EUROPEAN CENTRAL BANK

EUROSYSTEM

If the Fed sneezes, who gets a cold?

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Ninth Conference of the IRFMP
Frankfurt, 18-19 March 2016

Disclaimer: The views expressed here are our own and do not necessarily reflect those of the ECB.

Motivation

- Global repercussions of US monetary policy topical issue in view of interest rate normalization.
- Does a monetary tightening result in positive or negative output spillovers for other advanced economies and EMEs?
- What are the effects on short- and long-term interest rates and financial conditions?
- Does it lead to capital inflows or outflows?
- What are the implications of closer trade and financial links with US for the sign and size of spillovers?
- Do the exchange-rate regime and degree of capital mobility affect the macroeconomic and financial spillovers of US monetary policy?

Yet another one on US MP spillovers?

- Like many others: e.g. Canova 2005; Mackowiak 2007, Miniane and Rogers 2007, Agrippina-Miranda and Rey 2015,...
  - But the question we are really asking is: “If the Fed makes the US sneeze, who catches a cold?”
- Identification takes as given US monetary policy has ‘textbook’ effects on domestic interest rates, output and inflation, asset prices.
  - Assume also dollar appreciation and an increase in interest rate differential with other G7 → Rule out shocks too correlated across major currencies.
- In second stage regress each country variables on shocks to look at macroeconomic and financial impact, trade-offs.

Preview of key results

- Our (preliminary) answer: “If the Fed makes the US sneeze, everybody catches a cold, but possibly with different macroeconomic and financial symptoms.”
  - US tightening depresses real activity everywhere, despite widespread dollar appreciation – Aggregate demand/interest rate channel, little expenditure switching effects.
  - Interest rates seem to respond more in AEs than EMEs, inflation falls in AEs and rises in EMEs – Different pass-through.
  - Housing prices, domestic credit decline in EMEs, which seem also to experience capital (banking and portfolio) outflows.
  - Independently of capital mobility, EMEs with more flexible exchange rates seem more insulated from financial spillovers.
- Caveat: Focus is positive, **no normative** implications.

Some related literature: Trilemma

- Di Giovanni and Shambaugh (2008): effect of foreign interest rate on domestic growth larger in pegs.
- Klein and Shambaugh (2010, 2013): interest rates are more closely linked in countries that peg and have open capital markets than in floats and less open capital markets → Support for the trilemma.
  - But drivers of interest rates not identified, role of common shocks.
- Rey (2013), Agrippino-Miranda and Rey (2015): Estimate a global factor explaining the variance of a large cross section of asset returns and show that US monetary policy is a driver of this global factor and global asset prices.

Some related literature: MP shocks

- Canova (2005): Among Latin American countries, floaters and pegs display similar output but different inflation and interest rate responses.
- Mackowiak (2007): The price level and real output in typical EME respond to U.S. monetary shocks by more than the price level and real output in the U.S. itself.
- Miniane and Rogers (2007): Exchange rate flexibility does insulate domestic interest rates from US monetary shocks, capital controls don't – But macroeconomic effects remarkably similar despite exchange-rate regime.
- Georgiadis (2014): A floating exchange rate reduces the output spill-over from US monetary policy shocks (the more open the receiving countries).

Econometric approach

- **Two-step** procedure:

  (i) Estimate US monetary policy shocks in a large BVAR using sign restrictions;

  (ii) Regress a number of variables in countries other than US on estimated MP shocks and own lags – Challenge due to large number of estimated shocks.

  Group countries according to their cross sectional characteristics, such as income levels, exchange rate regime, financial openness, dollar financial exposure, US trade…

First stage estimation: Large BVAR

- BVAR with 13 variables
  - US variables: IP, CPI, FFR, 1Y GBY, Corporate bond spread, Mortgage spread, Commercial paper spread, Stock prices, Nominal effective exchange rate (NEER)
  - International Variables: CRB index of commodity prices, OECD industrial production, Global stock prices (ex US), Difference between G7 short-term interest rate and the US 3-month T-bill rate.
  - Control for global drivers of fluctuations in countries other than the USA.
- Technical details – Giannone, Lenza and Primiceri (2015): Large BVAR with empirical determination of hyperparameters shaping distributions of VAR parameters.

Identification of US monetary policy shocks

- Sign restrictions requiring shocks to have domestic effects consistent with theoretical and empirical literature.
- Benchmark is empirical findings in Gertler and Karadi (2015):
  - Allows to consider responses of many asset prices.
  - Deal with the lower bound by modelling the responses of a range of interest rates.
- In addition restrictions on interest rate differential and exchange rate to isolate shocks with stronger US-specific component.
  - Especially a concern over recent period due to ultra low rates in all major currency blocs.
- “Tighter” prior to recover shocks with desired features.

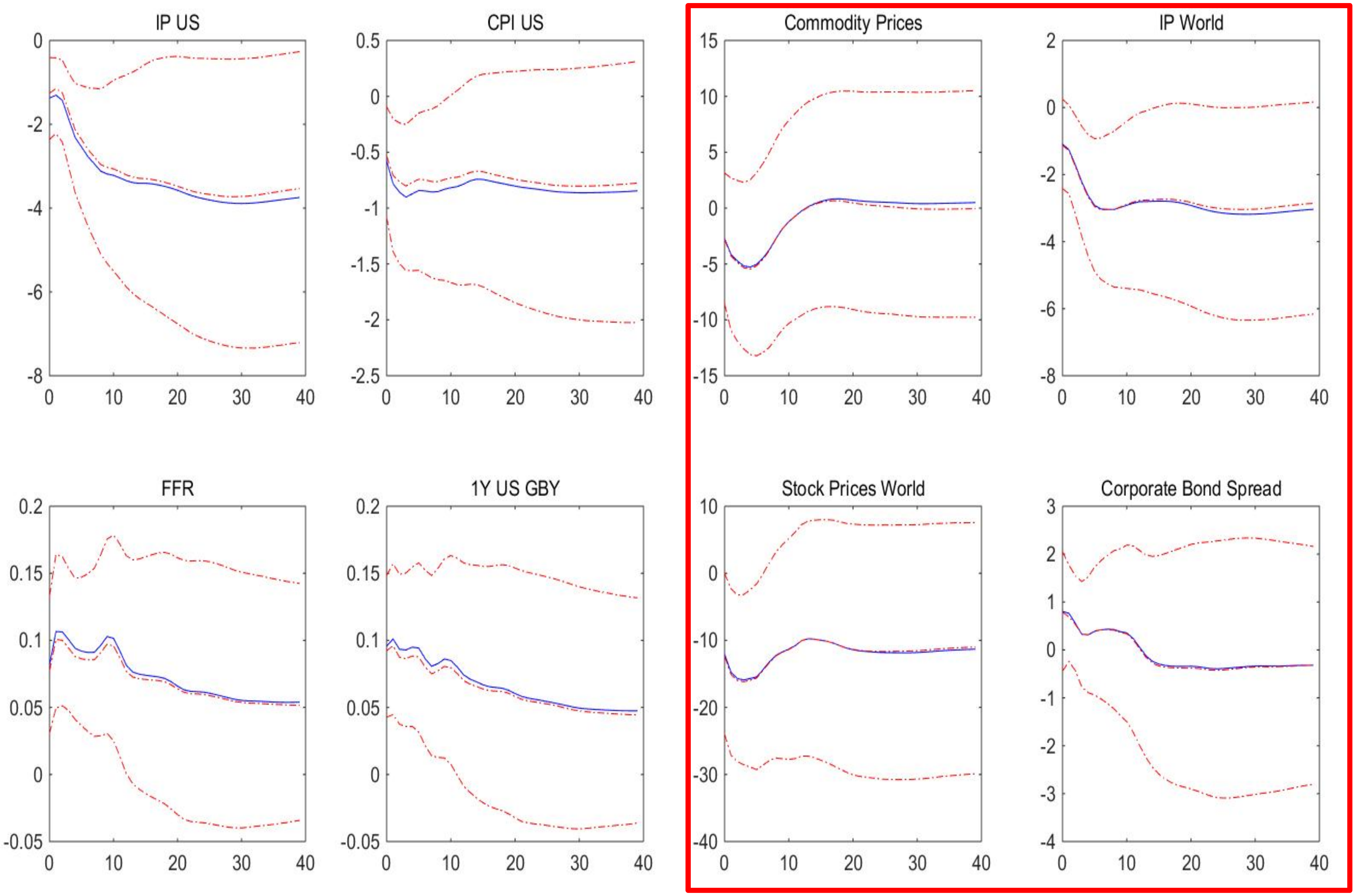
Issues with ZLB

- Approach similar to estimation of "shadow rate".
  - A contractionary shock has to increase the short-term rate (relative to its normal level in line with macro and financial conditions).
  - But also has to increase the 1-year rate, interest rate spreads, and appreciate the dollar.
- Any lack of accommodation in short-term rate interpreted as a contractionary shock only if associated with increases in all these other interest rates, and currency appreciation.
- Key is also the assumption that other G7 rates should not increase as much, for similar reasons → Robust inclusion of post-2008 data

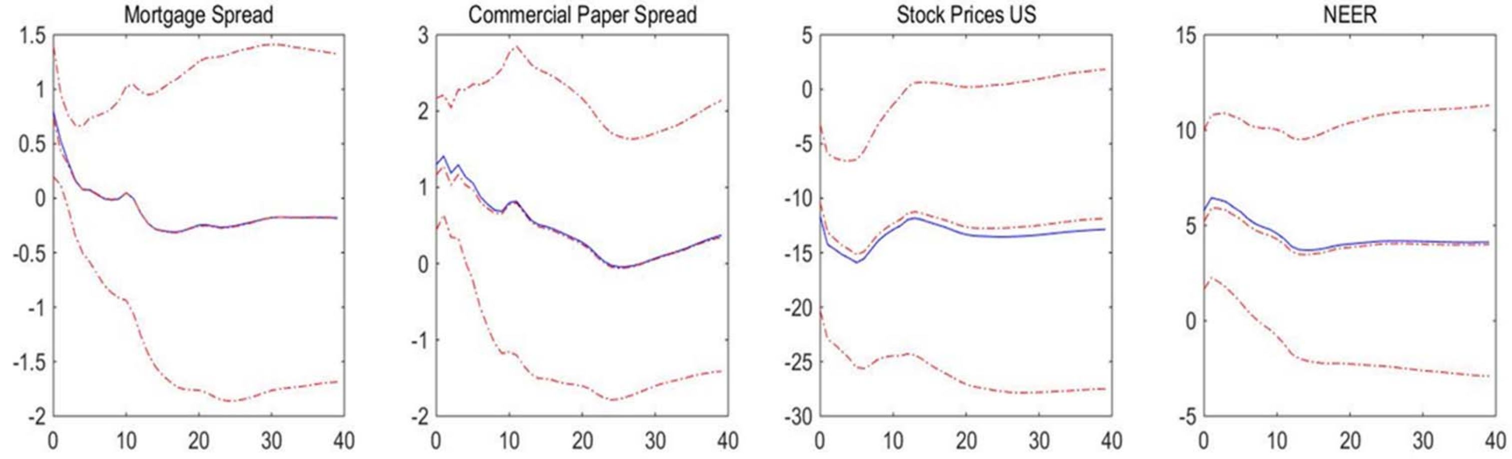
Estimation of US monetary policy shocks

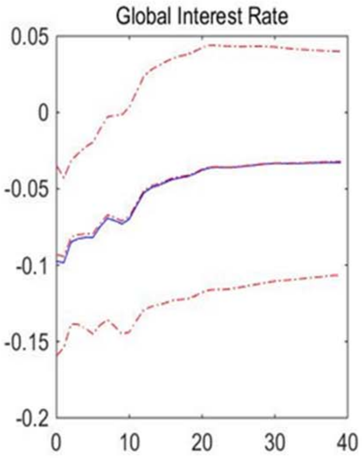
- Sign restrictions on
    - FFR>0 t=1-6
    - US IP <0 t=2-6
    - CPI US<0 t=4
    - US 1-year rate>0 t=1-4
    - Mortgage spread>0 t=2
    - Commercial paper spread>0 t=1-3
    - Stock prices US<0, t=1
    - G7 interest differential<0 t=1
    - NEER>0 t=1
- Other variables unconstrained: Corporate spread, Commodity prices, Global stock prices and IP.
- For each draw from the BVAR posterior evaluate 1000 random orthogonalizations of the Variance-covariance matrix and keep those that satisfy sign restrictions (Uhlig, 2005).
- At least one suitable orthogonalization for over 99% of the draws from the reduced form posterior.

The effect of a US monetary policy shock: 1980-2013

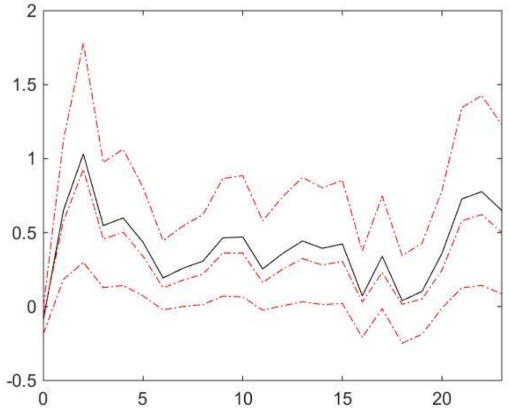


The effect of a US monetary policy shock: 1980-2013





US VIX



Robustness and validation

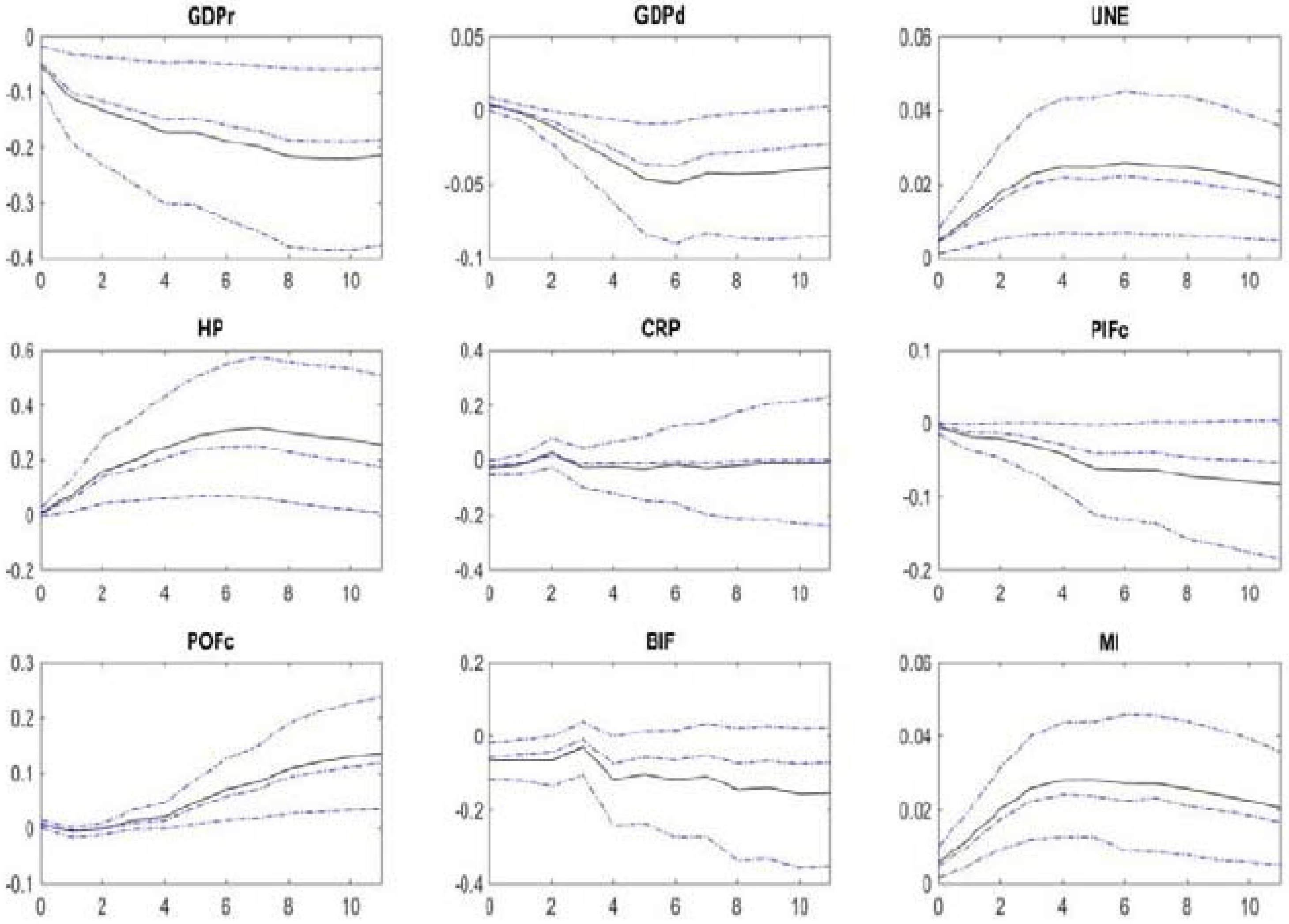
- When BVAR estimated up to the end of 2008:
  - IRFs are similar to baseline specification, except a smaller response of financial spreads.
  - But some large shocks estimated at end of 2008.

- Exclude the global interest rate differential from the BVAR:
  - Very persistent response of interest rates
  - Larger response of international variables

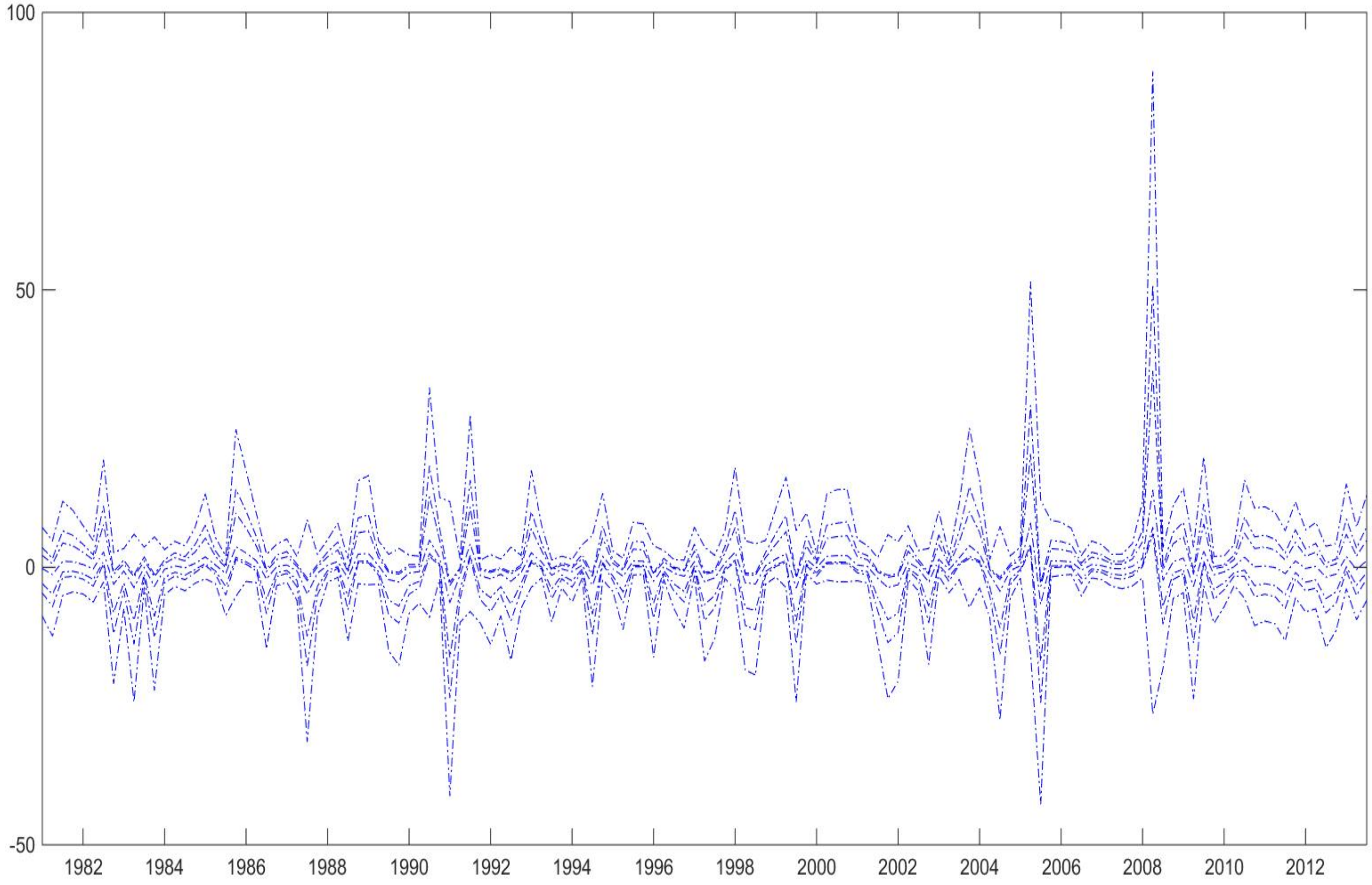
=> Key for robustness to inclusion of post-2008 sample

- Shocks significantly affect US variables not included in VAR:
  - VIX increases – Rey (2013), Obstfeld (2015).
  - Quarterly macro and financial variables including GDP, unemployment, capital (portfolio and banking) flows.

Validation: US quarterly responses 1980-2013



The estimated US monetary policy shocks 1980-2013 (Quarterly)



Second-stage regressions

- Each variable regressed on MP shocks and own lags.
- *Specification*: $y_{j,i,t} = \alpha_{i,j} + \phi_{i,j}(L)\, y_{j,i,t-1} + \beta_{i,j}(L)\, \varepsilon^{MP}_{US,t} + \varepsilon_t$
    - Lags of the dependent variable (12 if monthly, 4 if quarterly);
    - Contemporaneous MP shock + lags (24 if monthly, 8 if quarterly);
    - Constant + Trend + Dummy variables (for seasonality).
    - In quarterly regressions MP shocks aggregated taking the quarterly mean.
- In results below shocks estimation uncertainty fully taken into account by running regressions with all estimated shocks. (But not sampling uncertainty, so far computationally challenging to consider both).

Second-stage regressions results

- Results displayed for the quantiles of mean IRFs across countries groups based on average characteristics over sample:
  - Advanced vs Emerging
  - Floaters vs $ Pegs – Klein-Shambaugh (2010)
  - Financially Open vs Less Open – Chinn-Ito
  - Dollar Exposed vs Less Dollar Exposed – Benetrix, Lane, Shambaugh (2015)
  - Overall and bilateral (US) trade openness

Results with the last two features so far not very clear-cut, not shown here.

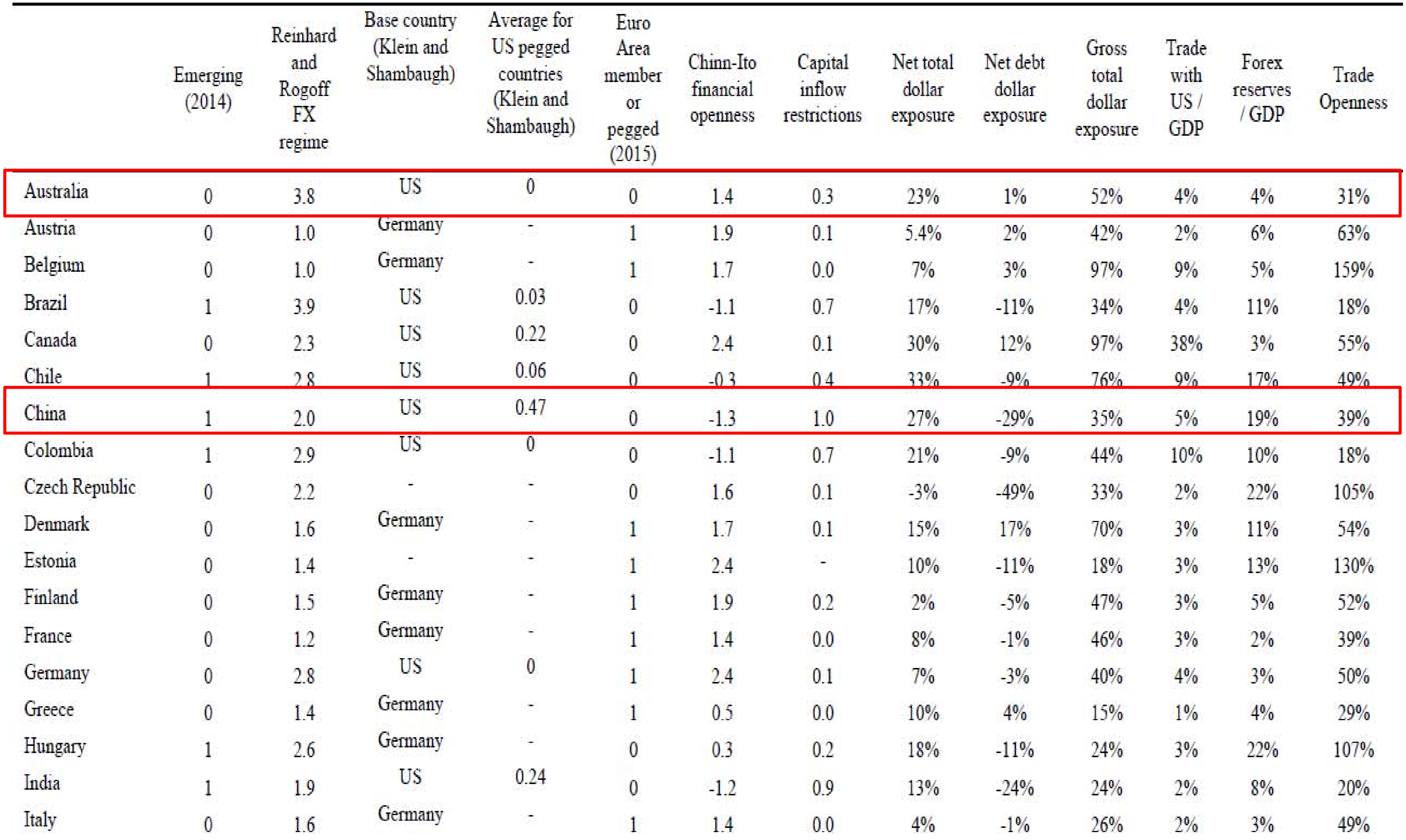
Country dataset

- **36 countries + euro area:**

Australia, Austria, Belgium, Brazil, Canada, Chile, China, Colombia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, India, Italy, Japan, Korea, Latvia, Lithuania, Malaysia, Mexico, Netherlands, Norway, Philippines, Poland, Portugal, Russia, South Africa, Spain, Sweden, Thailand, Turkey, UK.

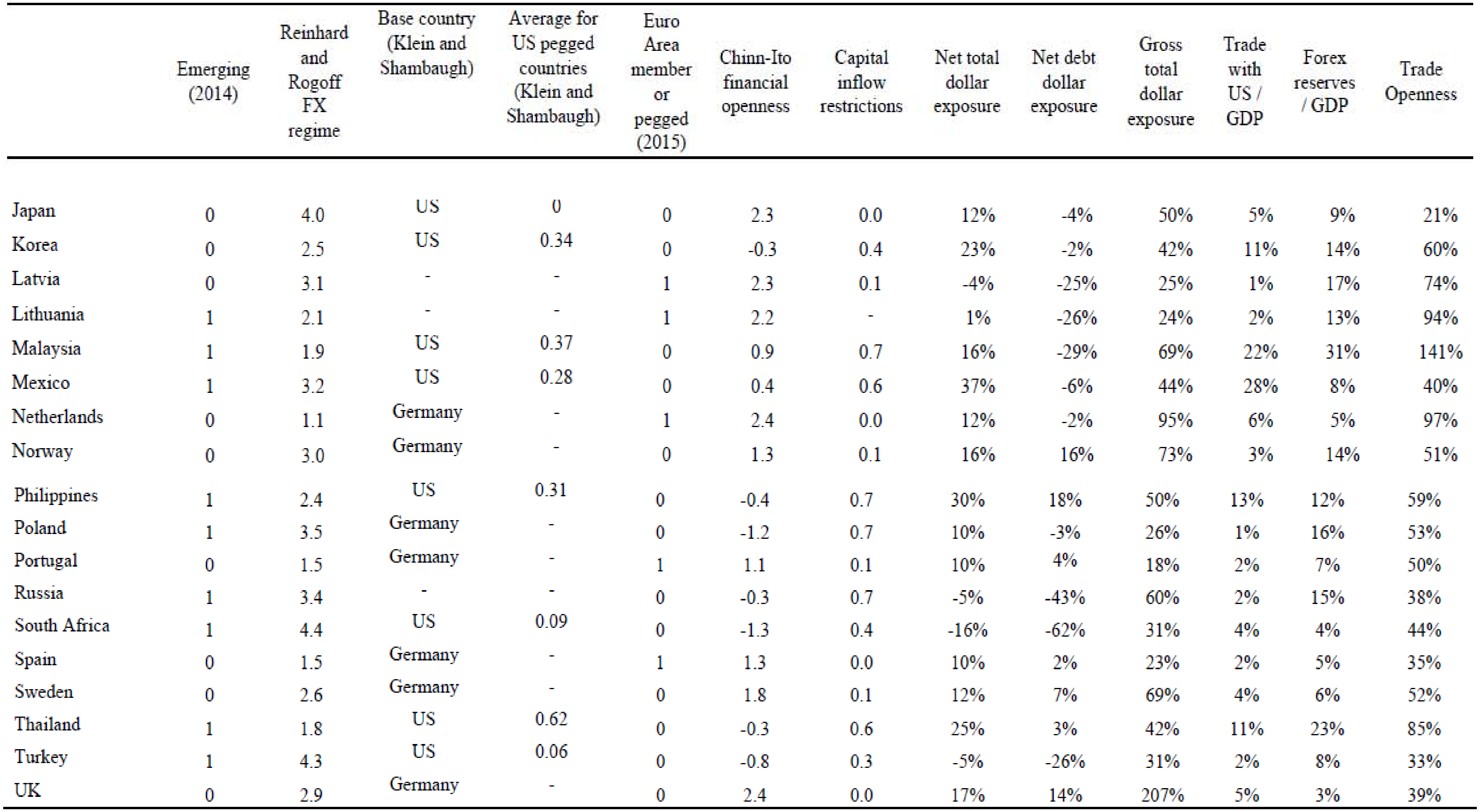
- **Variables:**
  - *Monthly*: Dollar NER, REER, IR Differential (Short) , CPI, IP, Real Stock Prices, Trade Balance,10Y Govt Bond Yield differential
  - *Quarterly*: Real GDP and Deflator, Unemployment, Real House Prices, Real Credit to Private Sector, Portfolio and Bank flows
- **Sample:** 1980 – 2013 (shorter for some countries/variables)

Countries characteristics



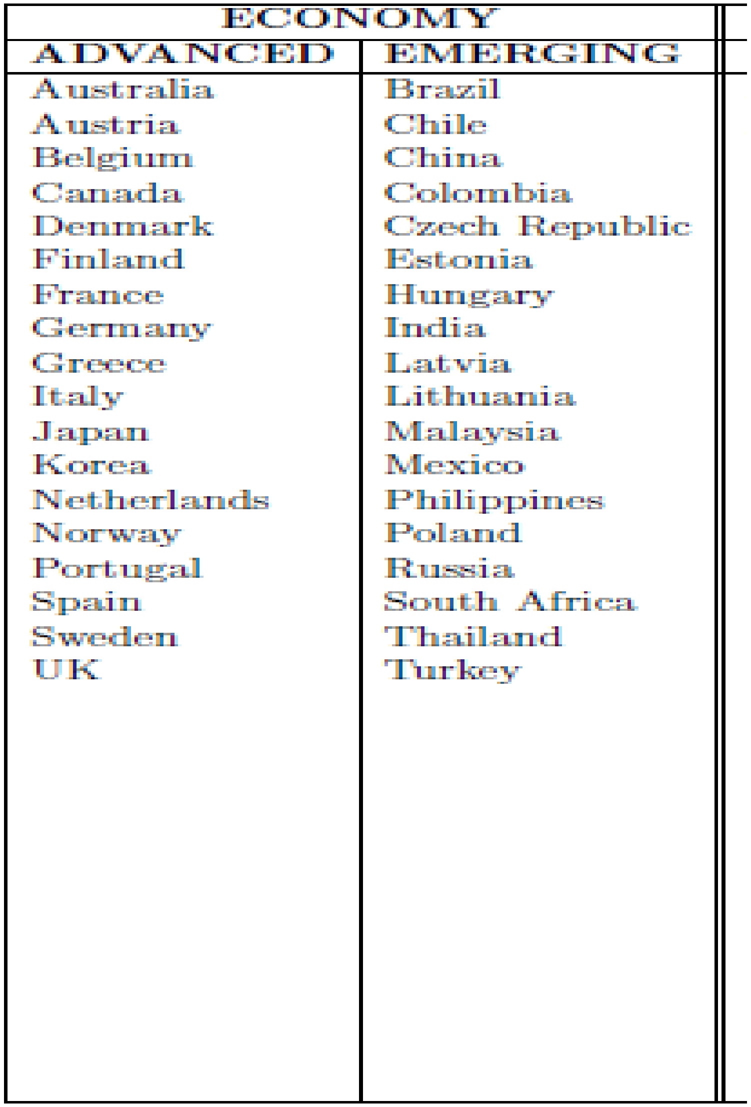
	Emerging (2014)	Reinhard and Rogoff FX regime	Base country (Klein and Shambaugh)	Average for US pegged countries (Klein and Shambaugh)	Euro Area member or pegged (2015)	Chinn-Ito financial openness	Capital inflow restrictions	Net total dollar exposure	Net debt dollar exposure	Gross total dollar exposure	Trade with US / GDP	Forex reserves / GDP	Trade Openness
Australia	0	3.8	US	0	0	1.4	0.3	23%	1%	52%	4%	4%	31%
Austria	0	1.0	Germany	-	1	1.9	0.1	5.4%	2%	42%	2%	6%	63%
Belgium	0	1.0	Germany	-	1	1.7	0.0	7%	3%	97%	9%	5%	159%
Brazil	1	3.9	US	0.03	0	-1.1	0.7	17%	-11%	34%	4%	11%	18%
Canada	0	2.3	US	0.22	0	2.4	0.1	30%	12%	97%	38%	3%	55%
Chile	1	2.8	US	0.06	0	-0.3	0.4	33%	-9%	76%	9%	17%	49%
China	1	2.0	US	0.47	0	-1.3	1.0	27%	-29%	35%	5%	19%	39%
Colombia	1	2.9	US	0	0	-1.1	0.7	21%	-9%	44%	10%	10%	18%
Czech Republic	0	2.2	-	-	0	1.6	0.1	-3%	-49%	33%	2%	22%	105%
Denmark	0	1.6	Germany	-	1	1.7	0.1	15%	17%	70%	3%	11%	54%
Estonia	0	1.4	-	-	1	2.4	-	10%	-11%	18%	3%	13%	130%
Finland	0	1.5	Germany	-	1	1.9	0.2	2%	-5%	47%	3%	5%	52%
France	0	1.2	Germany	-	1	1.4	0.0	8%	-1%	46%	3%	2%	39%
Germany	0	2.8	US	0	1	2.4	0.1	7%	-3%	40%	4%	3%	50%
Greece	0	1.4	Germany	-	1	0.5	0.0	10%	4%	15%	1%	4%	29%
Hungary	1	2.6	Germany	-	0	0.3	0.2	18%	-11%	24%	3%	22%	107%
India	1	1.9	US	0.24	0	-1.2	0.9	13%	-24%	24%	2%	8%	20%
Italy	0	1.6	Germany	-	1	1.4	0.0	4%	-1%	26%	2%	3%	49%

Countries characteristics



	Emerging (2014)	Reinhard and Rogoff FX regime	Base country (Klein and Shambaugh)	Average for US pegged countries (Klein and Shambaugh)	Euro Area member or pegged (2015)	Chinn-Ito financial openness	Capital inflow restrictions	Net total dollar exposure	Net debt dollar exposure	Gross total dollar exposure	Trade with US / GDP	Forex reserves / GDP	Trade Openness
Japan	0	4.0	US	0	0	2.3	0.0	12%	-4%	50%	5%	9%	21%
Korea	0	2.5	US	0.34	0	-0.3	0.4	23%	-2%	42%	11%	14%	60%
Latvia	0	3.1	-	-	1	2.3	0.1	-4%	-25%	25%	1%	17%	74%
Lithuania	1	2.1	-	-	1	2.2	-	1%	-26%	24%	2%	13%	94%
Malaysia	1	1.9	US	0.37	0	0.9	0.7	16%	-29%	69%	22%	31%	141%
Mexico	1	3.2	US	0.28	0	0.4	0.6	37%	-6%	44%	28%	8%	40%
Netherlands	0	1.1	Germany	-	1	2.4	0.0	12%	-2%	95%	6%	5%	97%
Norway	0	3.0	Germany	-	0	1.3	0.1	16%	16%	73%	3%	14%	51%
Philippines	1	2.4	US	0.31	0	-0.4	0.7	30%	18%	50%	13%	12%	59%
Poland	1	3.5	Germany	-	0	-1.2	0.7	10%	-3%	26%	1%	16%	53%
Portugal	0	1.5	Germany	-	1	1.1	0.1	10%	4%	18%	2%	7%	50%
Russia	1	3.4	-	-	0	-0.3	0.7	-5%	-43%	60%	2%	15%	38%
South Africa	1	4.4	US	0.09	0	-1.3	0.4	-16%	-62%	31%	4%	4%	44%
Spain	0	1.5	Germany	-	1	1.3	0.0	10%	2%	23%	2%	5%	35%
Sweden	0	2.6	Germany	-	0	1.8	0.1	12%	7%	69%	4%	6%	52%
Thailand	1	1.8	US	0.62	0	-0.3	0.6	25%	3%	42%	11%	23%	85%
Turkey	1	4.3	US	0.06	0	-0.8	0.3	-5%	-26%	31%	2%	8%	33%
UK	0	2.9	Germany	-	0	2.4	0.0	17%	14%	207%	5%	3%	39%

Countries groups: AEs and EMEs



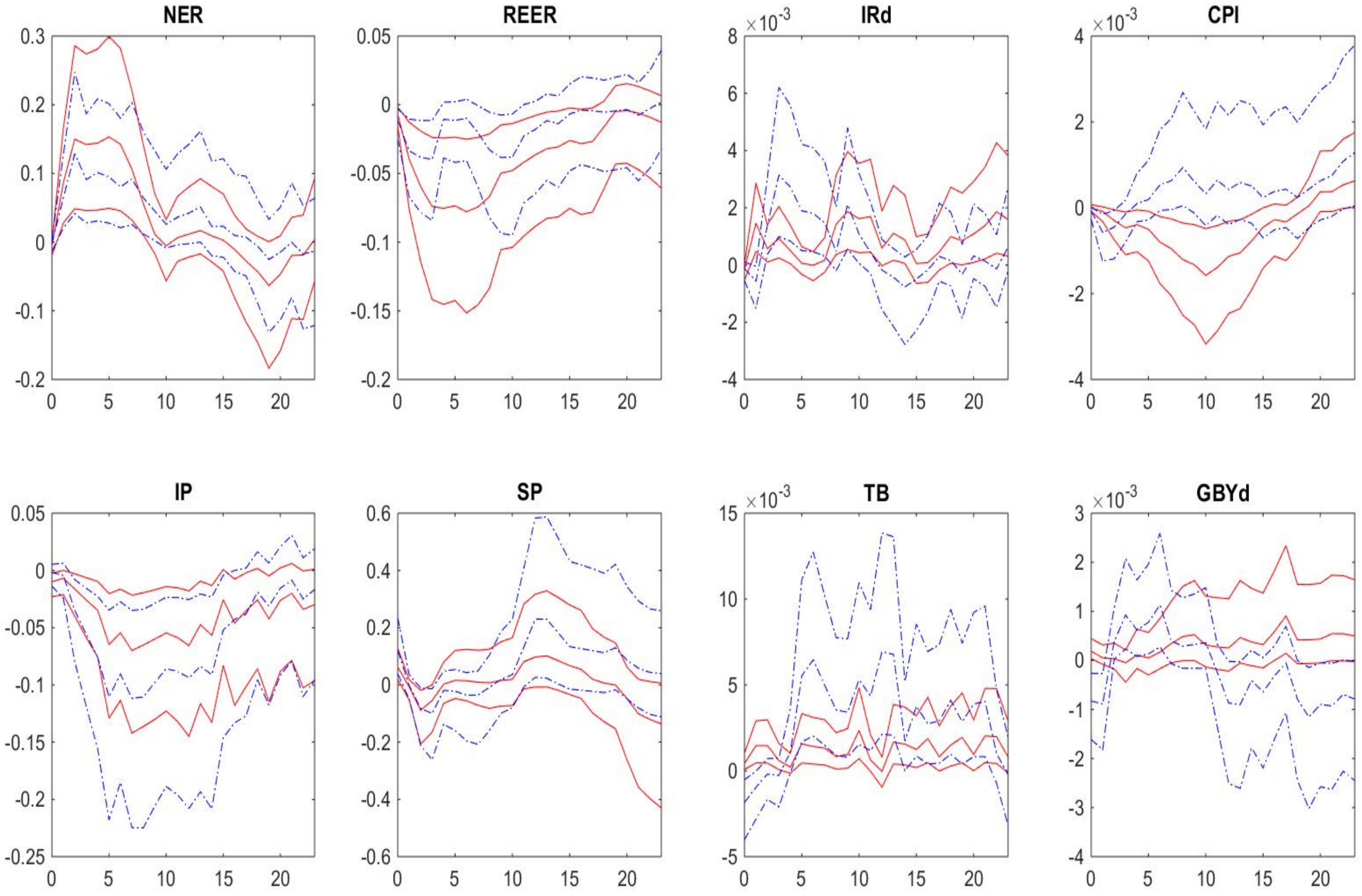
ECONOMY	
ADVANCED	EMERGING
Australia	Brazil
Austria	Chile
Belgium	China
Canada	Colombia
Denmark	Czech Republic
Finland	Estonia
France	Hungary
Germany	India
Greece	Latvia
Italy	Lithuania
Japan	Malaysia
Korea	Mexico
Netherlands	Philippines
Norway	Poland
Portugal	Russia
Spain	South Africa
Sweden	Thailand
UK	Turkey

Monthly results:

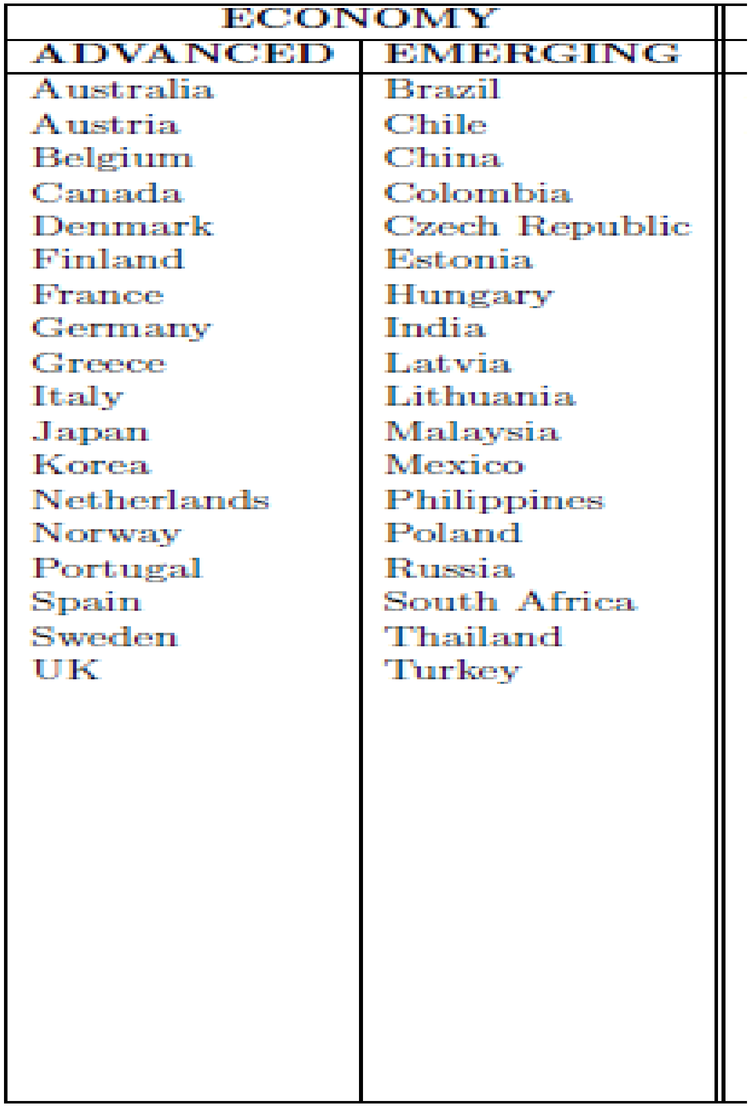
- Widespread depreciation and output (IP) reductions.
- CPI rises (declines) significantly in EMEs (AEs), while the trade balance falls (improves) on impact in EMEs (AEs).
- Consistent with lower pass-through and positive interest differentials in AEs.

AEs and EMEs

Monthly data full sample



Countries groups: AEs and EMEs

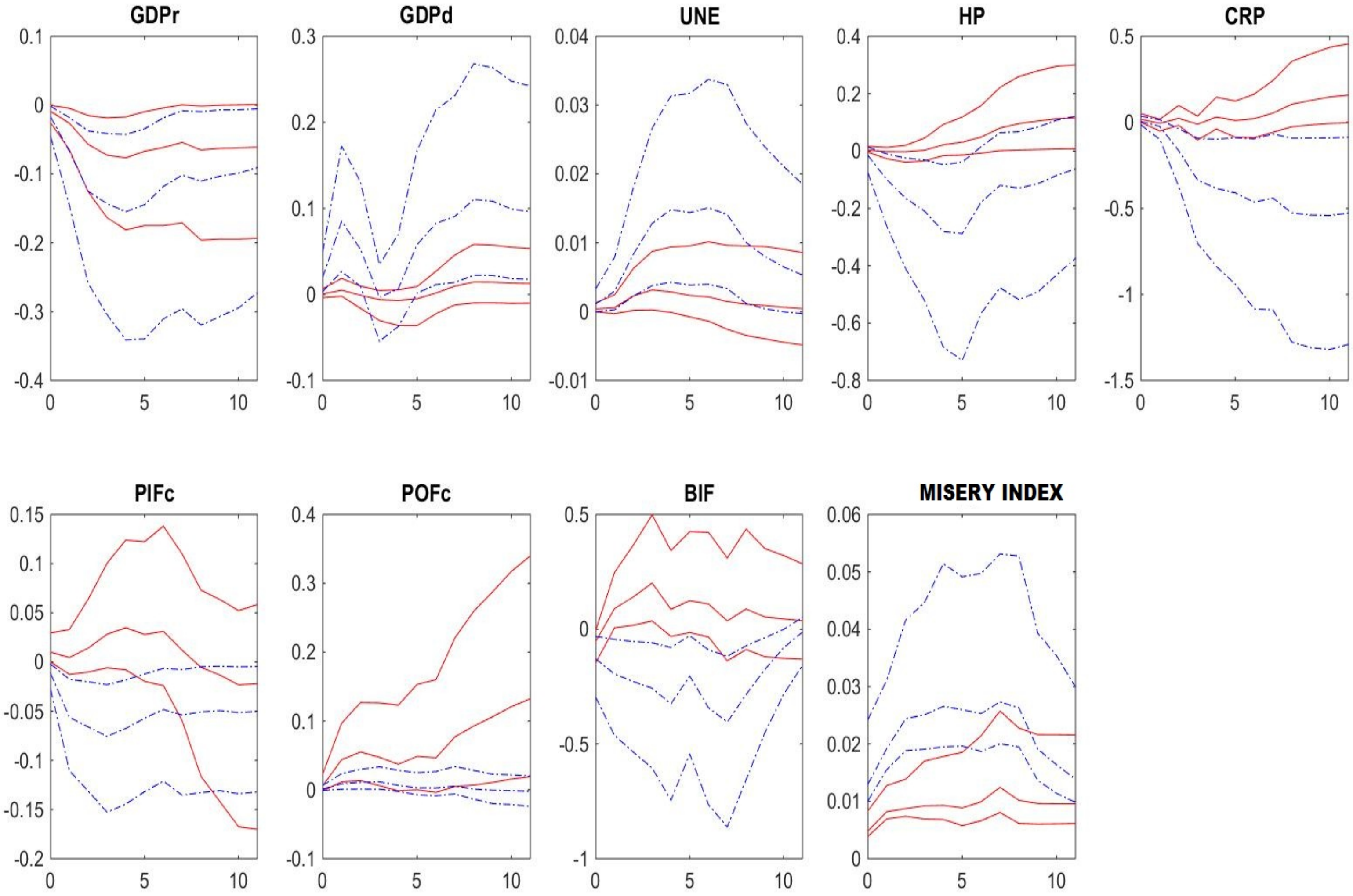


ECONOMY	
ADVANCED	EMERGING
Australia	Brazil
Austria	Chile
Belgium	China
Canada	Colombia
Denmark	Czech Republic
Finland	Estonia
France	Hungary
Germany	India
Greece	Latvia
Italy	Lithuania
Japan	Malaysia
Korea	Mexico
Netherlands	Philippines
Norway	Poland
Portugal	Russia
Spain	South Africa
Sweden	Thailand
UK	Turkey

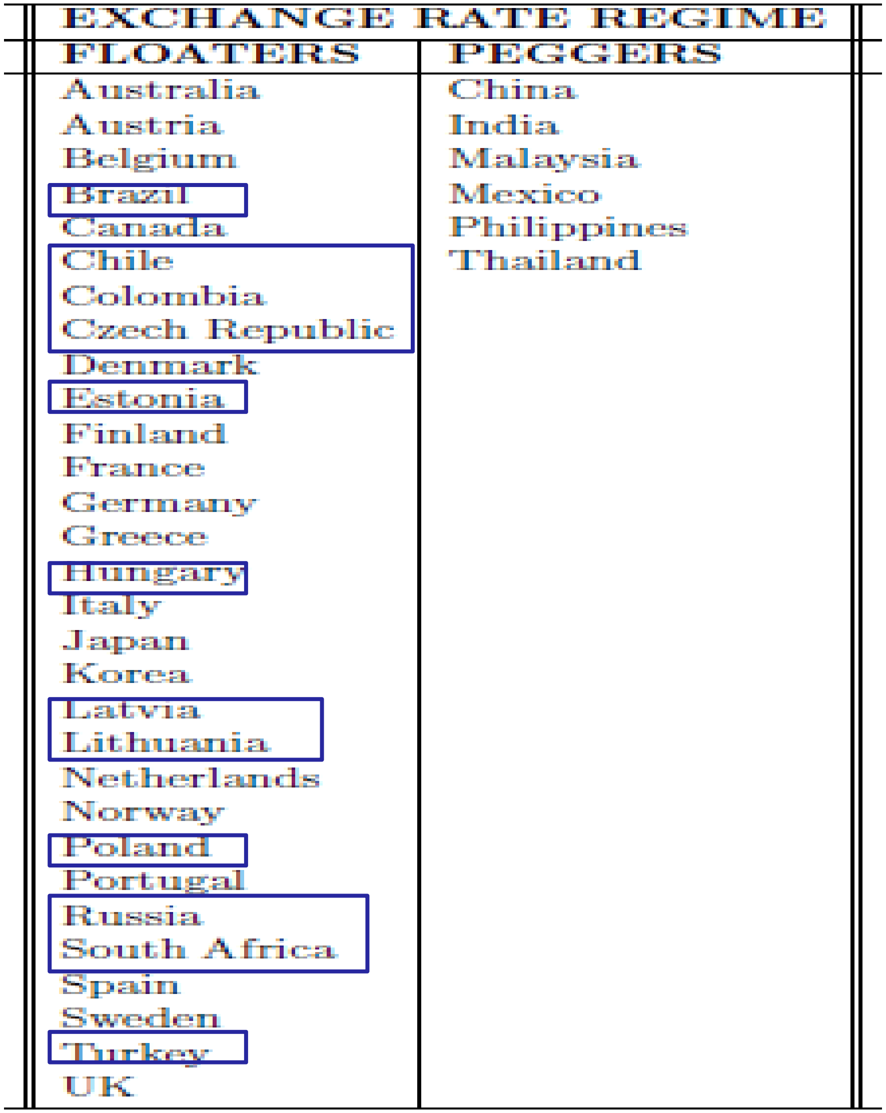
Quarterly results:

- GDP falls, unemployment rises.
- In EMEs falling real house prices, real domestic credit; negative capital inflows (notably bank inflows); higher macro and financial volatility.
- These variables barely affected in AEs, lower macro volatility ("misery" index).
- US tightening similar to capital outflow shock for EMEs.

AEs and EMEs
Quarterly data full sample



Countries groups: EMEs, $ Pegs and Floats



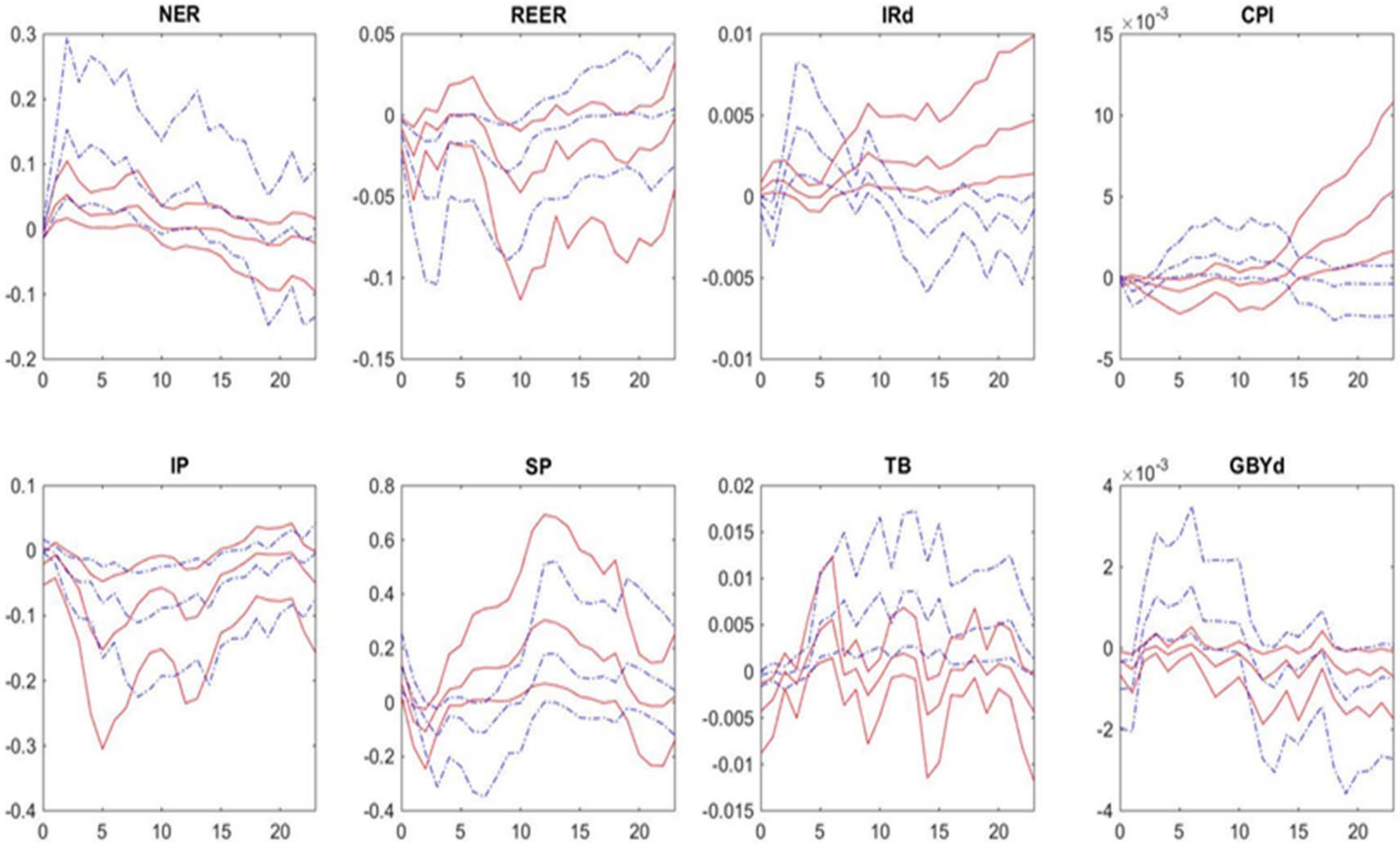
EXCHANGE RATE REGIME	
FLOATERS	PEGGERS
Australia	China
Austria	India
Belgium	Malaysia
Brazil	Mexico
Canada	Philippines
Chile	Thailand
Colombia	
Czech Republic	
Denmark	
Estonia	
Finland	
France	
Germany	
Greece	
Hungary	
Italy	
Japan	
Korea	
Latvia	
Lithuania	
Netherlands	
Norway	
Poland	
Portugal	
Russia	
South Africa	
Spain	
Sweden	
Turkey	
UK	

Monthly results:

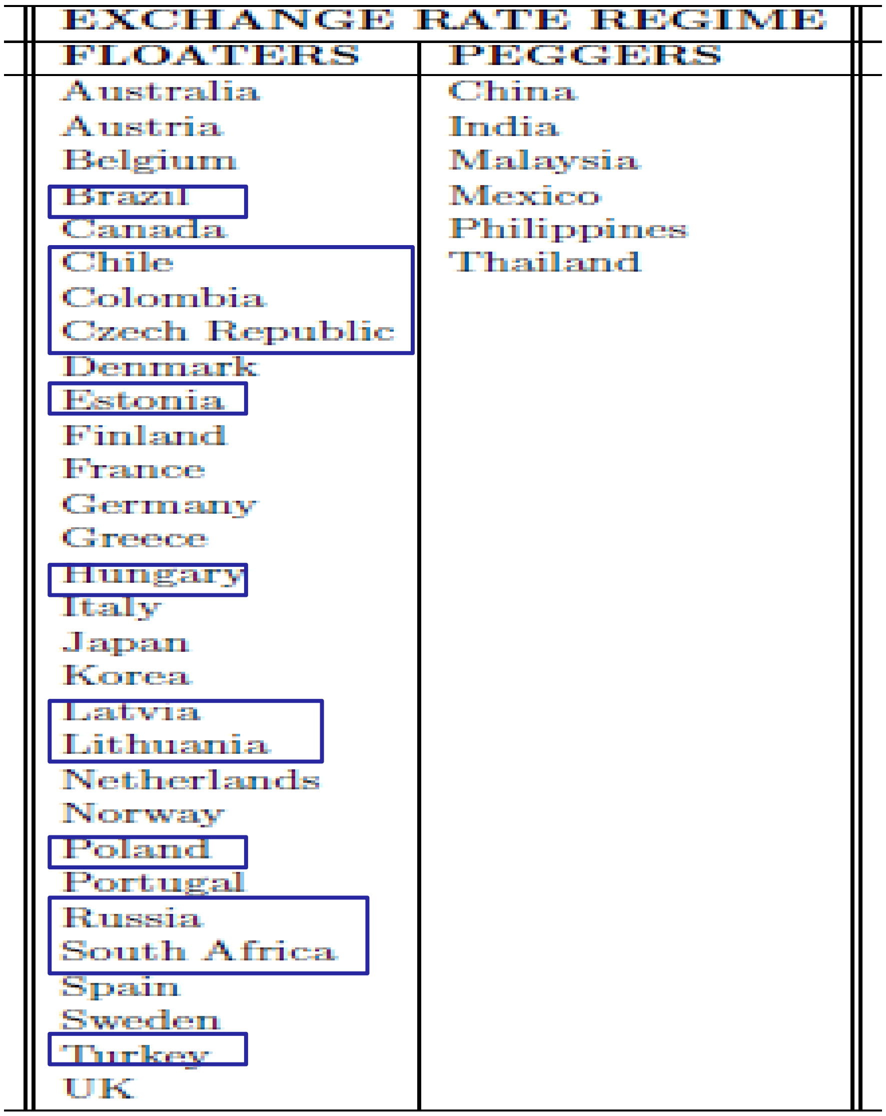
- Short-term rates respond more (less) than one-to-one to US rates in Pegs (Floaters), but CPI increases persistently (temporarily).
- Responses of industrial production, stock prices quite similar, but trade balance deteriorates more (less) in Pegs (Floaters) – Smaller depreciation.

EMEs, $ Pegs and Floaters

Monthly data full sample



Countries groups: EMEs, $ Pegs and Floats



EXCHANGE RATE REGIME	
FLOATERS	**PEGGERS**
Australia	China
Austria	India
Belgium	Malaysia
Brazil	Mexico
Canada	Philippines
Chile	Thailand
Colombia	
Czech Republic	
Denmark	
Estonia	
Finland	
France	
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Korea	
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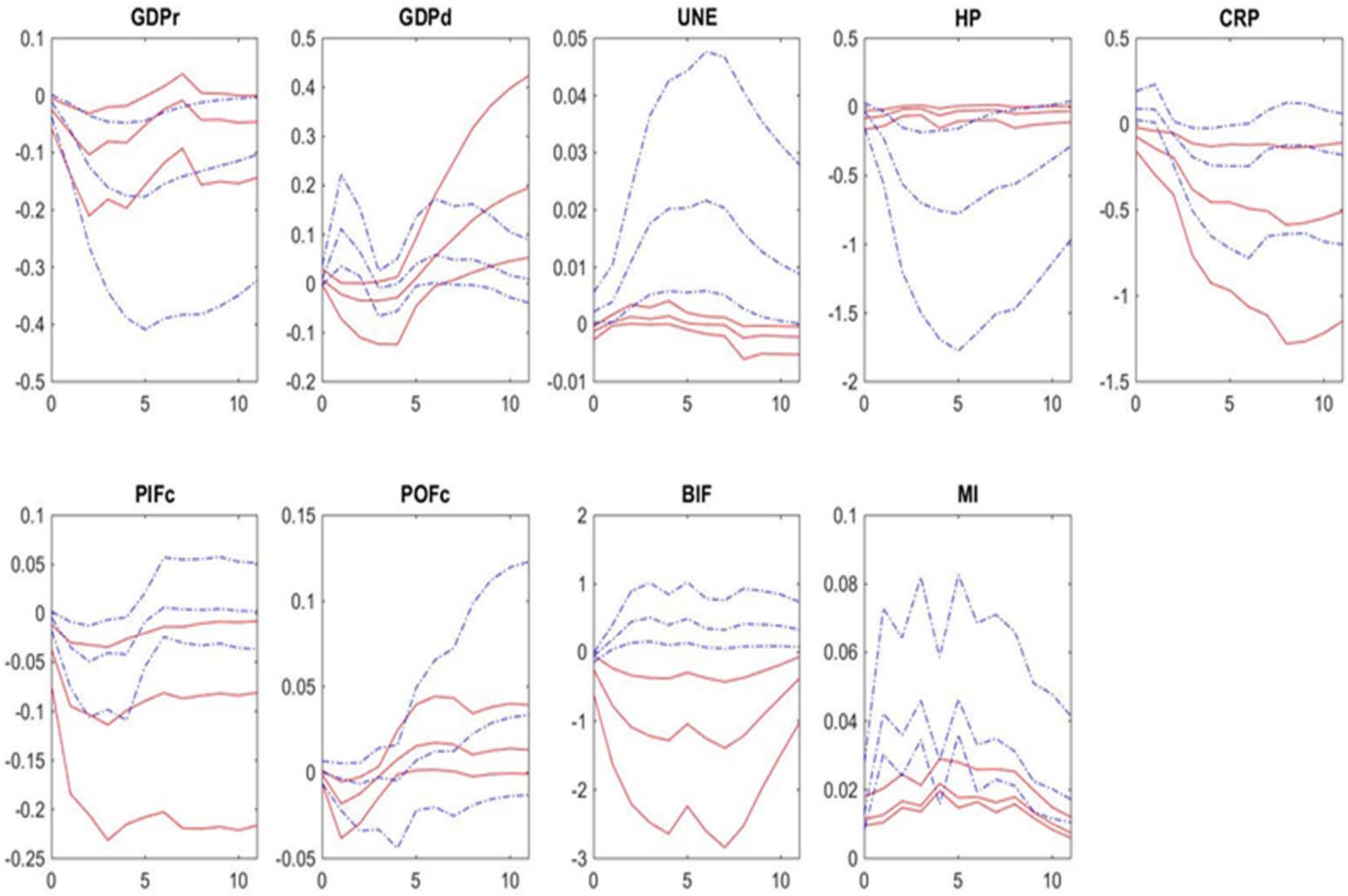
Lithuania	
Netherlands	
Norway	
Poland	
Portugal	
Russia	
South Africa	
Spain	
Sweden	
Turkey	
UK	

Quarterly results:

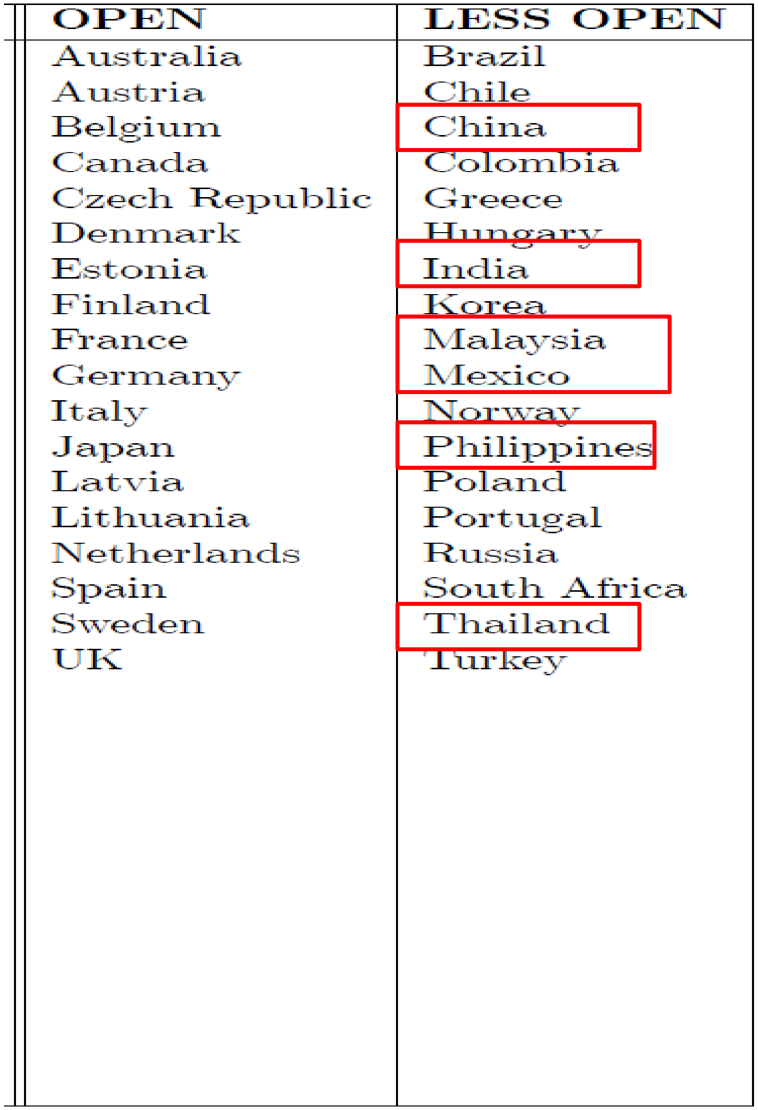
- Floaters (Pegs) experience higher (lower) unemployment, with temporary (persistent) increase in GDP deflator, like CPI, but higher (lower) macro volatility.
- Real credit turns positive (negative) in Floaters (Pegs), like banking inflows, while HP fall more (less).

EMEs, $ Pegs and Floaters

Quarterly data full sample



Country groups: Financially closed EMEs, $ Pegs and Floaters



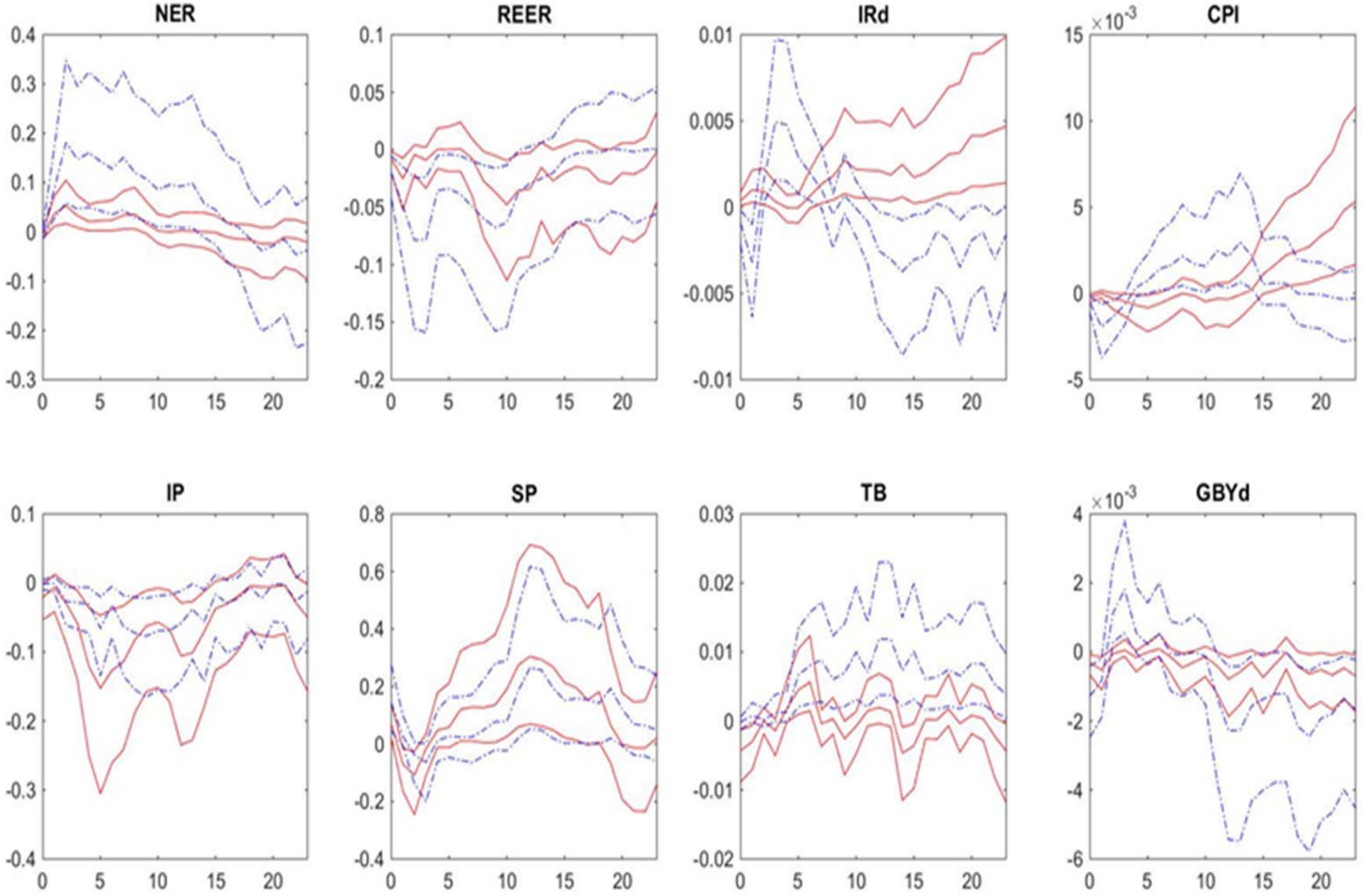
OPEN	LESS OPEN
Australia	Brazil
Austria	Chile
Belgium	China
Canada	Colombia
Czech Republic	Greece
Denmark	Hungary
Estonia	India
Finland	Korea
France	Malaysia
Germany	Mexico
Italy	Norway
Japan	Philippines
Latvia	Poland
Lithuania	Portugal
Netherlands	Russia
Spain	South Africa
Sweden	Thailand
UK	Turkey

Monthly results:

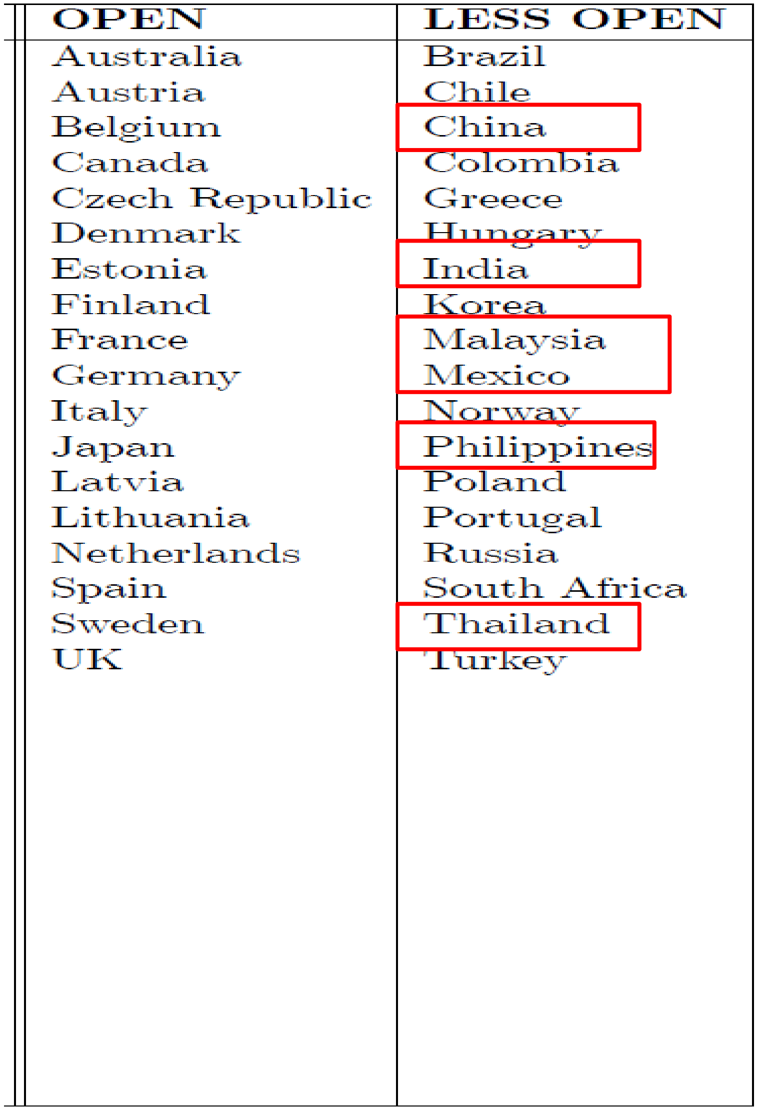
- In closed Floaters (Pegs) interest differentials fall (increase) on impact, CPI rises temporarily (persistently).
- IP falls similarly, trade balance improves (deteriorates).

Financially closed EMEs, $Pegs and Floaters

Monthly data full sample



Country groups: Financially closed EMEs, $Pegs and Floaters



OPEN	LESS OPEN
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Italy	Norway
Japan	Philippines
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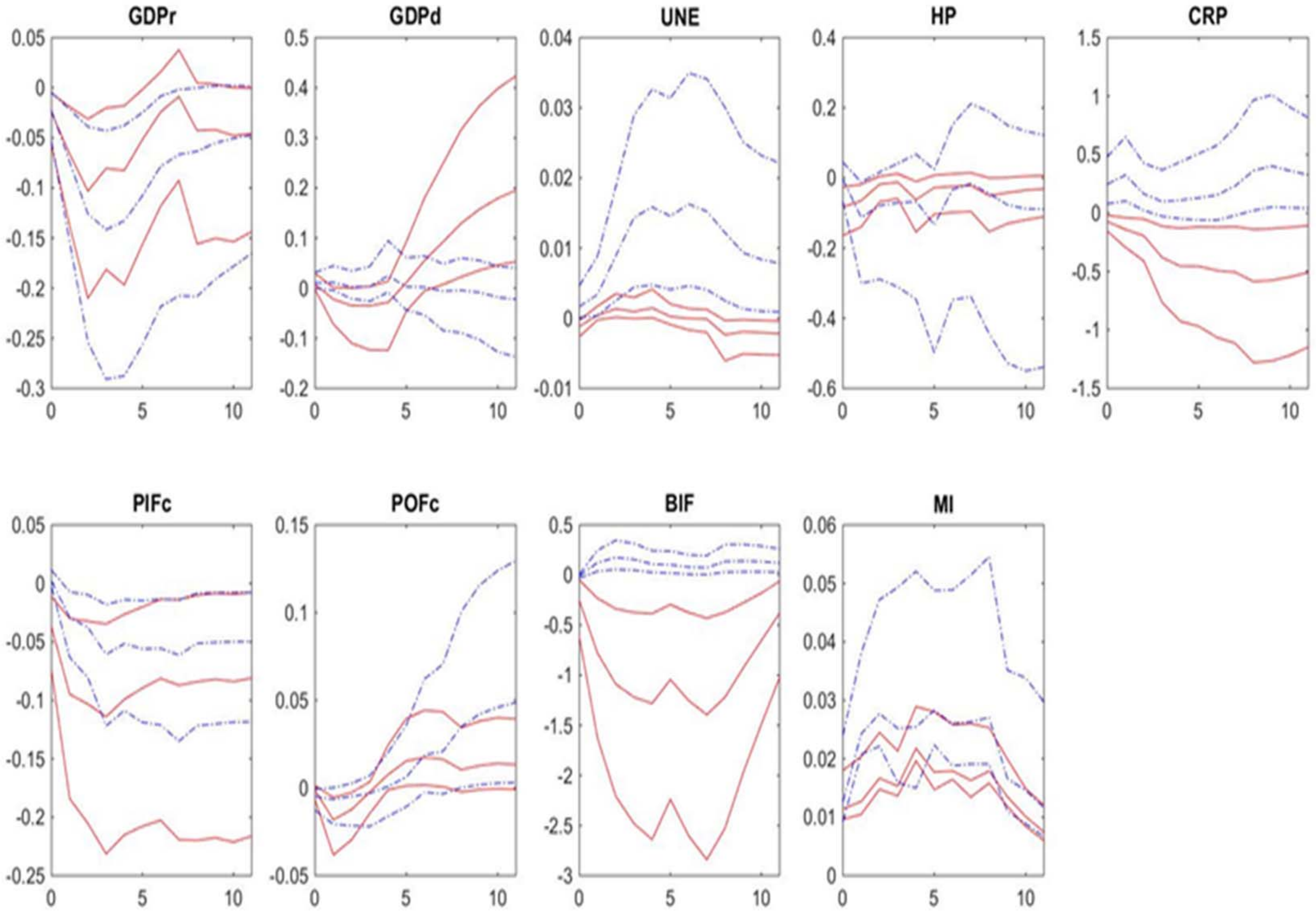
Lithuania	Portugal
Netherlands	Russia
Spain	South Africa
Sweden	Thailand
UK	Turkey

Quarterly results:

- In closed Floaters (Pegs) unemployment increases more persistently (temporarily), while GDP deflator tracks CPI.
- Domestic credit and bank inflows increase (decline).
- Combination of flexible exchange rate and low capital mobility seems to grant some insulation against financial spillovers, but higher macro volatility.

Financially closed EMEs, $Pegs vs Floaters

Quarterly data full sample



Concluding remarks

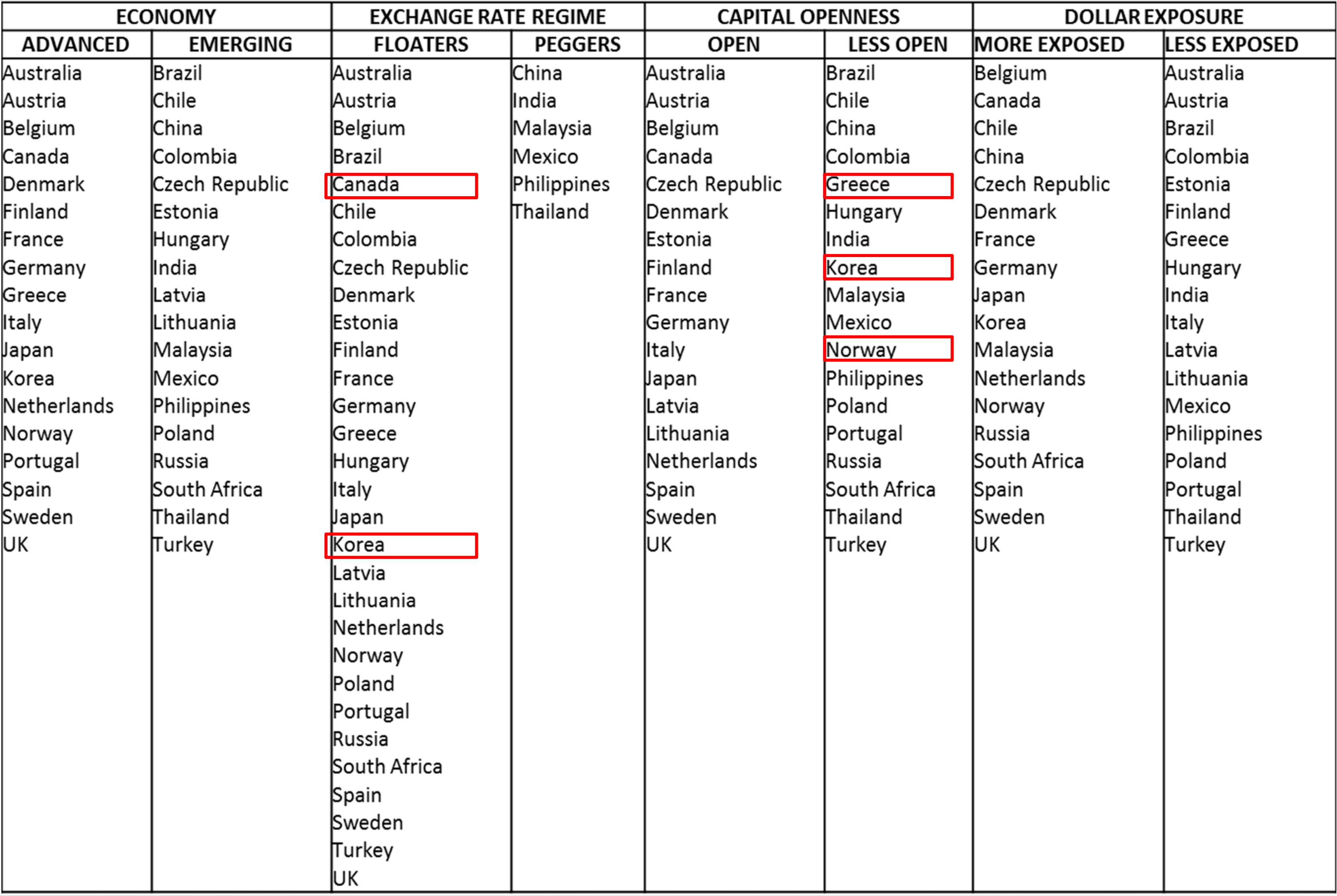
- Study of the effects of US monetary policy shocks on a large set of countries and real, nominal, financial variables.
- Main differences in macroeconomic and financial effects across AEs and EMEs – Pass-through, financial stability.
- Some evidence that EMEs exchange-rate regime matter, even after controlling for capital account openness:
    - More flexible exchange rates seem to better insulate from some financial repercussions.
    - Dollar pegs seemingly suffer larger higher volatility in interest rates, inflation and financials; but lower overall macro volatility.
- **No normative** implications for global consequences of US systematic monetary policy.

Still some work ahead

Several things to do:

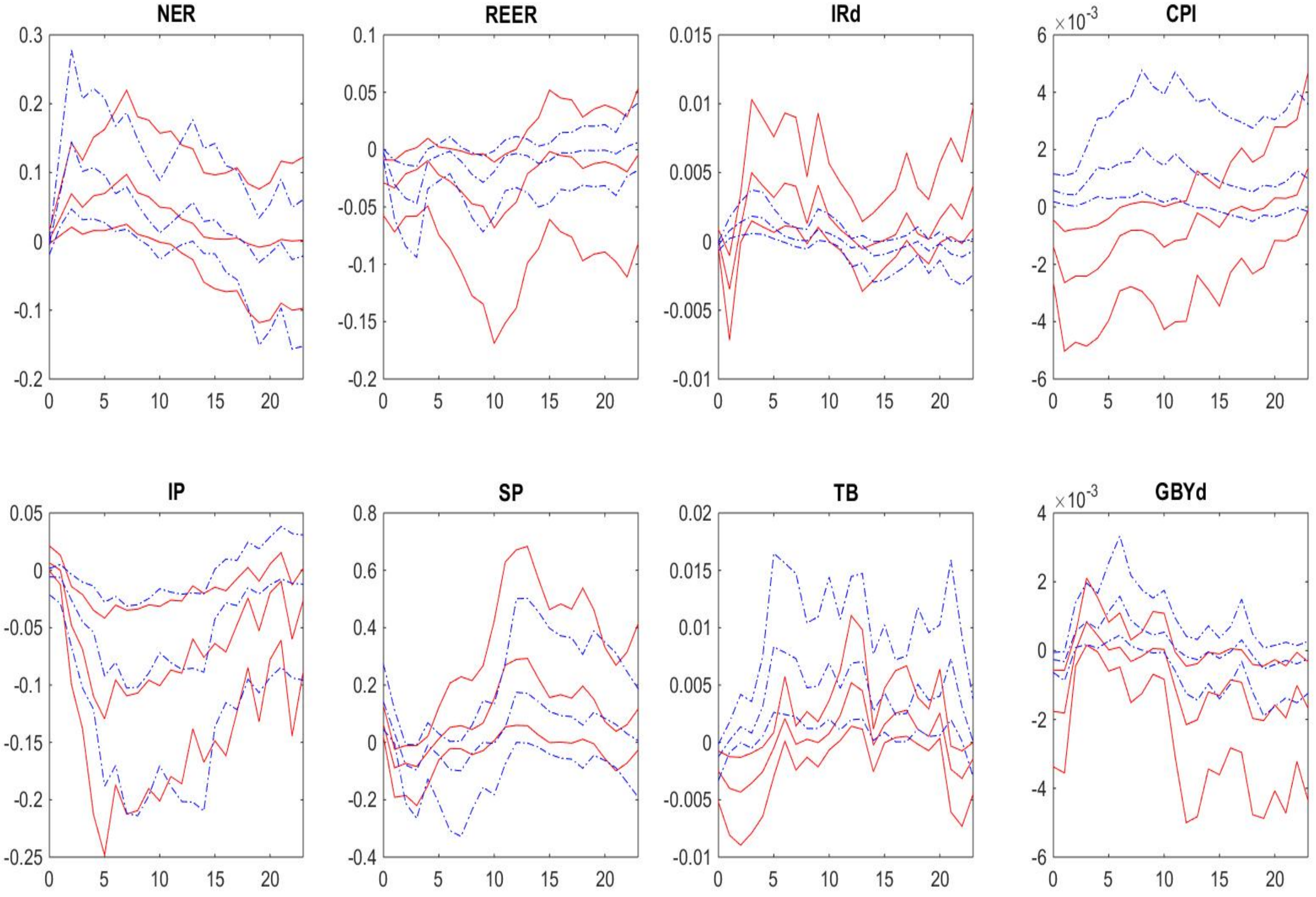
- Better characterization of 2nd stage estimation uncertainty
- Time-varying country characteristics – Panel approach
- Other measures of country characteristics
- Sub-sample robustness

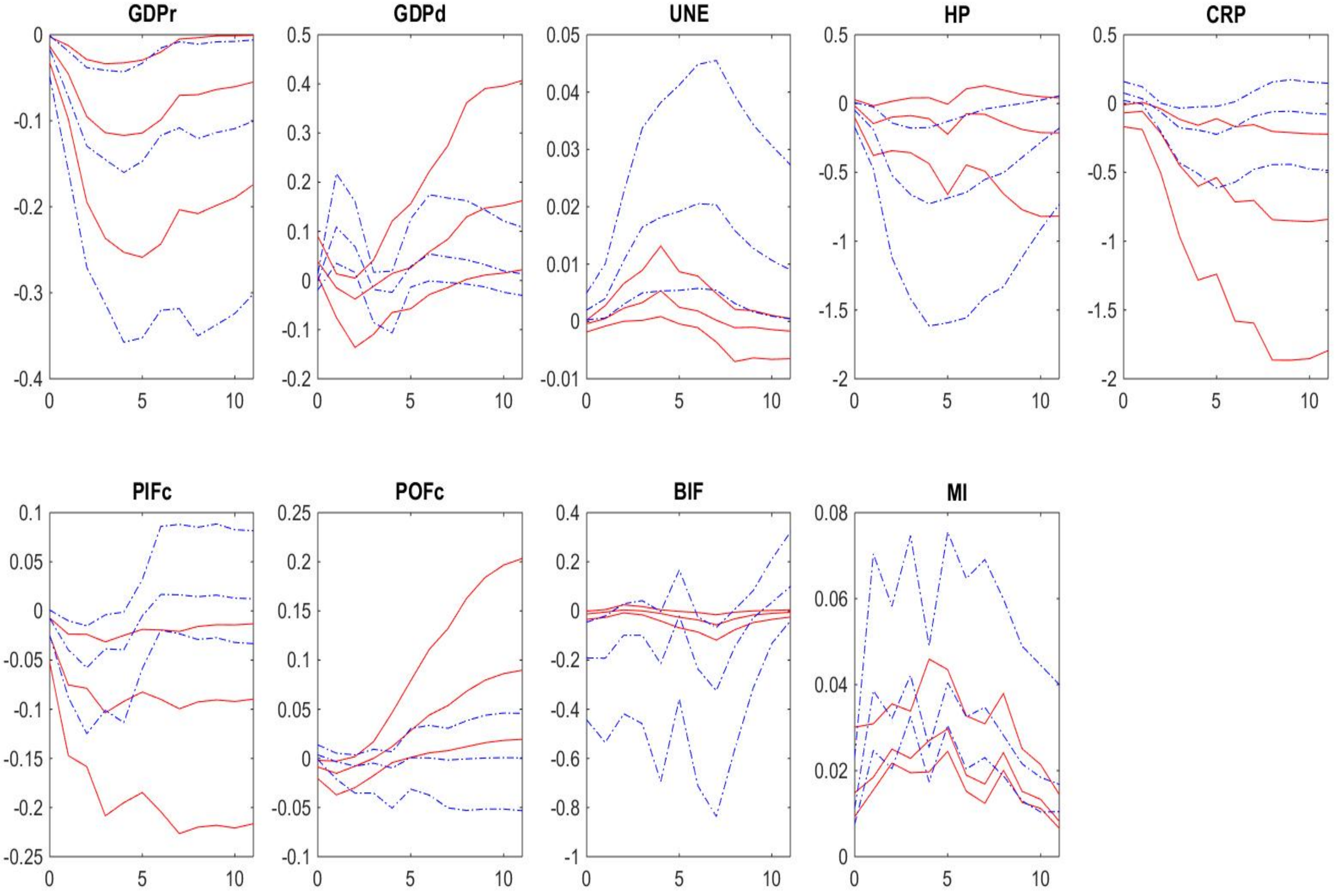
Country groups



ECONOMY		EXCHANGE RATE REGIME		CAPITAL OPENNESS		DOLLAR EXPOSURE	
ADVANCED	EMERGING	FLOATERS	PEGGERS	OPEN	LESS OPEN	MORE EXPOSED	LESS EXPOSED
Australia	Brazil	Australia	China	Australia	Brazil	Belgium	Australia
Austria	Chile	Austria	India	Austria	Chile	Canada	Austria
Belgium	China	Belgium	Malaysia	Belgium	China	Chile	Brazil
Canada	Colombia	Brazil	Mexico	Canada	Colombia	China	Colombia
Denmark	Czech Republic	Canada	Philippines	Czech Republic	Greece	Czech Republic	Estonia
Finland	Estonia	Chile	Thailand	Denmark	Hungary	Denmark	Finland
France	Hungary	Colombia		Estonia	India	France	Greece
Germany	India	Czech Republic		Finland	Korea	Germany	Hungary
Greece	Latvia	Denmark		France	Malaysia	Japan	India
Italy	Lithuania	Estonia		Germany	Mexico	Korea	Italy
Japan	Malaysia	Finland		Italy	Norway	Malaysia	Latvia
Korea	Mexico	France		Japan	Philippines	Netherlands	Lithuania
Netherlands	Philippines	Germany		Latvia	Poland	Norway	Mexico
Norway	Poland	Greece		Lithuania	Portugal	Russia	Philippines
Portugal	Russia	Hungary		Netherlands	Russia	South Africa	Poland
Spain	South Africa	Italy		Spain	South Africa	Spain	Portugal
Sweden	Thailand	Japan		Sweden	Thailand	Sweden	Thailand
UK	Turkey	Korea		UK	Turkey	UK	Turkey
		Latvia					
		Lithuania					
		Netherlands					
		Norway					
		Poland					
		Portugal					
		Russia					
		South Africa					
		Spain					
		Sweden					
		Turkey					
		UK					

EMEs with high (red) low (blue) exposure to $ Monthly data full sample



EMEs with high (red) low (blue) exposure to $ Quarterly data full sample