

Shocks vs Structure:

Explaining Differences in Exchange Rate Pass-Through Across Countries and Time



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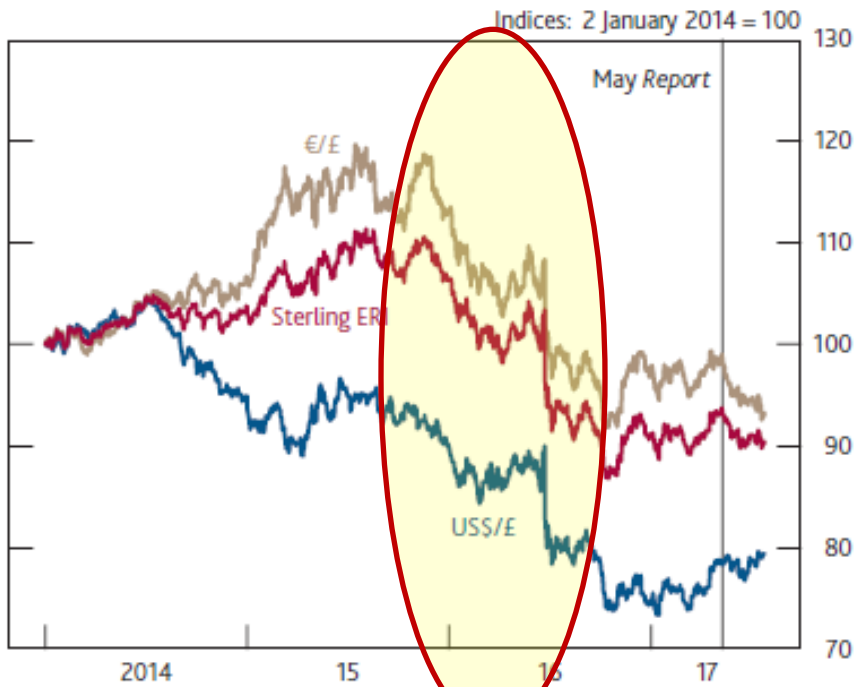
ECB Conference “Understanding Inflation”, Sept. 22, 2017

Motivation

- Exchange rate pass-through (ERPT): critical for inflation
- Challenge: Estimating ERPT
 - Well known: varies substantially across countries
 - Less appreciated: can vary substantially over time within a country
 - Can be critically important for forecasting and setting monetary policy
 - Examples: UK & euro

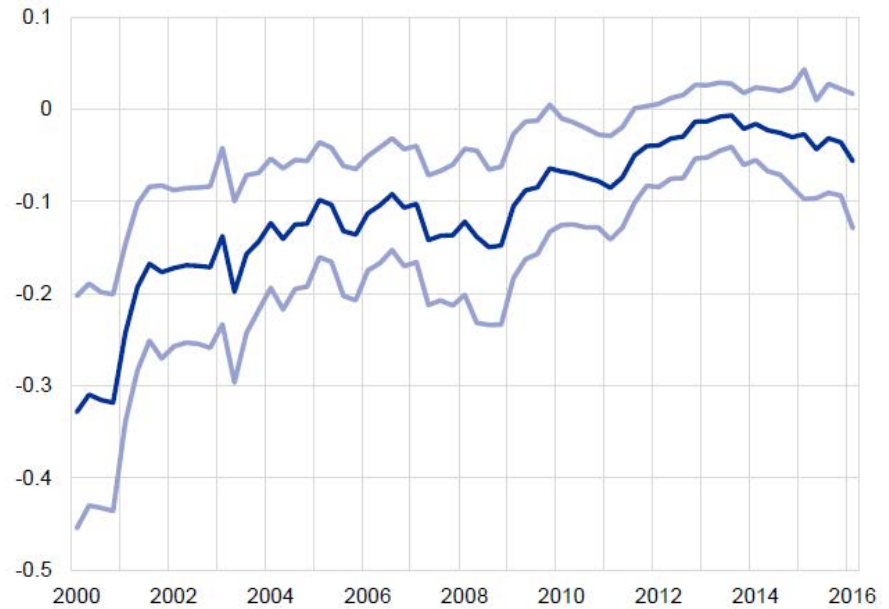
Examples

Sterling exchange rates



Source: Bank of England, *Inflation Report*, Aug 2017

Exchange rate pass-through to HICP inflation over time



Source: Speech by Benoit Coeuré, 11/09/17

Key question: how will a given exchange rate movement “pass through” into inflation?

Two Empirical Approaches

- **“Structure”** : Dominant approach
 - Highlights role of relatively stable country characteristics
 - inflation rate & variability, openness, frequency of price adjustments, nominal rigidities, foreign currency invoicing, central bank credibility, monopoly power
 - Yields “rules of thumb” for ERPT for a country given its characteristics
 - Focus: cross-section dimension (or long time-series)
 - Campa & Goldberg (2005, 2010), Devereux *et al.* (2015), Gopinath (2015), many others....
- **“Shocks”**: Less common, increasing interest
 - Highlights role of different shocks behind ER movement
 - monetary policy vs. demand vs supply vs risk shocks
 - Yields estimates of ERPT that change over short periods of time
 - Focus: time-series dimension (often limited countries)
 - Shambaugh (2008), Forbes *et al.* (2015), Comunale & Kunovac (2017)

Our Paper

- Assess relative importance of “shocks” vs. “structural” approaches to ERPT
 - Explaining cross-section variation
 - Explaining time-series variation
- Conclusion: Both “shocks” and “structure” important
 - Structural approach most important in cross-section
 - Shocks equally important—and sometimes more important—in explaining time-series variation
- Estimates of pass-through for forecasts (and monetary policy) should incorporate both the structural and shocks approaches

Today

- Standard, reduced-form estimates of ERPT
- Shock-based methodology & estimates of ERPT
- Estimates of role of “structural” versus “shock” variables:
 - Explaining cross-section dimension
 - Explaining time-series dimension
 - Relative magnitudes
- Conclusions

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Sample

- 3 criteria
 - Flexible exchange rates
 - IMF AREARs, “floating” or “free floating”, ≥ 10 years
 - Small open economies
 - No significant effect on world export prices (i.e., not US & EA)
 - Data on key variables required for analysis
 - Quarterly data (short-term interest rates, real GDP, etc)
- Final sample: 26 countries
 - 11 “advanced” and 15 “emerging”
 - Maximum time period: 1990-2015

Reduced-Form ERPT

- Standard approach
 - Campa & Goldberg (2005), Burstein & Gopinath (2014), Gopinath (2015)
- Distributed lag regression (for full sample period & shorter windows):

$$p_t = \alpha + \sum_{n=0}^4 \beta_{t-n} s_{t-n} + \sum_{n=0}^4 \gamma_{t-n} wxp_{t-n} + \delta \Delta gdp_t + \varepsilon_t$$

p_t : quarterly log change in domestic CPI

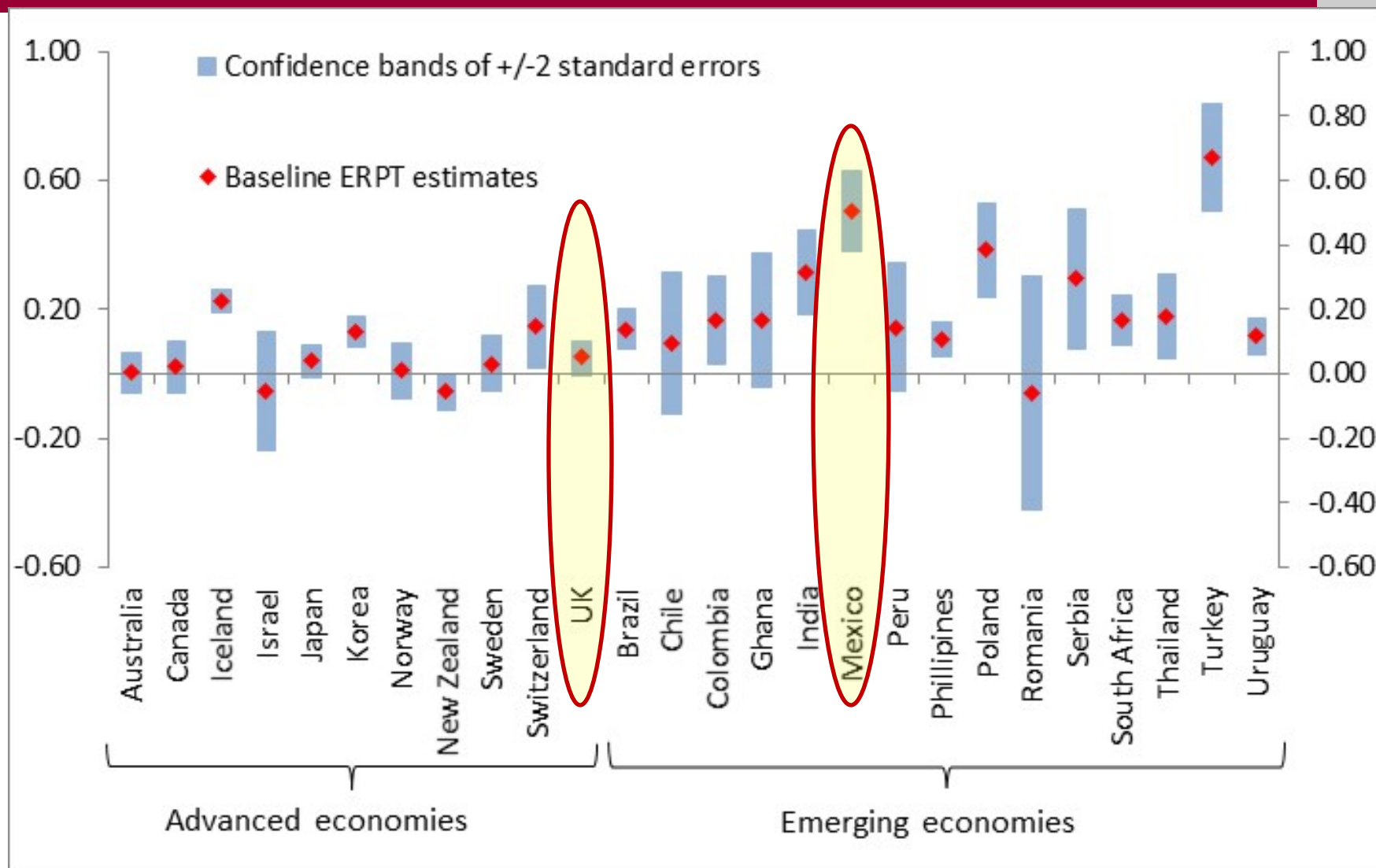
s_t : quarterly log change in domestic effective exchange rate index

wxp_t : quarterly log change in trade-weighted index of foreign export prices

Δgdp_t : quarterly log change in domestic GDP

- ERPT: sum of the coefficients on all lags of the exchange rate ($\sum_{n=0}^{\tau} \beta_{t-n}$)
 - Usually: time-invariant parameter (historical average)
- Base case: lags for 4 quarters, OLS with Newey-West standard errors robust to autocorrelation of lags up to 8 quarters
- **28 variants (controls, lag structures, etc.)**

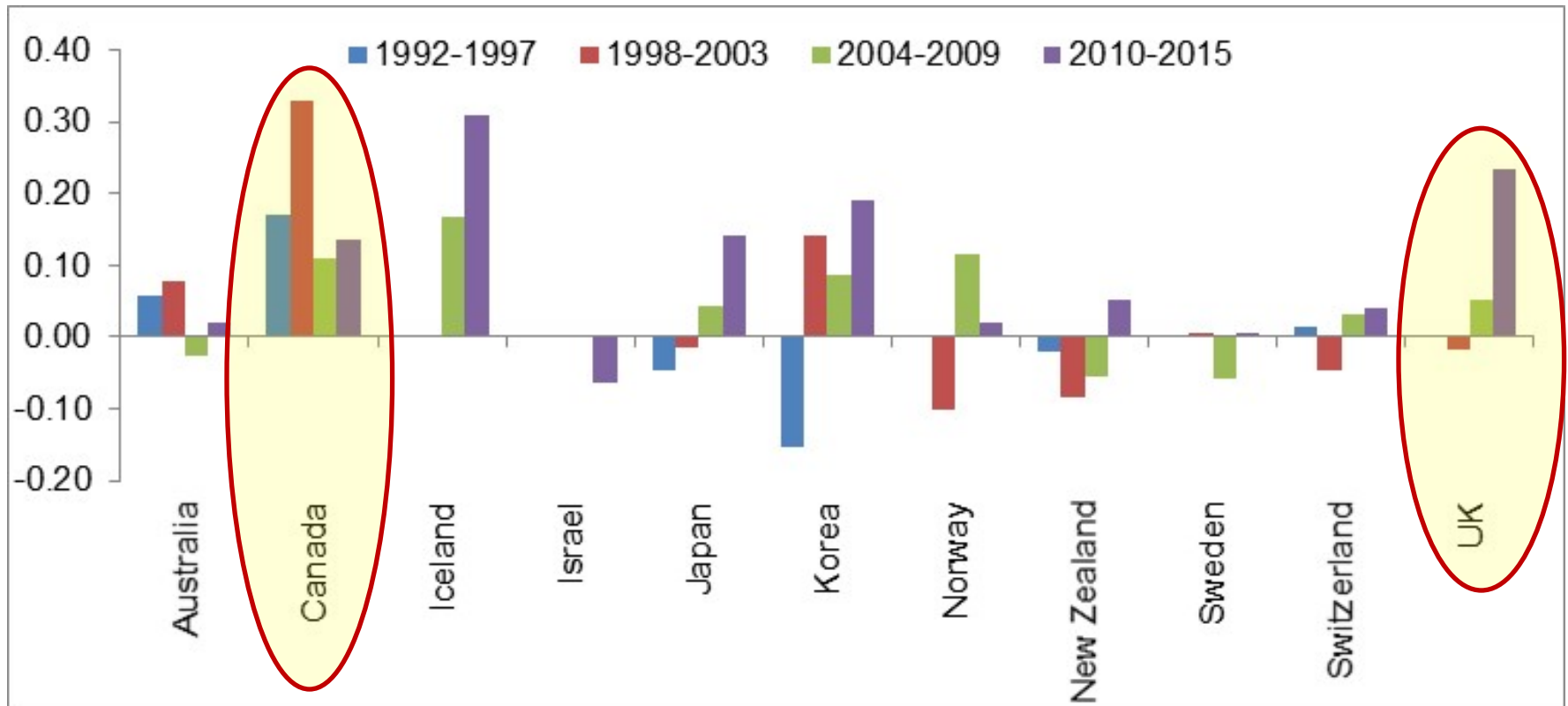
Estimates: Reduced-Form ERPT (Long Sample ERPT)



Estimates: Reduced-Form ERPT

Fixed 6-year windows

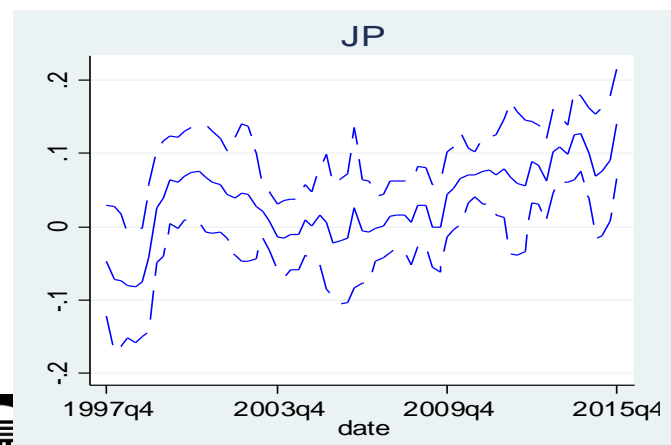
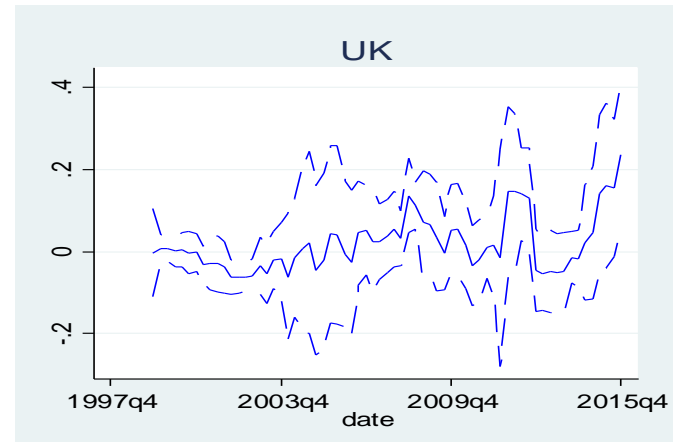
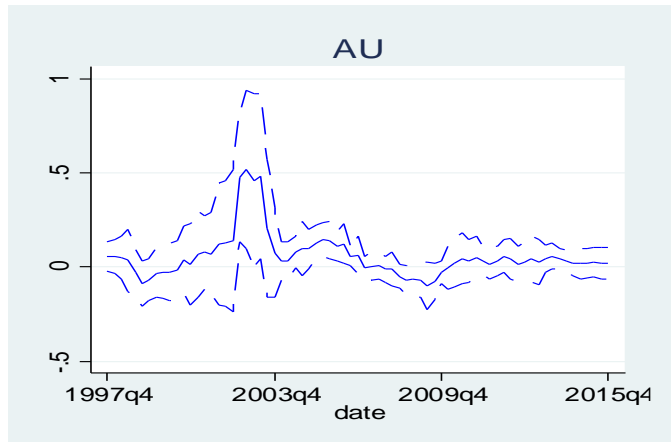
ADVANCED ECONOMIES



Estimates: Reduced-Form ERPT

Rolling 6-year windows

SELECTED ADVANCED ECONOMIES



Questions standard
rule-of-thumb
approach to ERPT!

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- Standard, reduced-form estimates of ERPT
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- Estimates of role of “structural” versus “shock” variables:
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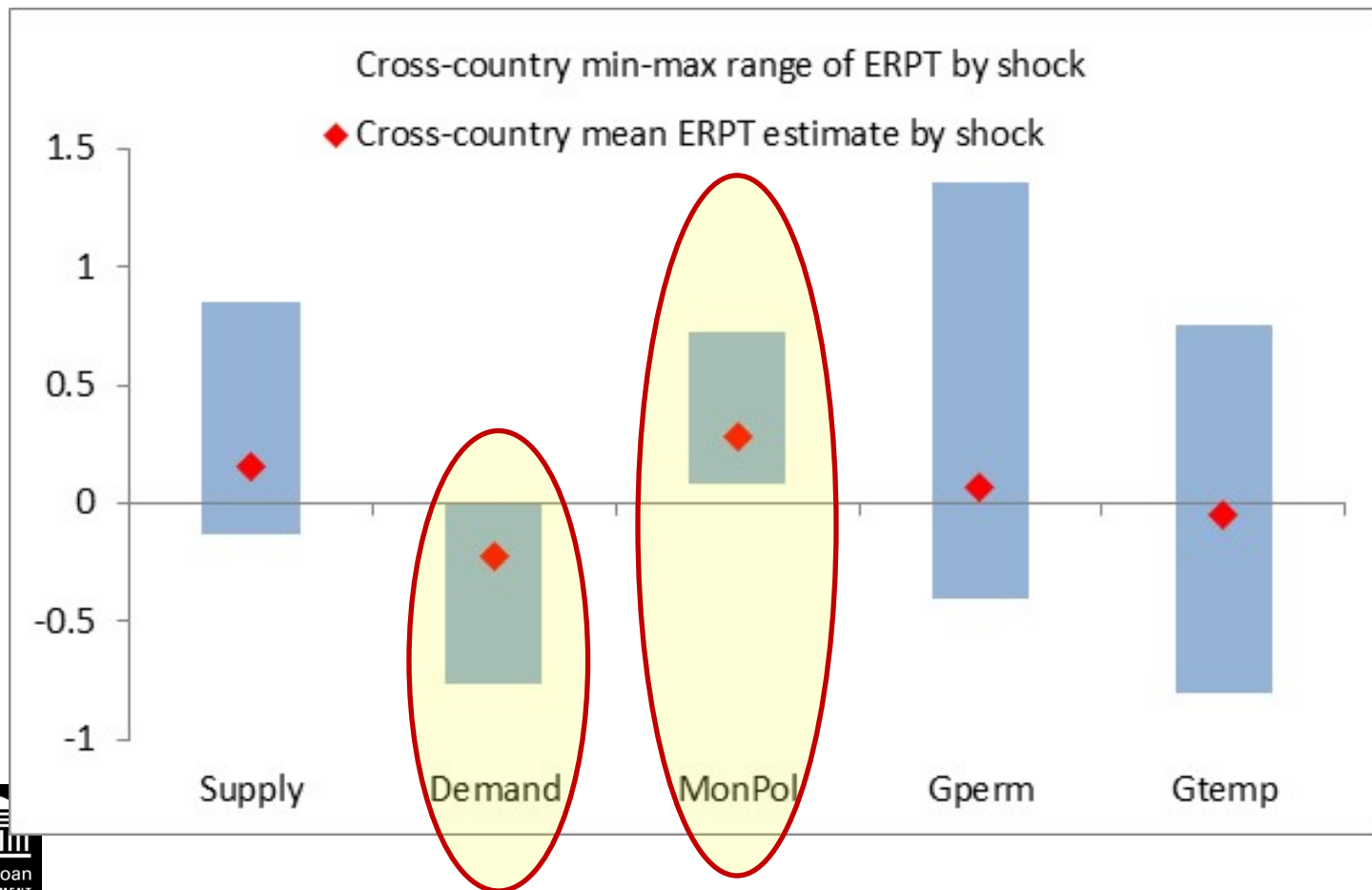
SVAR Identification

- Adapt SVAR framework developed in Forbes *et al.* (2015) for UK
- Same sample of 26 small-open economies, 1990-2015
- Identify 5 domestic and global shocks:
 - domestic supply, domestic demand and domestic monetary policy shocks;
 - global persistent and transitory shocks.
- Identification through a combination of short- and long-run zero restrictions as well as sign restrictions
 - Algorithm based on Rubio-Ramirez *et al.* (2010) and Binning (2013)
- Bayesian estimation with standard Minnesota priors

Estimates: Shock-Based ERPT

Average & Range Across Countries

8 quarters after ER shock

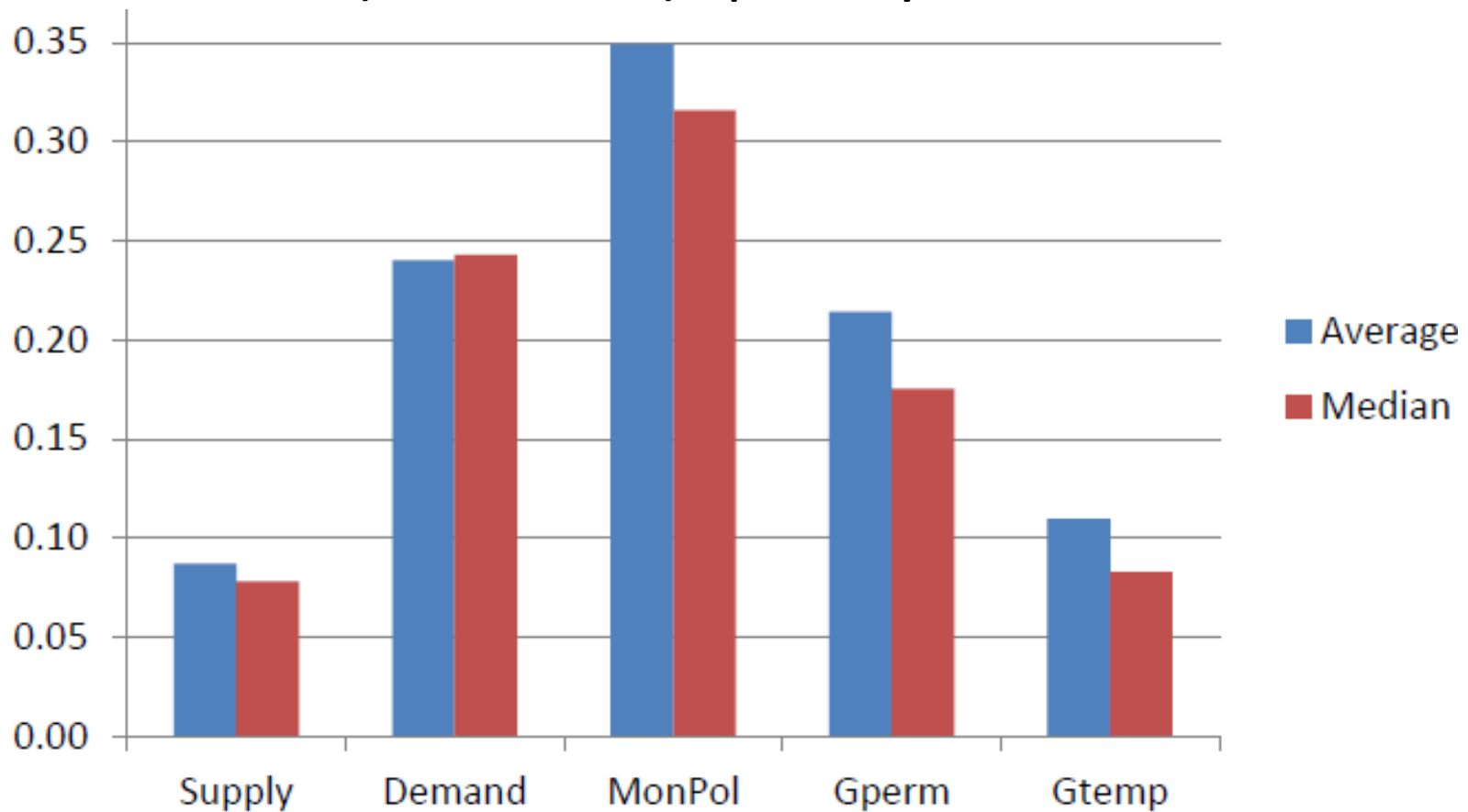


Shock-Based ERPT

- Estimate role of different shocks in ERPT across countries
 - Monetary policy & demand shocks the greatest weight on average
 - But substantial differences across countries
 - Examples: Iceland and Australia
- Estimate role of different shocks in ERPT across time within countries
 - Changing weights for some countries
 - Examples: Korea & Chile

Role of Different Shocks

Average share of exchange rate forecast error variance (across countries) explained by SVAR shocks



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Estimates: Shocks vs. Structure

- Assess role of “structural” variables and “shock” variables in explaining differences in average rates of ERPT across countries
 - 2-stage regression approach with wtd-least squares following Campa & Goldberg (2005)
- “Structural” variables
 - % imports invoiced in foreign currency, ER volatility, π volatility, π rate, EM dummy
 - Trade openness, % differentiated goods, regulation
- “Shock” variables
 - Monetary, demand, supply, global permanent, global transitory
 - Relative weight of demand to monetary shocks
- Results



Cross-Section: Bivariate Results

Foreign currency %	0.50*														expected sign & significant (5% level)
ER volatility		4.12*													expected sign & not significant
π (average)			10.91*												unexpected sign & not significant
π volatility				17.54*											unexpected sign & significant (5% level)
EM dummy					0.10*										
Trade openness						0.33									
Less differentiated							0.12								
Regulation								0.08*							
% demand shock									-0.26						
% monetary policy										0.06					
% demand/monetary											-0.04				
% supply shock												0.3			
% permanent													0.14		
% temporary														-0.07	
# observations	18	26	26	26	26	26	26	26	19	26	26	26	26	26	26
Adjusted-R²	0.28	0.3	0.44	0.62	0.12	0.05	-0.04	0.23	0.06	-0.03	0.05	-0.02	-0.02	-0.04	

Cross-Section: Multivariate Results

Structure	Foreign currency %	0.06 (0.17)				
	ER volatility	0.18 (1.18)				
	π (average)	3.82 (6.82)				
	π volatility	17.17** (7.70)	23.61*** (3.21)	17.50*** (2.69)	16.74*** (2.77)	
	Emerging market dummy	(0.08) (0.05)				
	Trade openness		0.33** (0.14)	0.19 (0.15)	0.25 (0.15)	
	Less differentiated goods/imports		0.38* (0.21)	0.21 (0.21)	0.17 (0.24)	
	Regulation		(0.02) (0.02)			
	Shocks	% monetary policy shock			0.11 (0.10)	
		% demand shock to % monetary policy				(0.01) (0.02)
	<i># observations</i>	18	19	26	26	
	<i>Adjusted-R²</i>	0.7	0.82	0.65	0.63	

Time Series: Bivariate Results (Fixed 6-year windows)

Foreign currency %	0.95										expected sign & significant (5% level)
ER volatility		1.29*									expected sign & not significant
π (average)			6.10**								unexpected sign & not significant
π volatility				12.40**							unexpected sign & significant (5% level)
Trade openness					0.63*						
Less differentiated						0.77*					
Regulation							0.00				
% demand shock								-0.22*			
% monetary policy									0.32**		
% demand/monetary										-0.03**	
# observations	39	74	74	74	74	76	59	74	74	74	74
Adjusted-R²	0.47	0.52	0.53	0.63	0.52	0.52	0.49	0.52	0.55	0.53	

Time Series: Multivariate Results

		Non-overlapping 6-year windows			Rolling 6-year windows		
Structure	π volatility	16.65*** (2.69)	16.25*** (2.54)	16.32*** (2.44)	3.53*** (0.97)	5.83*** (0.96)	4.13*** (0.98)
	Trade openness	1.21*** (0.25)	0.92*** (0.33)	1.11*** (0.24)	-0.22 (0.40)	-0.11 (0.40)	-0.18 (0.40)
	% demand shock	-0.02 (0.09)			-0.28*** (0.04)		
	% monetary policy		0.15 (0.12)			0.19*** (0.03)	
Shocks	% demand/monetary			-0.02** (0.01)			-0.01*** 0.00
	# observations	73	73	73	1304	1304	1304
	Adjusted-R²	0.75	0.76	0.77	0.06	0.05	0.03

Shocks vs. Structure: Summary

- **Cross-section:**
 - **Structure variables:** generally have expected sign, many significant & magnitudes can be large
 - **Shock variables:** generally have expected sign, but rarely significant & magnitudes smaller
 - Structural variables explain much of cross-section variation in ERPT, shock variables little
- **Time-series:**
 - **Structure variables:** generally have expected sign, but only some significant (π volatility), magnitudes can be large
 - **Shock variables:** generally have expected signs & usually significant (demand/monetary shocks), magnitudes can be large
 - Shock and structural variables each explain similar share of time-series variation in ERPT

Shocks vs. Structure: Summary

	Non-overlapping 6-year windows			Rolling 6-year windows		
π volatility (Structure)	12.40*** (2.85)		13.68*** (2.49)	6.03*** (0.94)		6.68*** (0.94)
% monetary policy (Shock)		0.32*** (0.12)	0.38*** (0.09)		0.15*** (0.03)	0.17*** (0.03)
Constant	-0.04 (0.03)	-0.03 (0.04)	-0.09*** (0.03)	-0.01* 0.00	-0.01* 0.00	0.00 0.00
# observations	74	74	74	1474	1450	1450
Degrees of freedom	47	47	46	1447	1423	1422
Adjusted-R²	0.63	0.55	0.73	0.02	0.02	0.05

Final Thoughts

- Pass-through can vary significantly across time as well as across countries
- To understand ERPT:
 - Structural variables most important to understand cross-country differences in averages over long periods
 - The shock behind the exchange rate movement can be just as important at specific times
- Incorporating both “shocks” and “structure” will improve ability to forecast inflation and set monetary policy

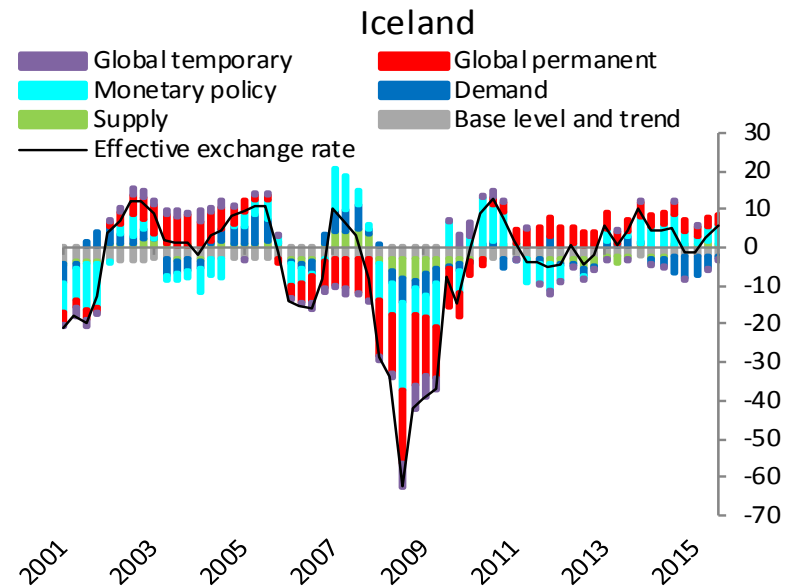
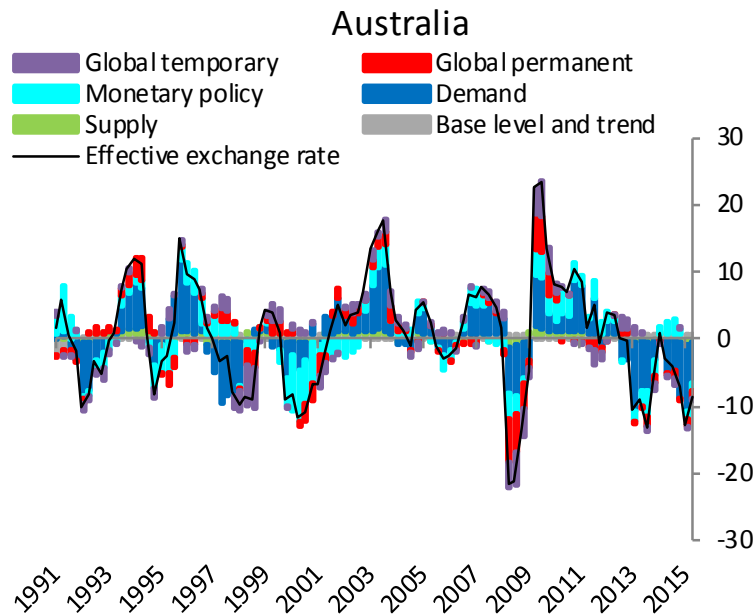
Backup



SVAR identification

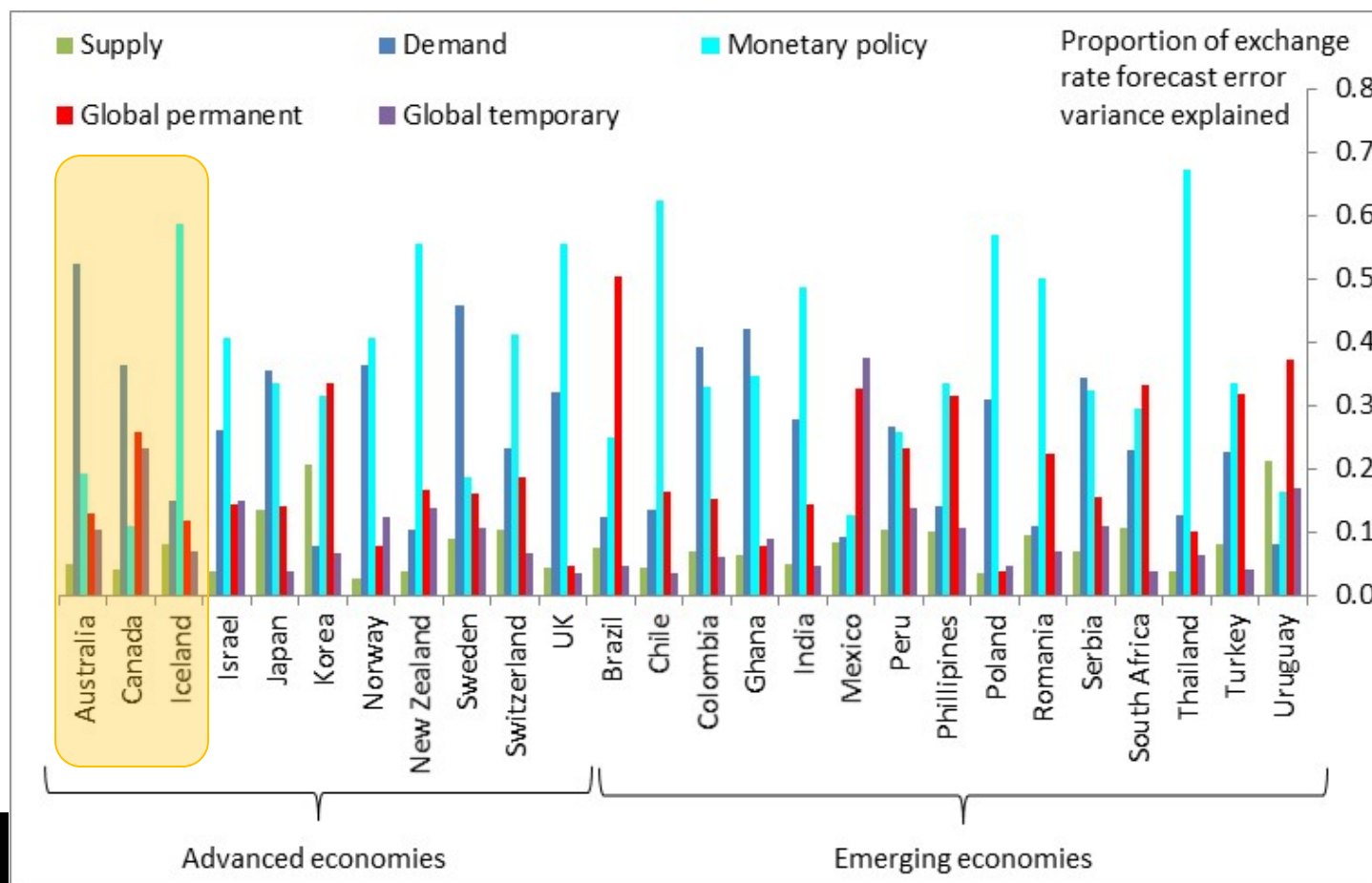
	Domestic supply shock	Domestic demand shock	Domestic monetary policy shock	Global persistent shock	Global transitory shock
<i>Short-run restrictions</i>					
UK GDP	+	+	-		
UK CPI	-	+	-		
UK interest rate		+	+		
UK nominal ERI		+	+		
Foreign export prices	0	0	0		
<i>Long-run restrictions</i>					
UK GDP		0	0		0
UK CPI					
UK interest rate					
UK nominal ERI					
Foreign export prices	0	0	0		

Different Roles of Different Shocks

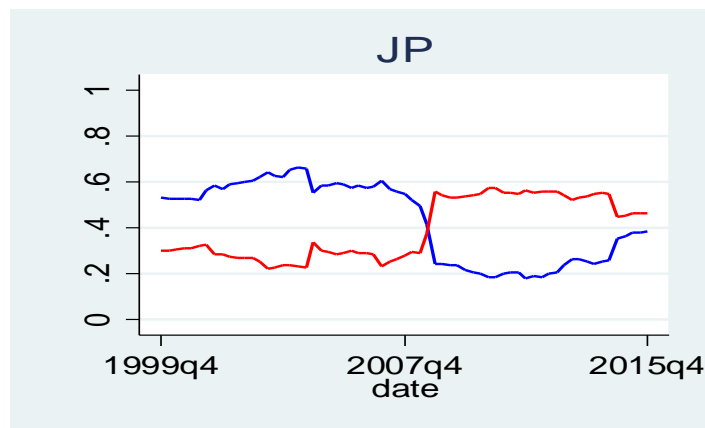
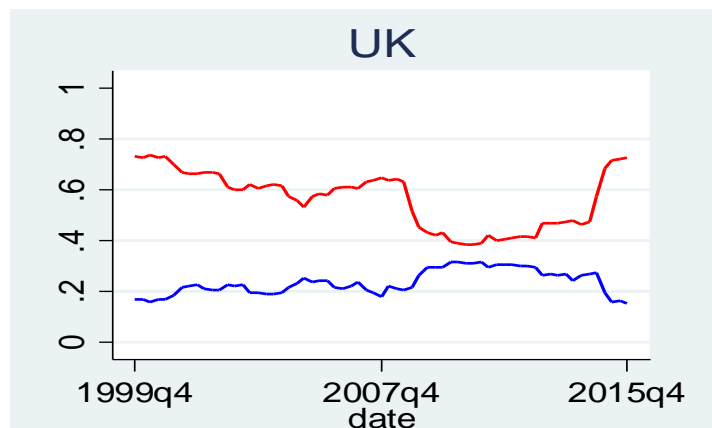
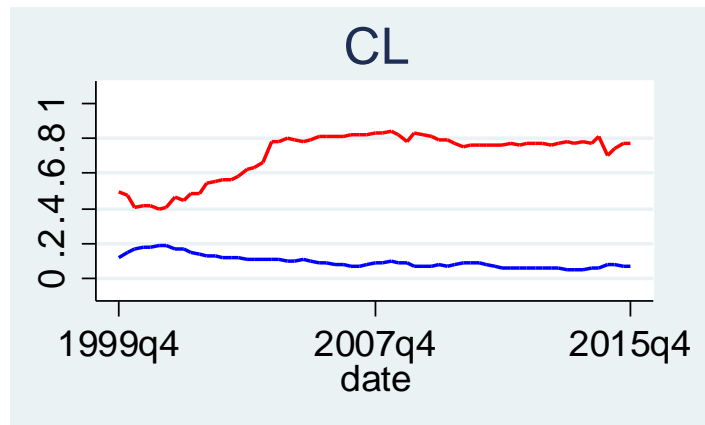
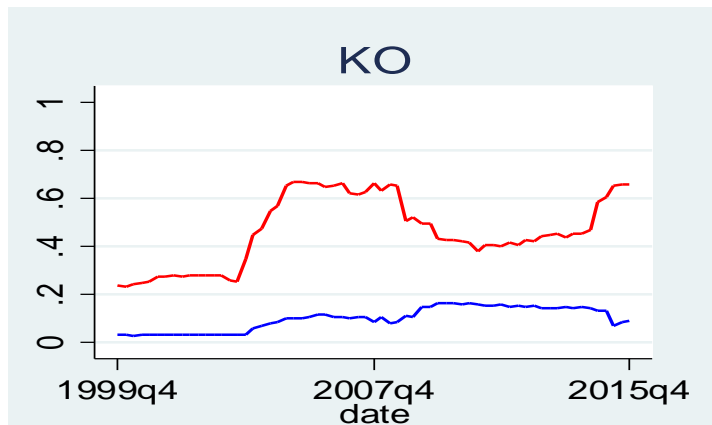


Different Roles of Different Shocks

Forecast error variance decomposition of exchange rate changes, 1990-2015



Changing Weights of Different Shocks



Blue: contribution of demand shock
Red: contribution of monetary policy shock

Estimates: Shock-Based ERPT (Long Sample ERPT)

