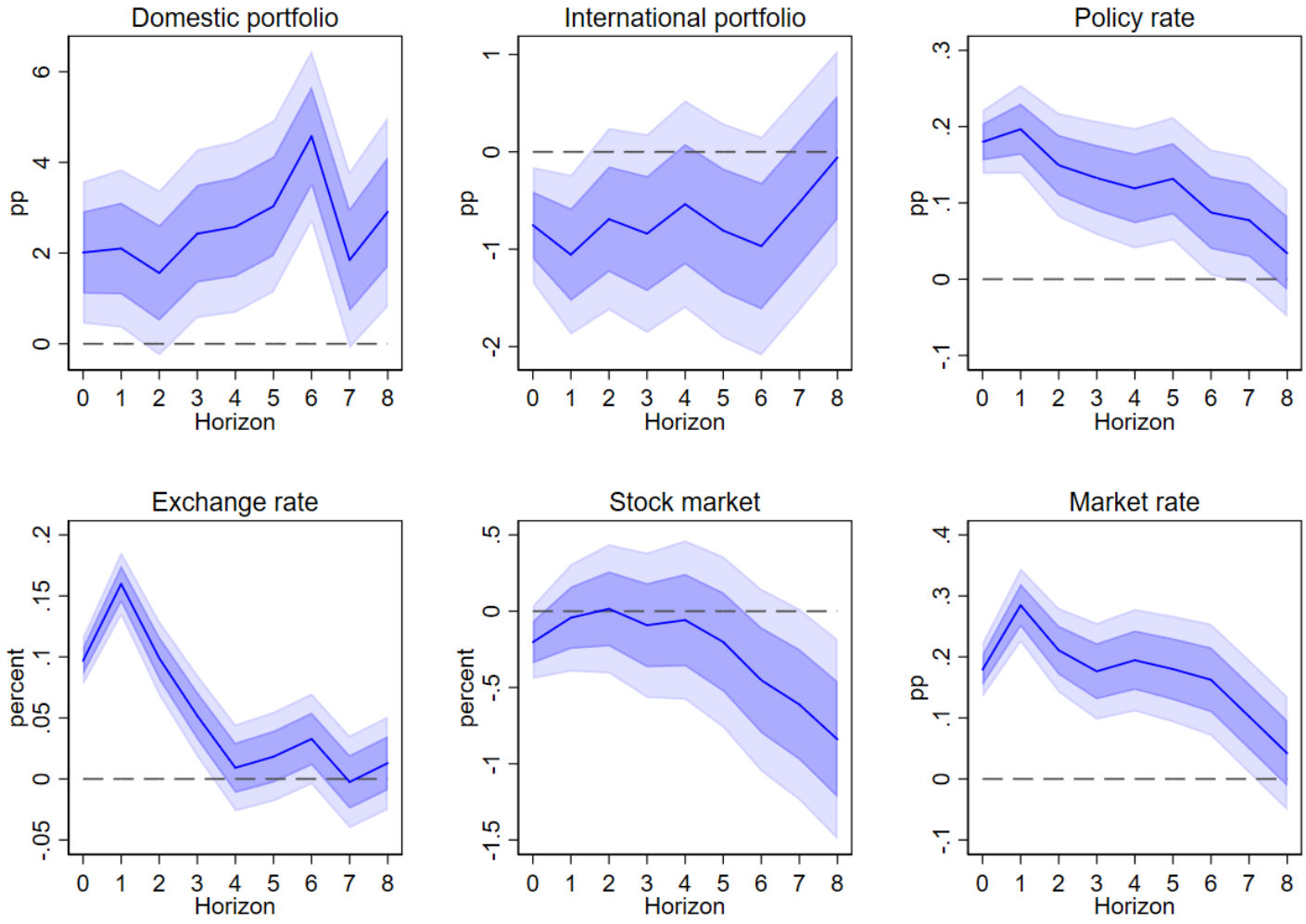
"Capital controls"



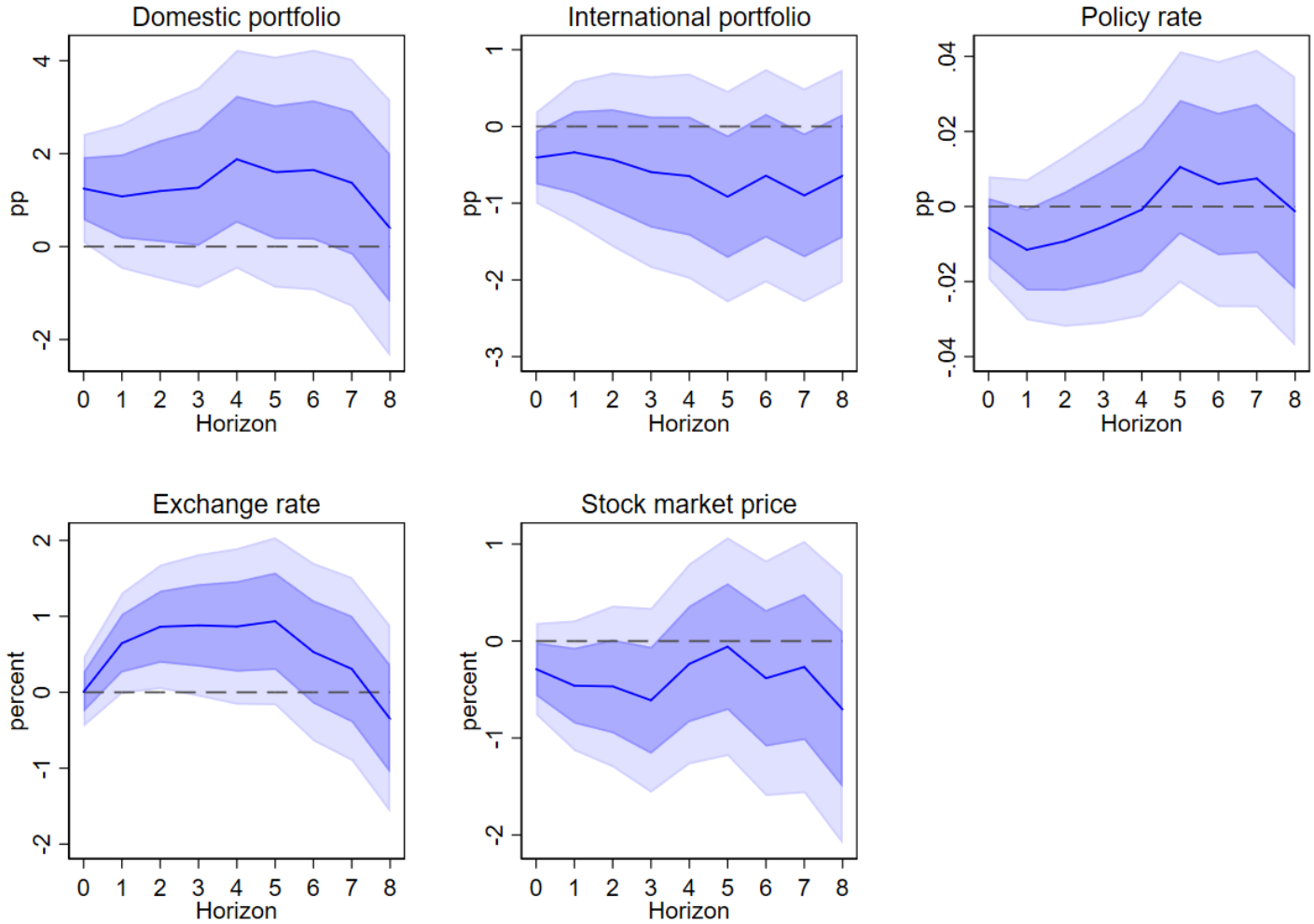
Summary of findings

- Systematic increase in CB domestic assets after international shock
- Consistent with low pass through under fixed-exchange rates (30-40bp)
- Adjustment under floating exchange rates not automatic
- Next steps: different historical periods

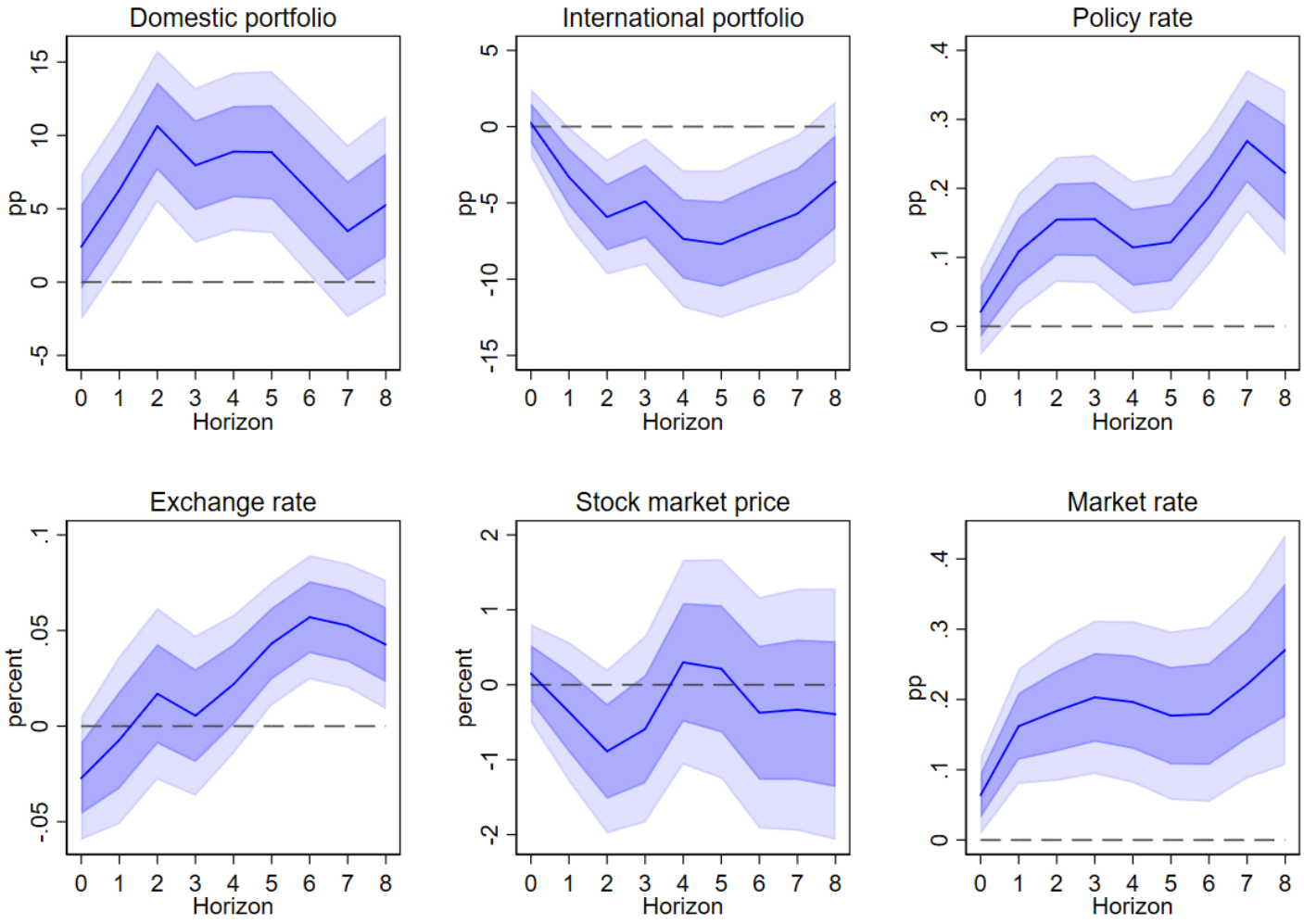
First Globalization. Gold standard (peg)



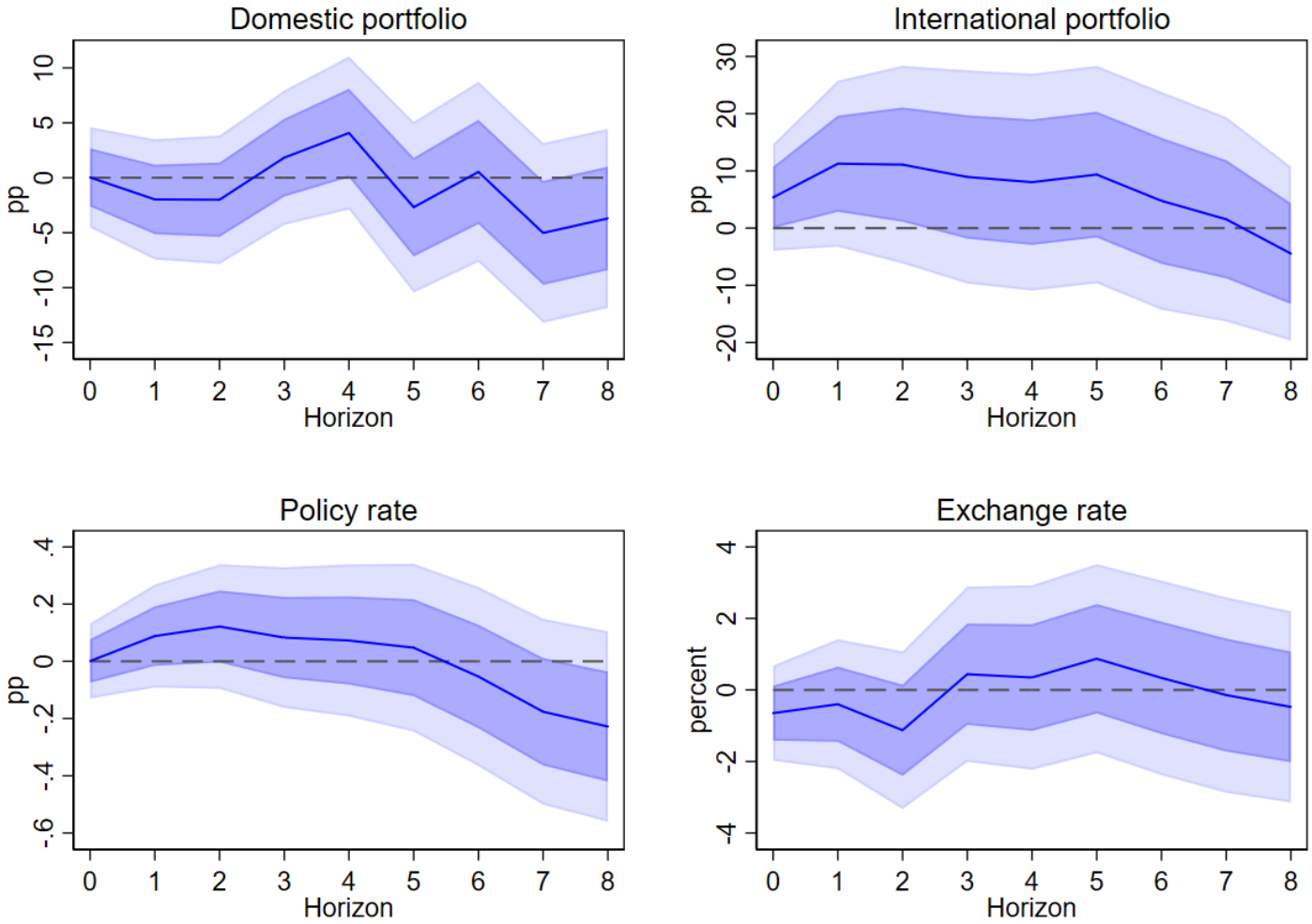
First Globalization. Floating countries



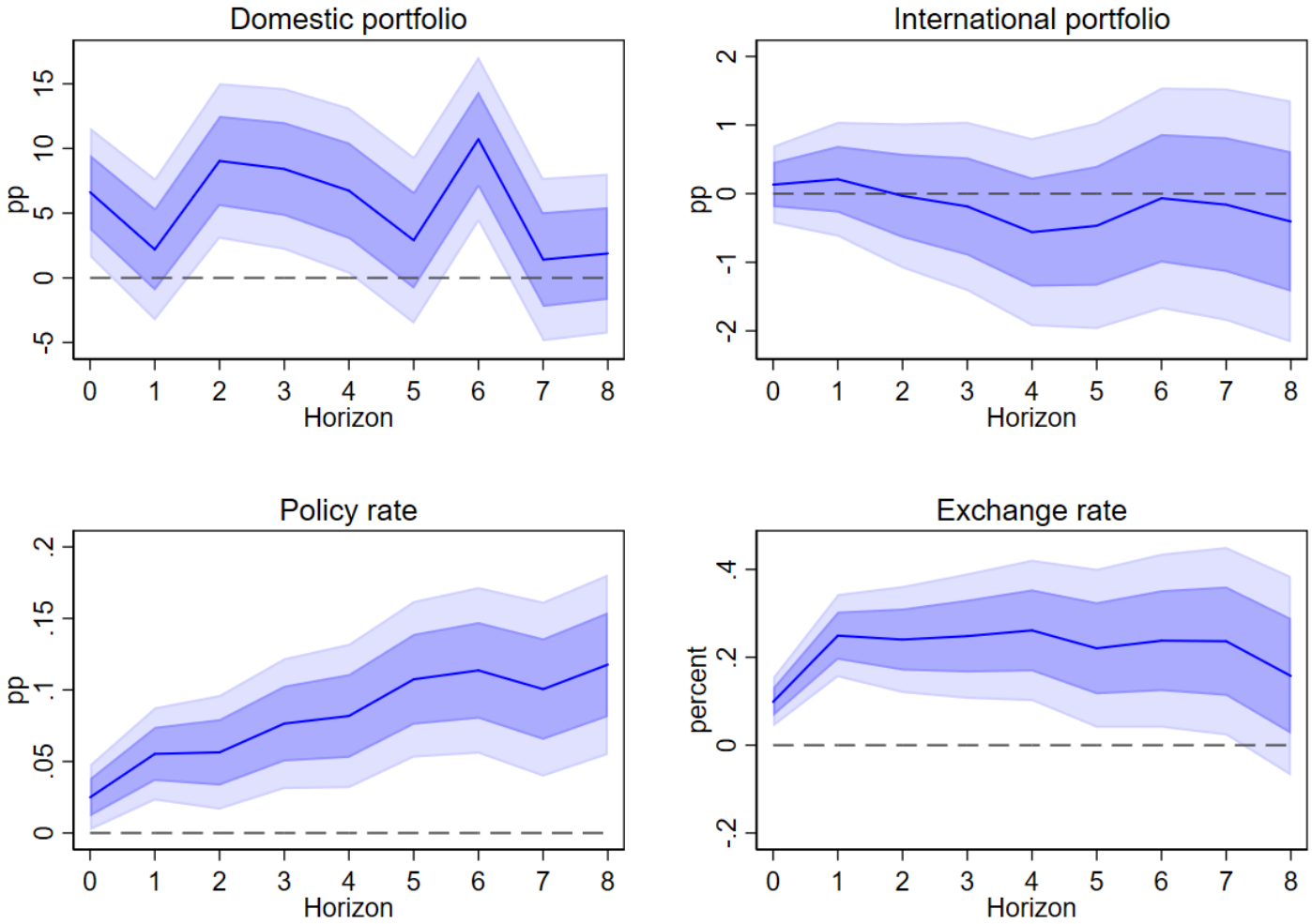
Interwar Gold standard



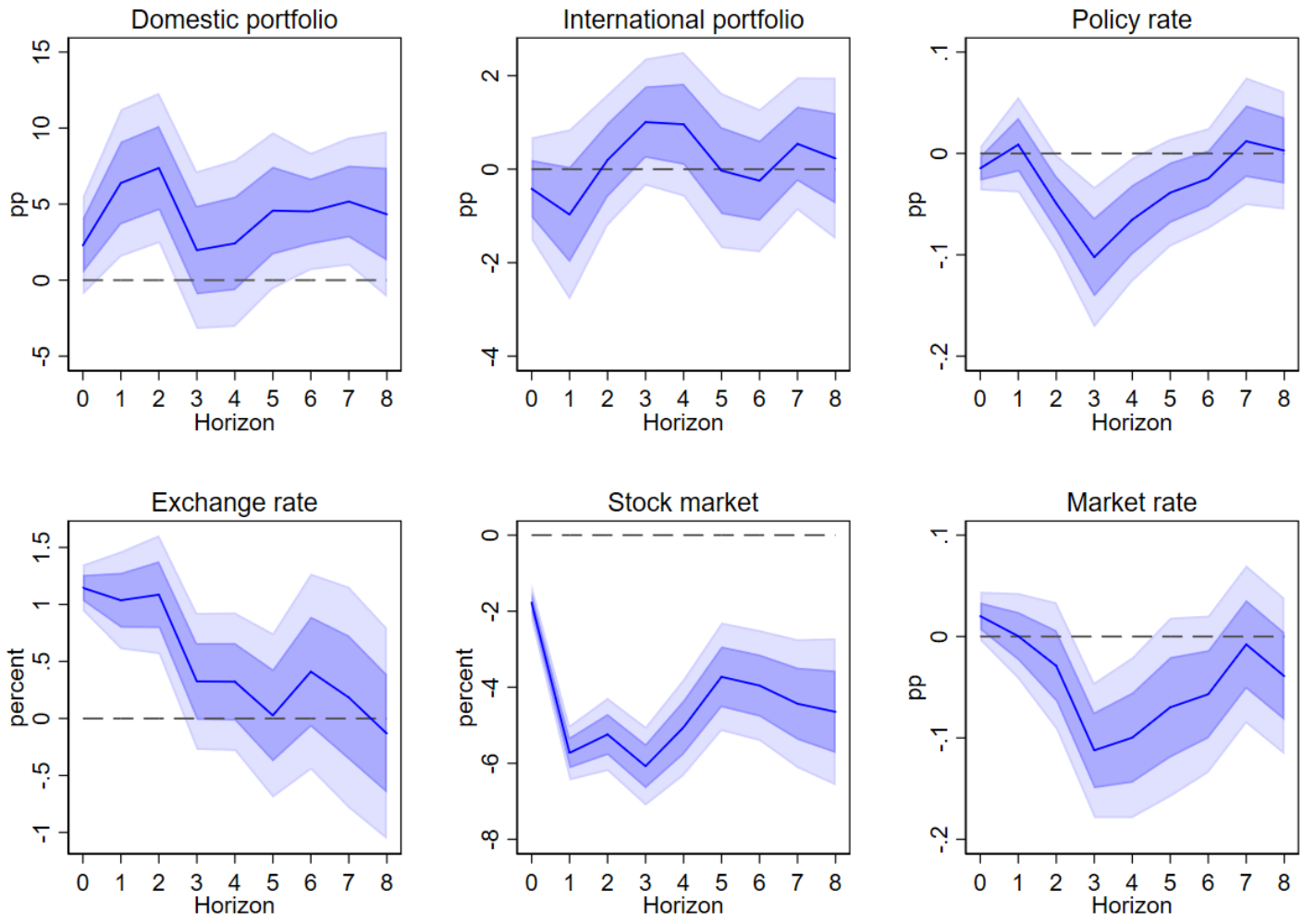
Bretton Woods, 1947-1958



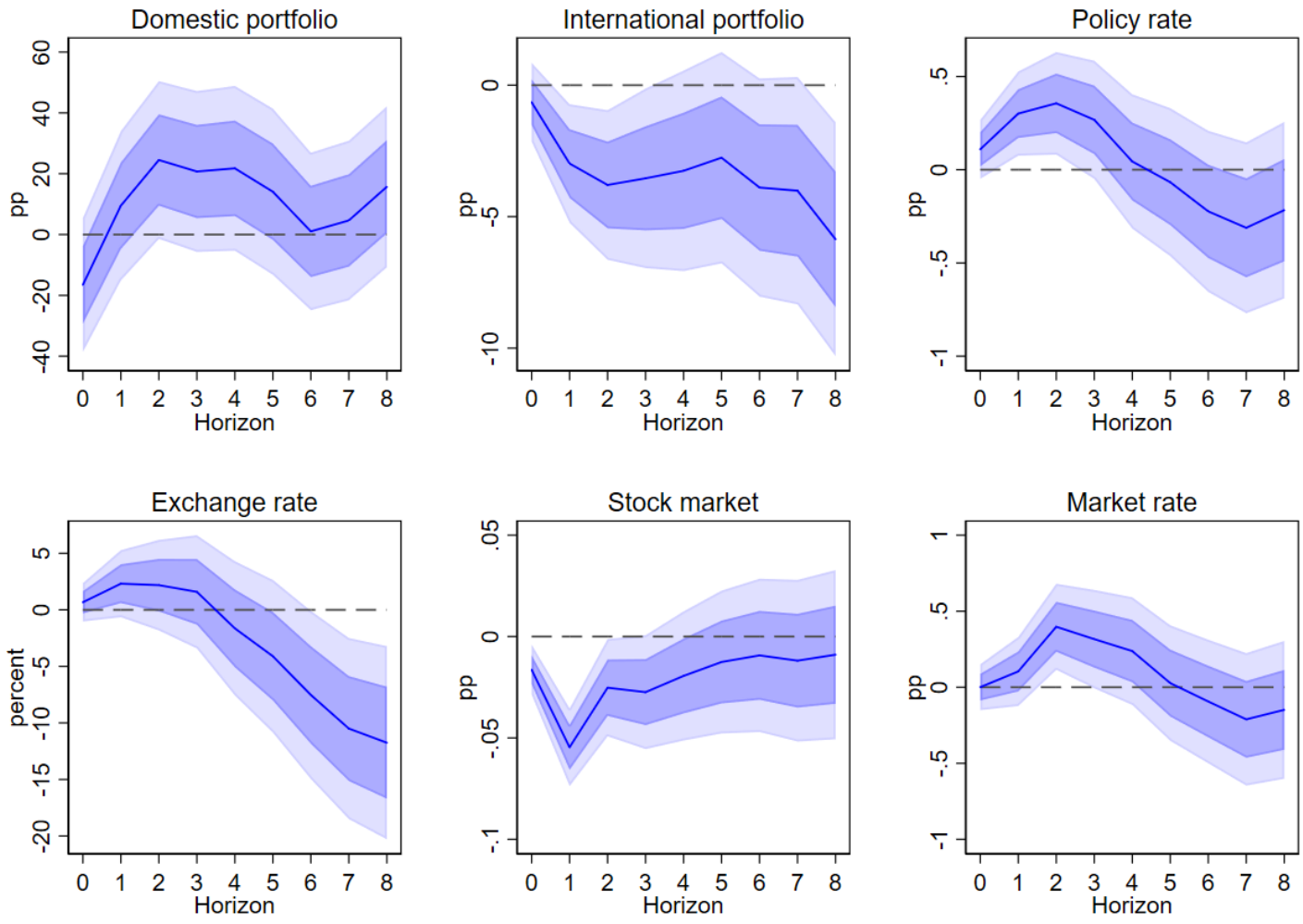
Bretton Woods, 1959-1971



Second Globalization. Floating countries/Advanced economies. Bauer-Swanson (2023) US shocks.



Second Globalization. Emerging markets. Bauer-Swanson (2023) US shocks.



Summary + other results/robustness checks in the paper

- CB balance sheets always active under financial openness & globalization
- in fixed exchange rate, CB elastic currency gives margins of maneuver (relative to trilemma).
- in floating exchange rate today, help to manage the dilemma
- EM CBs face difficulties to stabilize money market (Kalemli-Ozcan 2020, DeLeo et al. 2023)
- Reaction of domestic assets not only FX sterilization
- Robust to different currency denomination of FX assets (domestic, USD, SDR). But USD denomination overestimates FX reaction
- Robust to alternative monetary policy shocks

Conclusion

- Key historical role of CB's elastic currency to absorb international monetary shocks.
- Reliance on central bank's elastic currency has grown with financial globalization.

APPENDIX

Backup slides

Figure: Response to an exogenous monetary policy shock. England, classical gold standard.

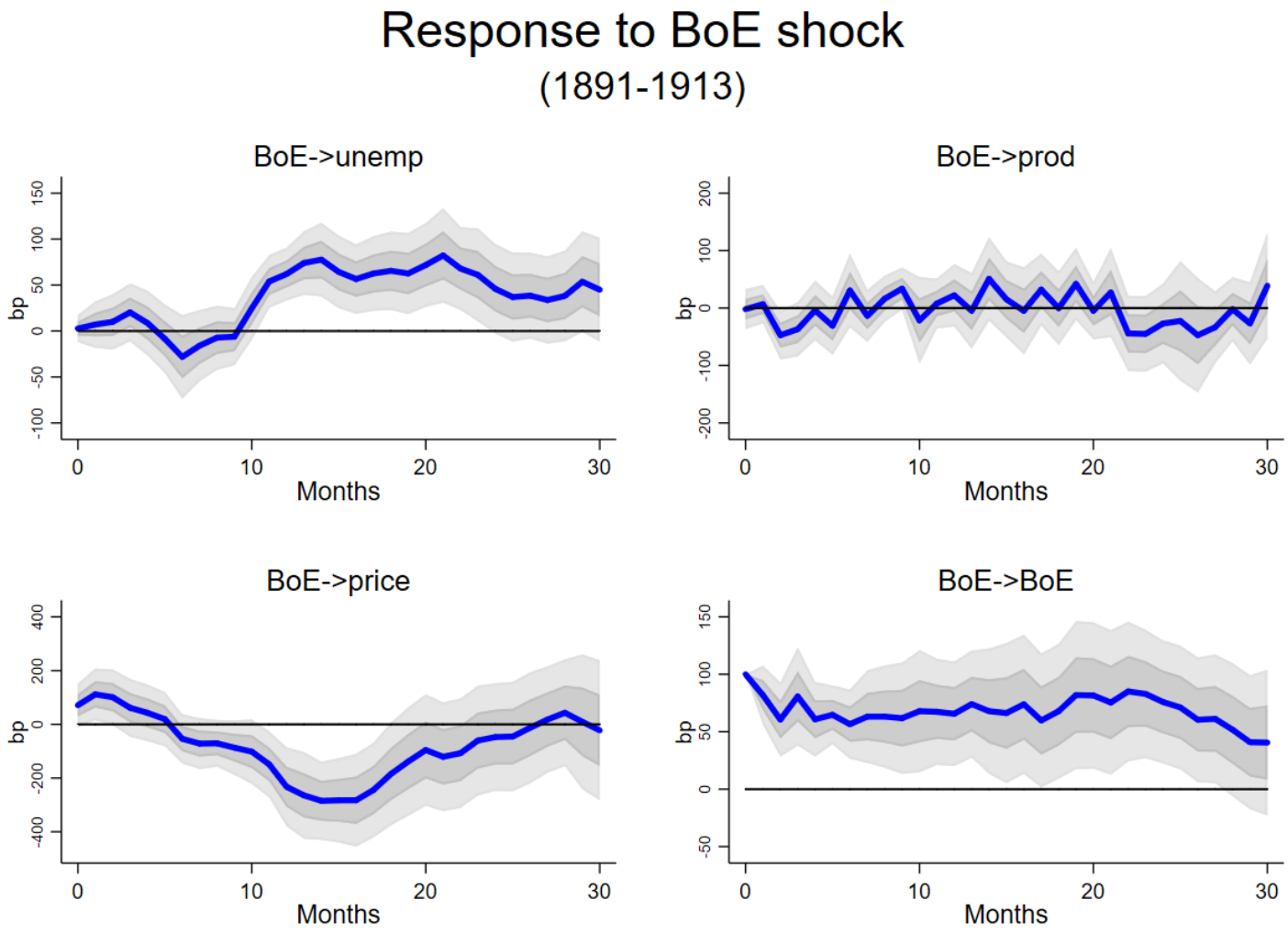


Figure: *

Note: Responses (in basis points) of the unemployment rate, the annual

Figure: Response to an exogenous monetary policy shock. England, gold exchange standard.

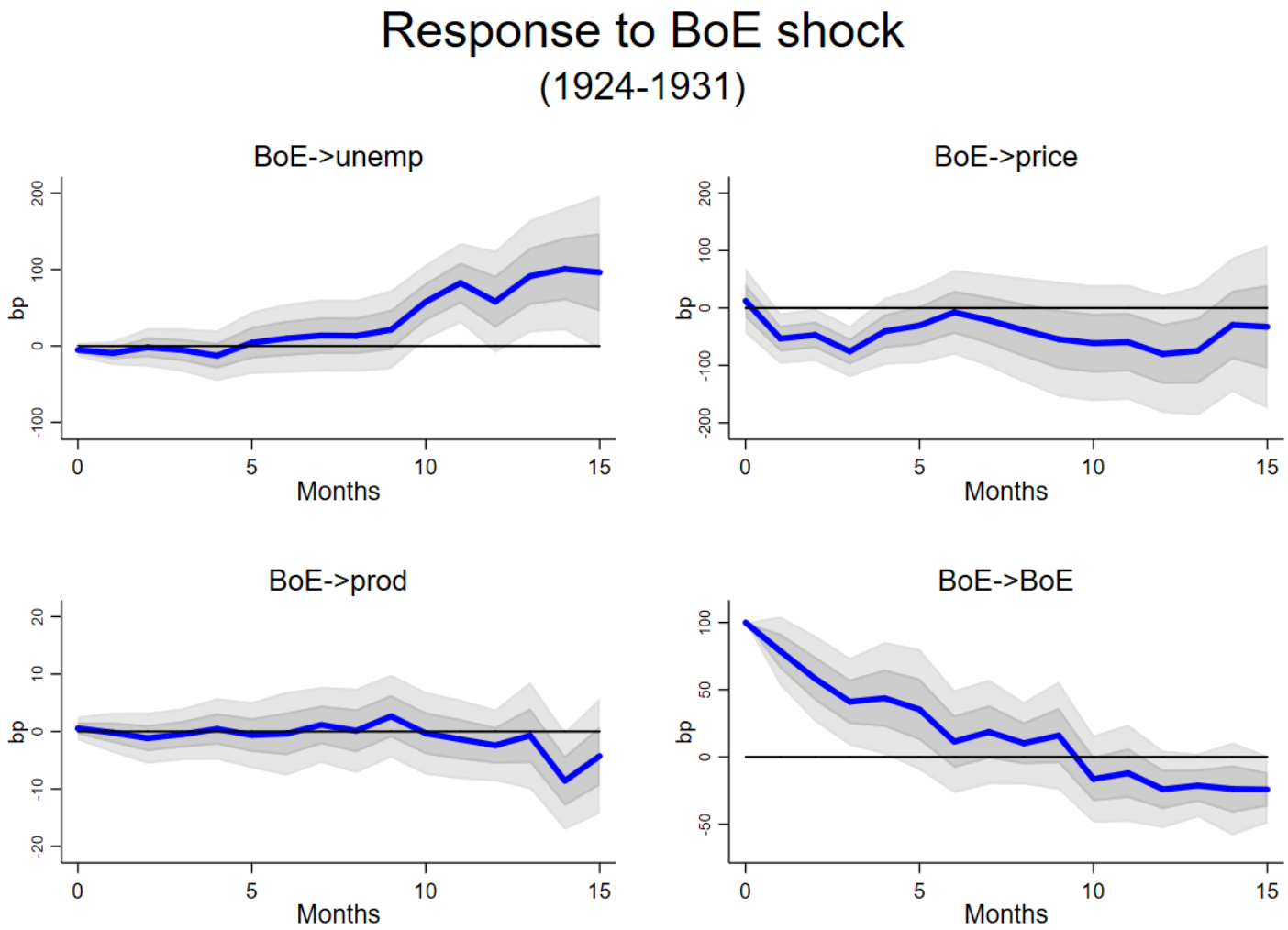


Figure: *

Note: Responses of the unemployment rate, the annual inflation rate and the

Figure: Response to an exogenous monetary policy shock. USA, Bretton Woods.

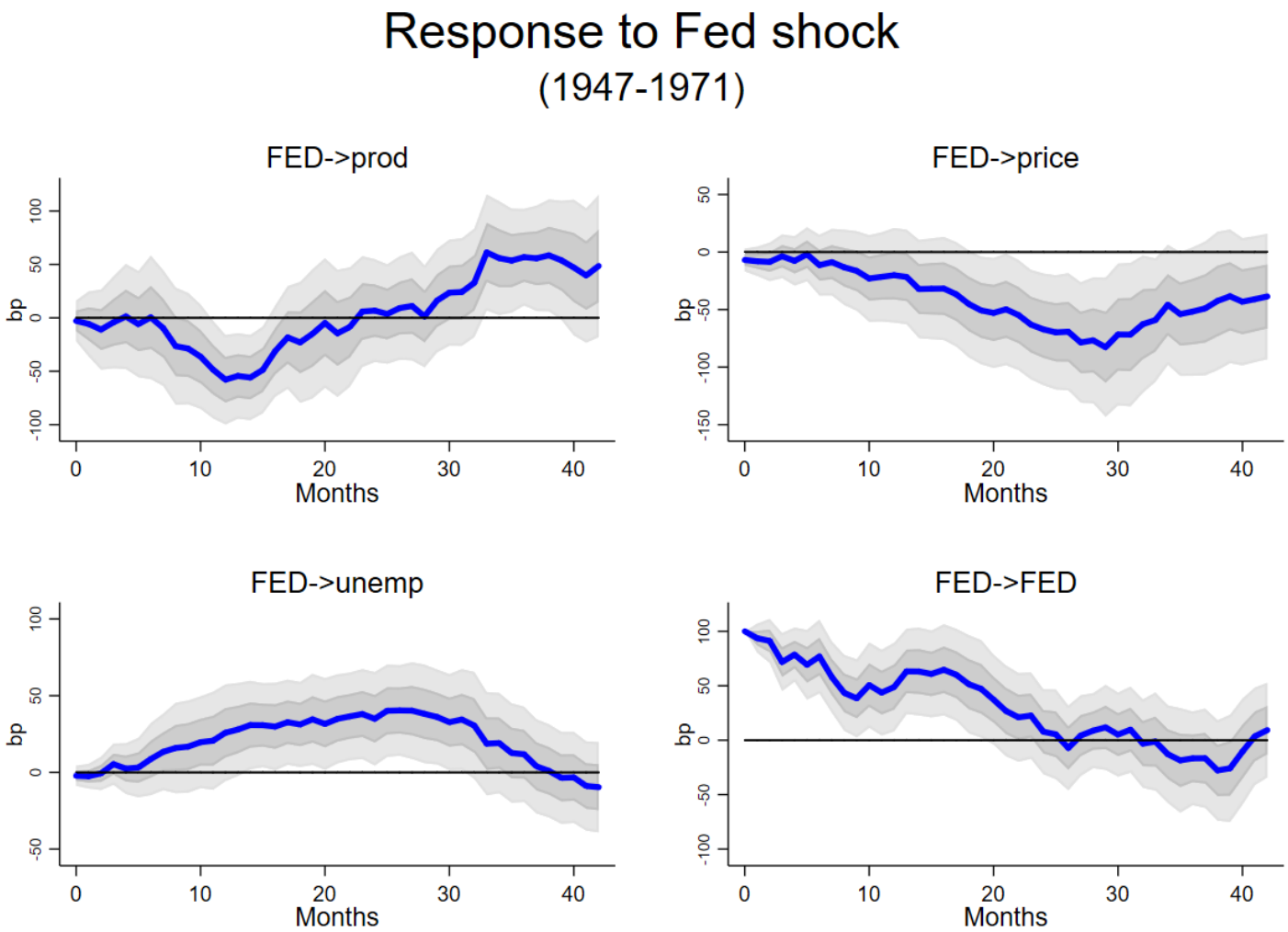
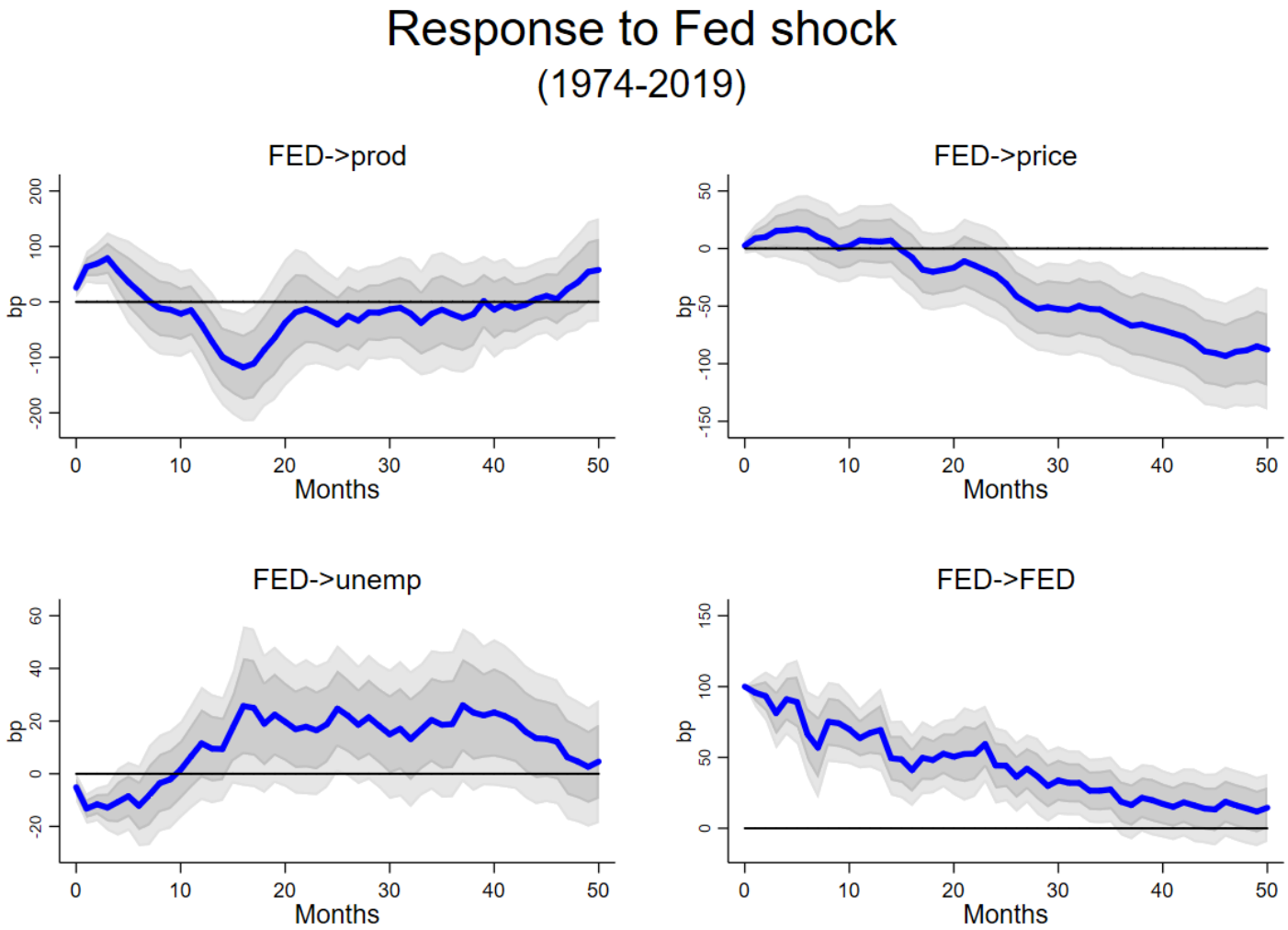


Figure: *

Note: Responses of the unemployment rate, the annual inflation rate and the

Figure: Response to an exogenous monetary policy shock. USA, post Bretton Woods (1973-2019)



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Note: Responses of the unemployment rate, the annual inflation rate and the

Theoretical framework

- The (simplified) central bank balance sheet:
- $D + I = L$
- with D the domestic portfolio (loans and securities), I international reserves (gold, foreign exchange, etc.), L short-term liabilities (banknotes and bank reserves).
- Objective of the central bank: $i_t = i^T$
- "'Elastic currency"': $D \uparrow, L \uparrow$ if $i_t > i^T$

Open economies (floating)

- How does the central bank react to an increase in i_t^*?
- UIP with floating exchange rate: $i_t = i_t^* + E(e_{t+1} - e_t) + \sigma_t$
- σ_t is UIP wedge (or premium). (Kalemli-Ozcan -Varela 2022 etc.)
- if $E(e_{t+1} - e_t) < 0$ and $\sigma_t = 0$, no need for a central bank.
- If not, $D \uparrow$ to offset the effect of σ_t on i_t
- The central bank has a reaction function $D(\sigma)$

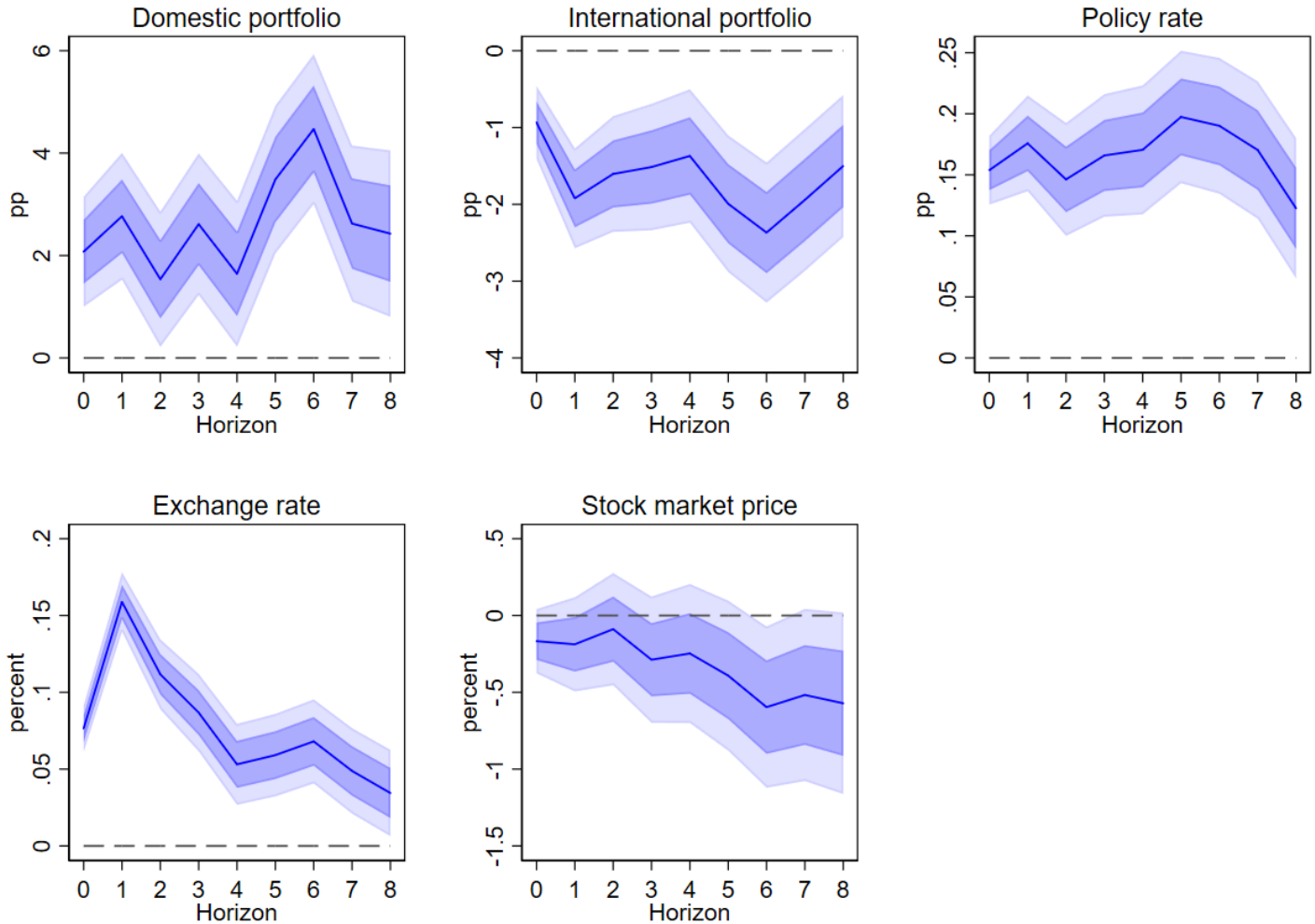
Open economies (fixed)

- Target zone (Krugman 1991, Svensson 1993): $i_t = i_t^* + E(e_{t+1} - e_t) + \sigma_t$ with
- $E(e_{t+1} - e_t) = E(c_{t+1} - c_t) + E(b_{t+1} - b_t =$
- with $\chi_t = E(c_{t+1} - c_t) =$ anticipated change in parity
- with $E(b_{t+1} - b_t) =$ anticipation of appreciation within the exchange rate band
- $i_t = i_t^* + E(b_{t+1} - b_t) + \chi_t + \sigma_t$
- $I \downarrow$ to offset the effect of χ_t on i_t (FX interventions)
- $D \uparrow$ to offset the effect of σ_t on i_t

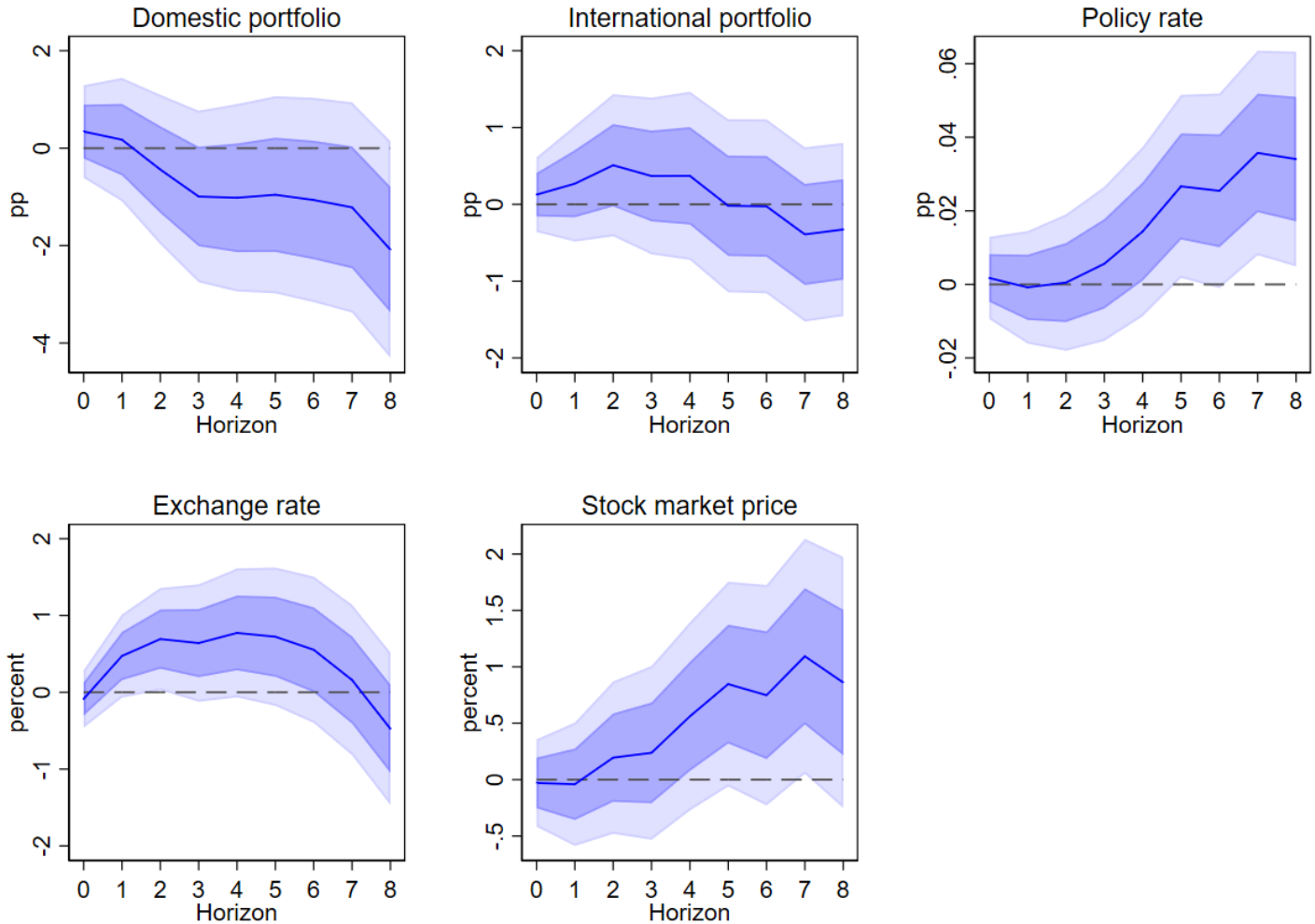
Foreign exchange interventions

- Unsterilized if $I \downarrow$ and $D \rightarrow$ (so $L \downarrow$ and $i^T \uparrow$)
- Sterilized if $I \downarrow$ and $D \uparrow$ (and $L \rightarrow$)
- Sterilized FX interventions long thought to be ineffective, but revised view (Gabaix Maggiori 2015, Blanchard et al. 2015, Weber & Naef 2022 etc.)
- Important: if $I \downarrow$, $D \uparrow$ and $\mathbf{L} \uparrow$, the central bank does more than sterilizing.

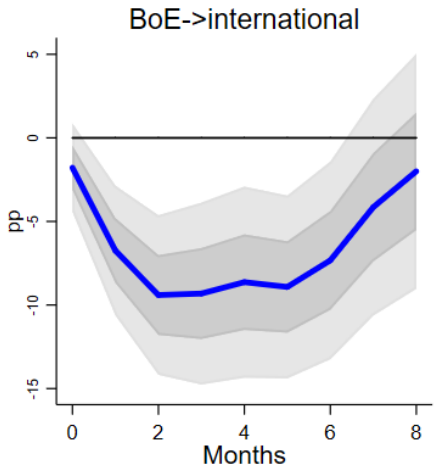
Gold standard peg. Our shock.

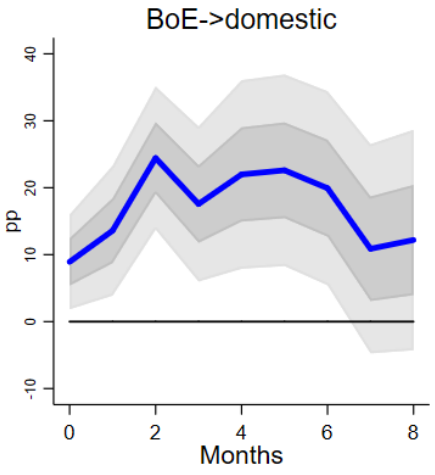


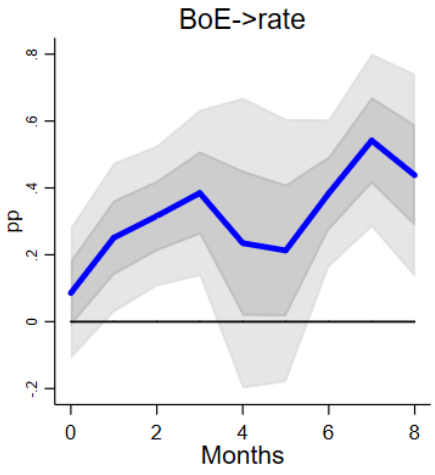
1st Globalization. Floating. Our shock.

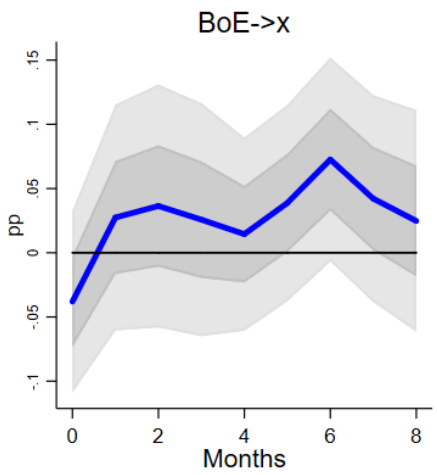


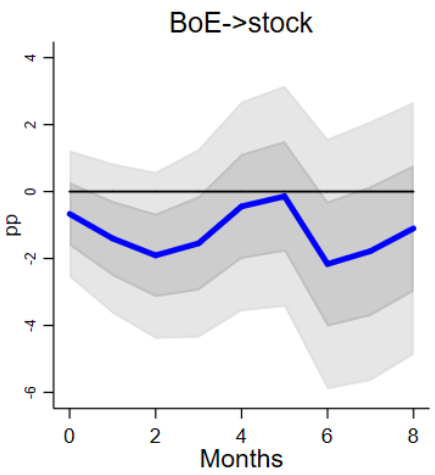
Interwar gold standard (1925-1931). Our shock (BoE).



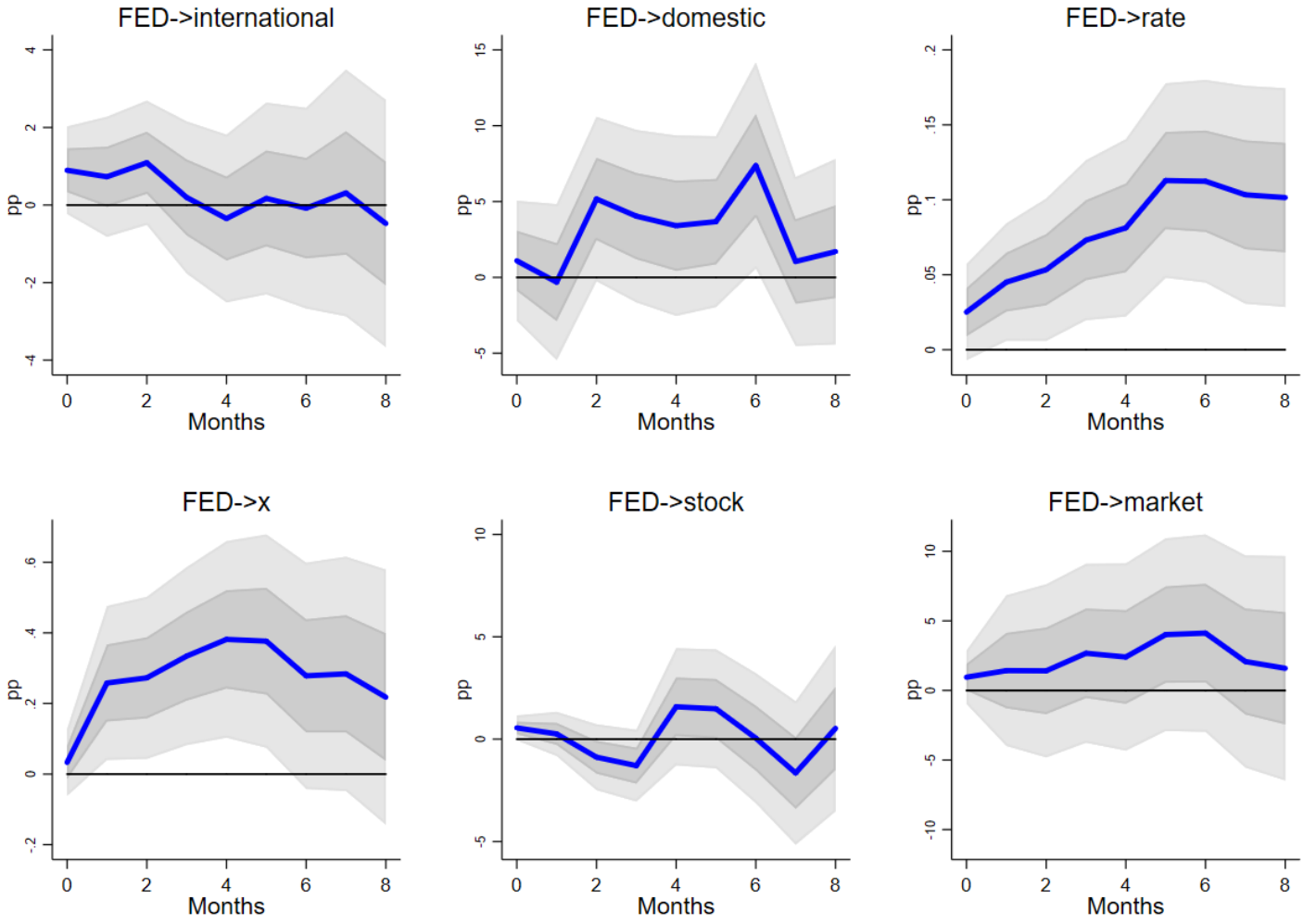




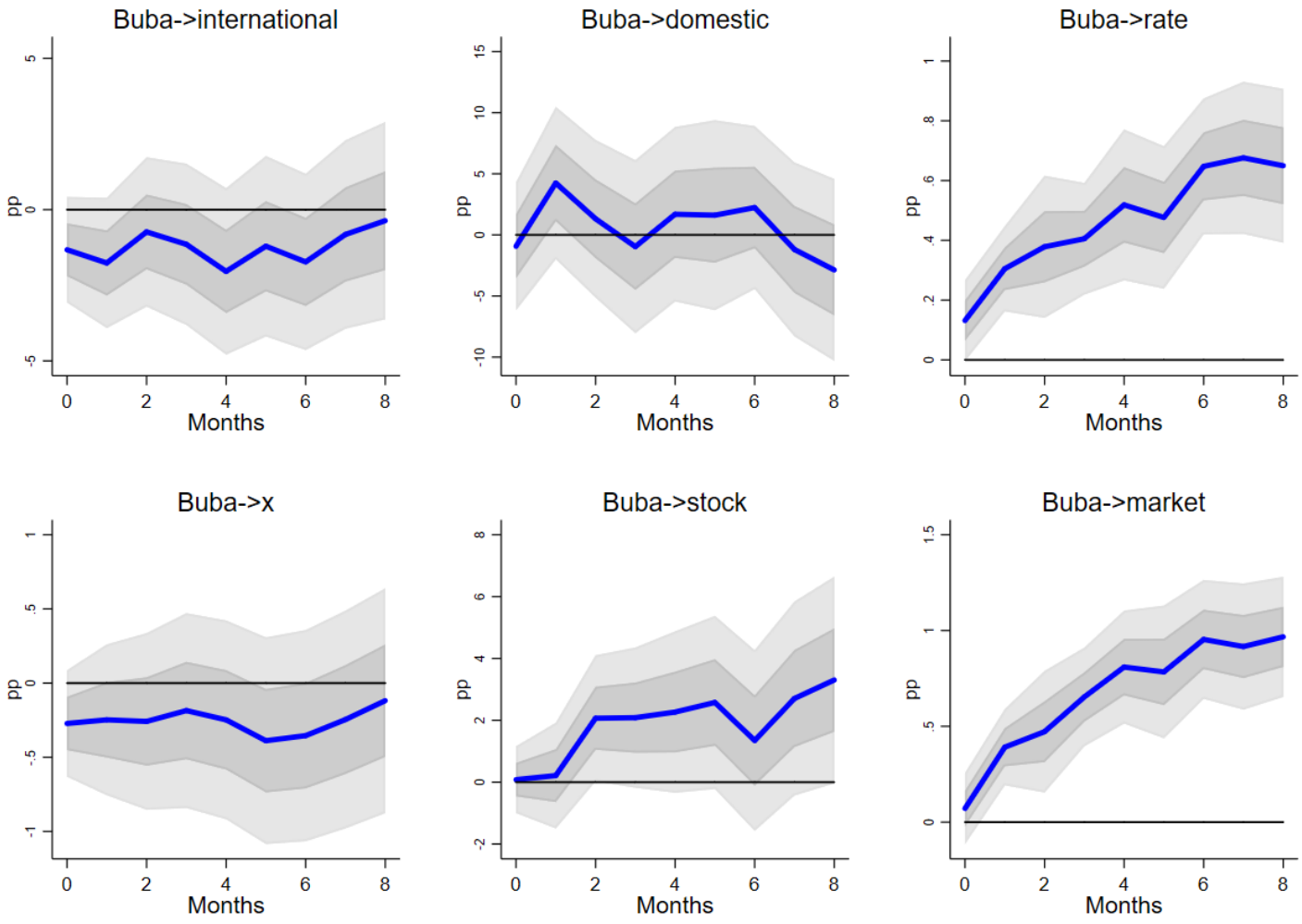




Bretton Woods (1946-1971). Our shock (Fed).



European Monetary System, 1980-1991. Our shock (Bundesbank).



Summary

- Consistent with previous results and with trilemma (Obstfeld-Taylor 2004, Obtsfeld et al. 2019).
- CB balance sheet can round the corner of trilemma in fixed-exchange rate regime (gold standard). No need if strong capital controls
- EMS: unique case where central banks decided to follow fully leading country (anticipate monetary union).

FX valuations

- Domestic portfolio of CBs not at market value.
- International reserves are **in floating exchange rates**. Value changes with exchange rate and security prices.
- **In practice, not revalued every month. But every quarter (or year).**
- **Revaluation does not affect monetary Liability (because revaluation acccount).**
- Falling price of securities $\rightarrow$ downward bias (but small according to CBs)
- Exchange rate depreciation $\rightarrow$ upward bias if in local currency
- Exchange rate depreciation $\rightarrow$ downward bias if in USD (because other reserve currency depreciate). More muted if in SDRs.

FX valuations

- Liability and domestic portfolio have no bias.
- No bias in fixed-exchange rate (always valued at parity).
- We expect bias to be small for short-term reaction (because no monthly revaluation)
- For recent period, we compare FX reserves in SDRs, USD and local currency.
- if reserves in USD or SDR, all biases (securities & x rate) are downward.
- Results: only FX in USD (valued by IMF) decrease significantly.