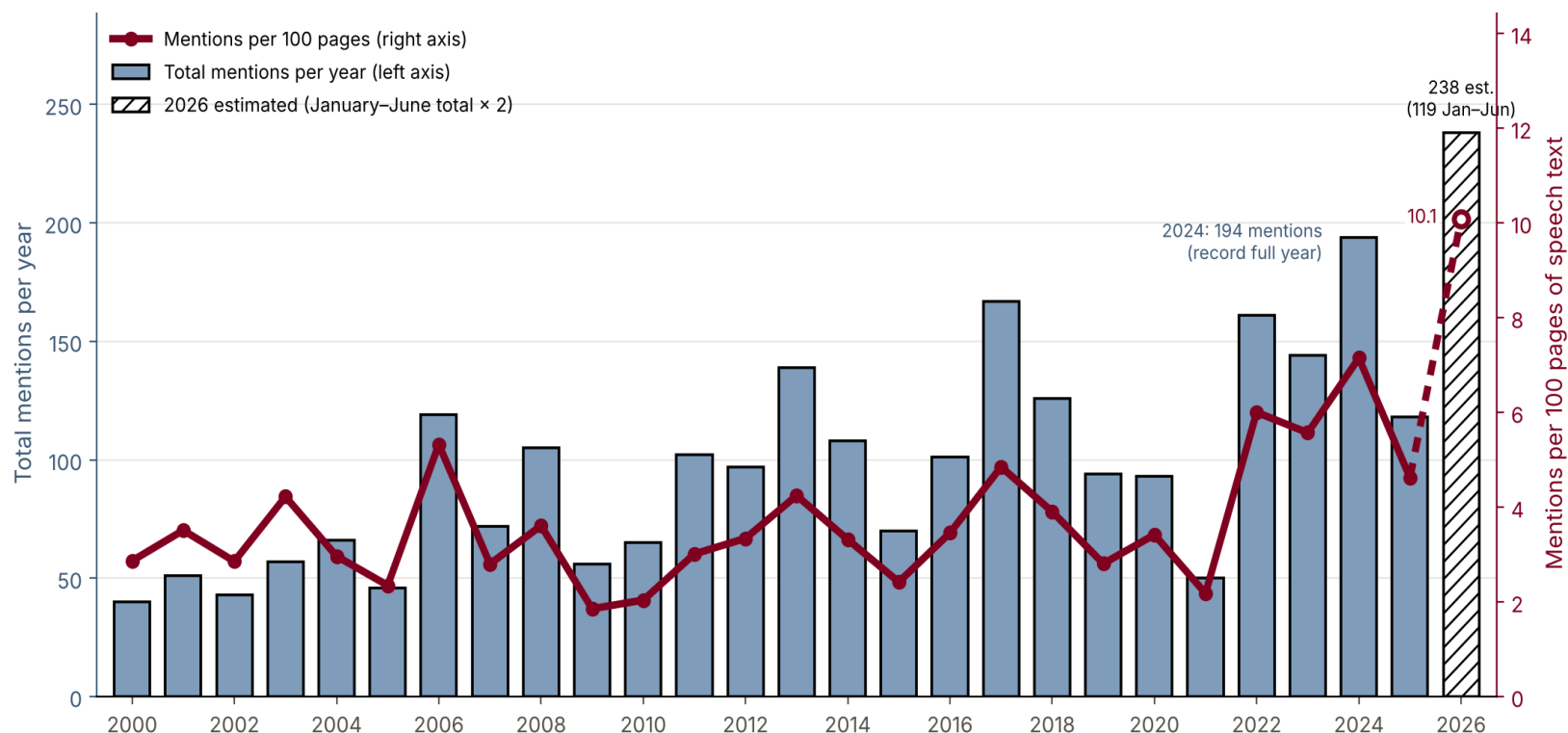




Muted or Mismeasured? **Monetary Policy Trade-offs** **over 50 Years of Rate Cycles**

Kristin Forbes: MIT-Sloan School of Management, NBER & CEPR

Use of Trade-offs in Central Bank Speeches



Source: BIS central bankers' speeches database; 11,084 speeches by governors, deputy governors and policy-committee members, 2000–June 2026.

2026 bar is an estimate: the January–June total (119 mentions in 209 speeches) doubled. The 2026 rate needs no scaling: it is January–June mentions divided by January–June pages.

Sample is central banks in 17 AEs, including ECB. Word count includes various spellings of "trade-offs".

Central Bank Rankings



Rank based on “trade-off” mentions per 100 pages (1 = most use)

Central bank	2022-26	2000-21
Norges Bank	1	1
Danmarks Nationalbank	2	16
Reserve Bank of New Zealand	3	6
Bank of Korea	4	15
Bank of England	5	2
Federal Reserve (Board and Bank presidents)	6	7
Reserve Bank of Australia	7	10
Bank of Canada	8	4
Sveriges Riksbank	9	11
ECB Executive Board	10	8
Banca d'Italia	11	9
Other euro-area governors	12	12
Swiss National Bank	13	13
Banque de France	14	3
Bundesbank	15	5
Bank of Japan	16	14

Words within ten words of each mention; size reflects frequency. Common filler words removed; plurals merged.



My Comments



How have central banks balanced these trade-offs over time?

Trade-offs around activity vs inflation—not financial vulnerabilities

Four key questions (and answers):

- 1) **Have the trade-offs facing central banks become more challenging?**
 - *Yes...due to changing nature of the shocks driving monetary policy*
- 2) **How have central banks managed these trade-offs over time?**
 - *Post-pandemic appeared successful based on conventional measures...*
- 3) **But—were the trade-offs muted? Or mismeasured?**
 - *Additional metrics: impact on the price level and adjustment path*
- 4) **What are the lessons for central banks today?**
 - *Caution merited.... lessons and legacies from 2022*



With Thanks



Comments build on series of papers with Ayhan Kose (World Bank) and Jongrim Ha (AMRO-Asia)

- **Rate Cycles** (2024). In “Monetary Policy in an Era of Transformation”, proceedings from the ECB Forum on Central Banking in Sintra, Portugal on July 1-3, 2024.
- **Tradeoffs over Rate Cycles: Activity, Inflation and the Price Level** (2026). *NBER Macroeconomics Annual*, vol 40, pp 191-277.
- **Heaven or Earth? The Evolving Role of Global Shocks for Domestic Monetary Policy** (2026). *NBER Working Paper 34806*. Forthcoming, *Journal of Political Economy: Macroeconomics*.
- **Look Through, Double Down or Business as Usual: Understanding the Heterogeneity in Global Supply Shocks**, *unpublished mimeo*

As well as...

- **The Art of Monetary Policy: Lessons from Sun Tzu for Central Banks** (2026). Karl Brunner Distinguished Lecture Series. Cambridge: MIT Press.
- **Convergence, Divergence and a Divergent: Monetary Policy and Global Imbalances** (2026). Paper prepared for Annual AIUla Conference for Emerging Market Economies in AIUla, Kingdom of Saudi Arabia, Feb 8-9.

WITH NEW AND UPDATED RESULTS MIXED THROUGHOUT





1. Have the Trade-offs Become More Challenging?

Changing Nature of Shocks



Methodology



- **Goal: assess if the nature of the shocks driving monetary policy has changed**
 - 13 advanced economies over 57 years (1970-2026, through July)

- **Approach: new factor-augmented autoregressive model (FAVAR)**
 - Explain fluctuations in interest rates (additional results for inflation/output growth)

$$B_0 Z_t = \alpha + \sum_{i=1}^L B_i Z_{t-i} + \varepsilon_t \quad \varepsilon_t \sim N(0, \Sigma_t),$$

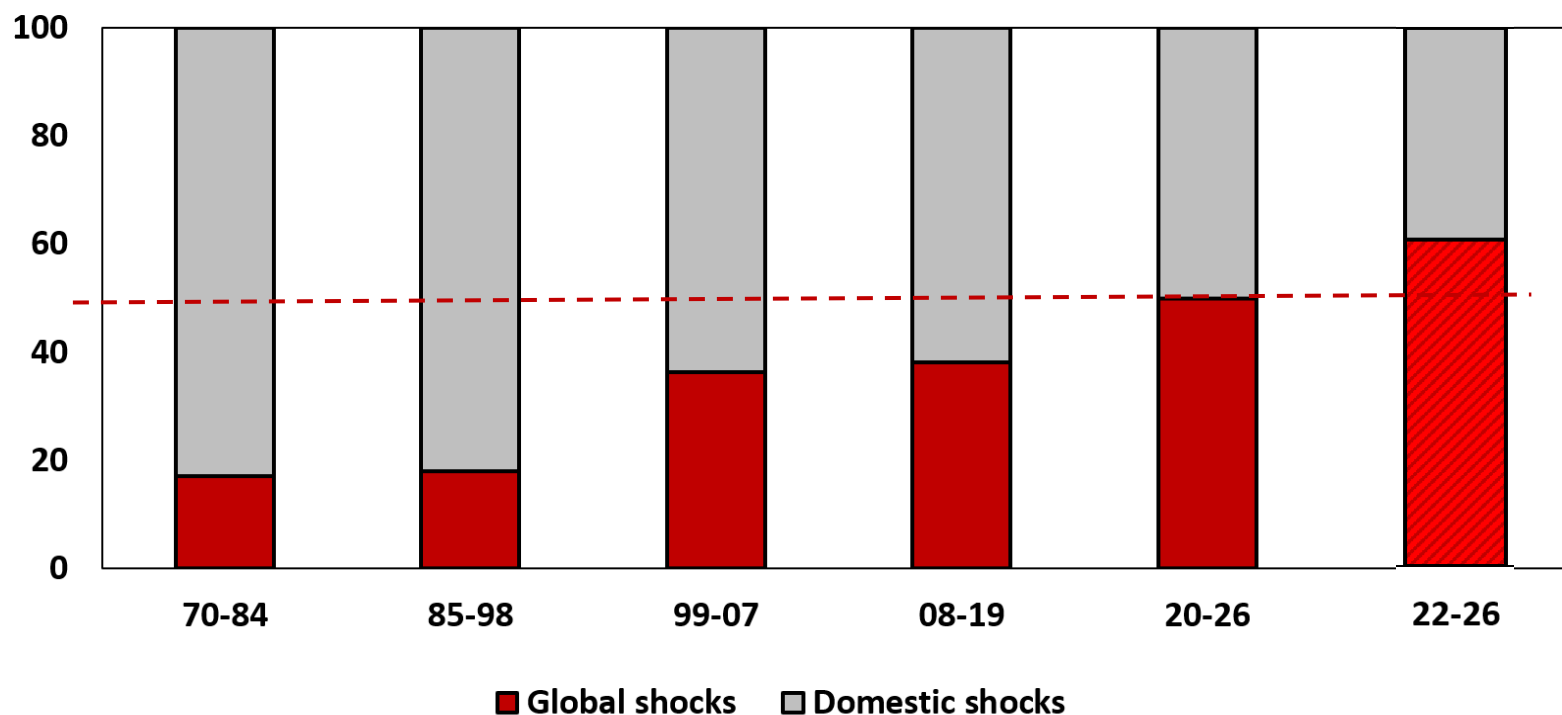
- Z_t : 7 variables - global interest rates, global inflation, global output growth, oil price growth, domestic interest rates, domestic inflation and domestic output growth
- **Key: richer decomposition of shocks, allows more granular analysis than past work**
 - ε_t is a vector of orthogonal structural innovations, with 7 shocks:
 - 4 global shocks: (1) monetary policy (2) demand (3) supply (4) oil prices
 - 3 domestic shocks (1) monetary policy (2) demand (3) supply



Growing Role of Global Shocks



Drivers of Domestic Monetary Policy
% of interest rate variation explained by shock type



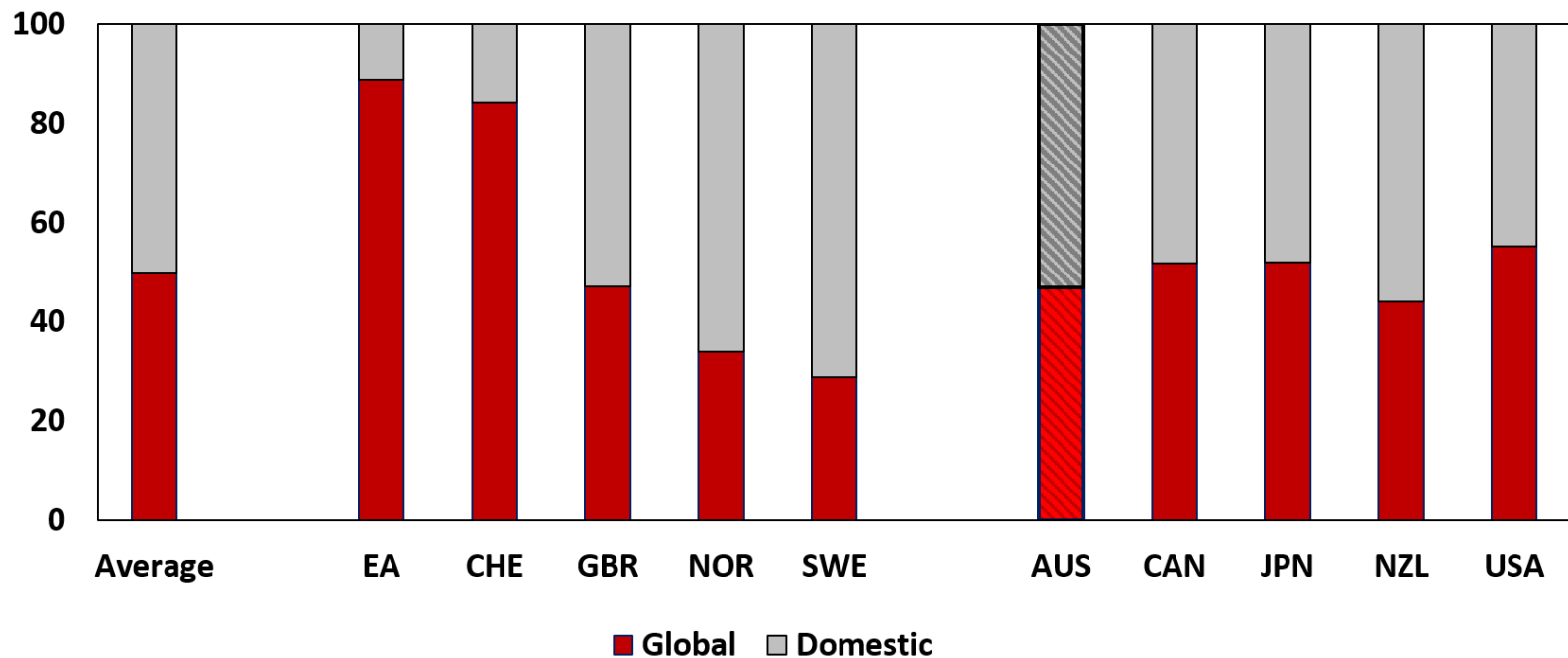
Source: Updated estimates with data through July 2026, based on analysis in Forbes, Ha and Kose (2026), "Heaven or Earth? The Evolving Role of Global Shocks for Domestic Monetary Policy." *Journal of Political Economy: Macroeconomics*, forthcoming.

Australia: Close to Average of AE Sample



Drivers of Domestic Monetary Policy: 2020-26

% of interest rate variation explained by shock type



Source: Updated estimates with data through July 2026, based on analysis in Forbes, Ha and Kose (2026), "Heaven or Earth? The Evolving Role of Global Shocks for Domestic Monetary Policy." *Journal of Political Economy: Macroeconomics*, forthcoming.

Does the Larger Role of Global Shocks Matter?



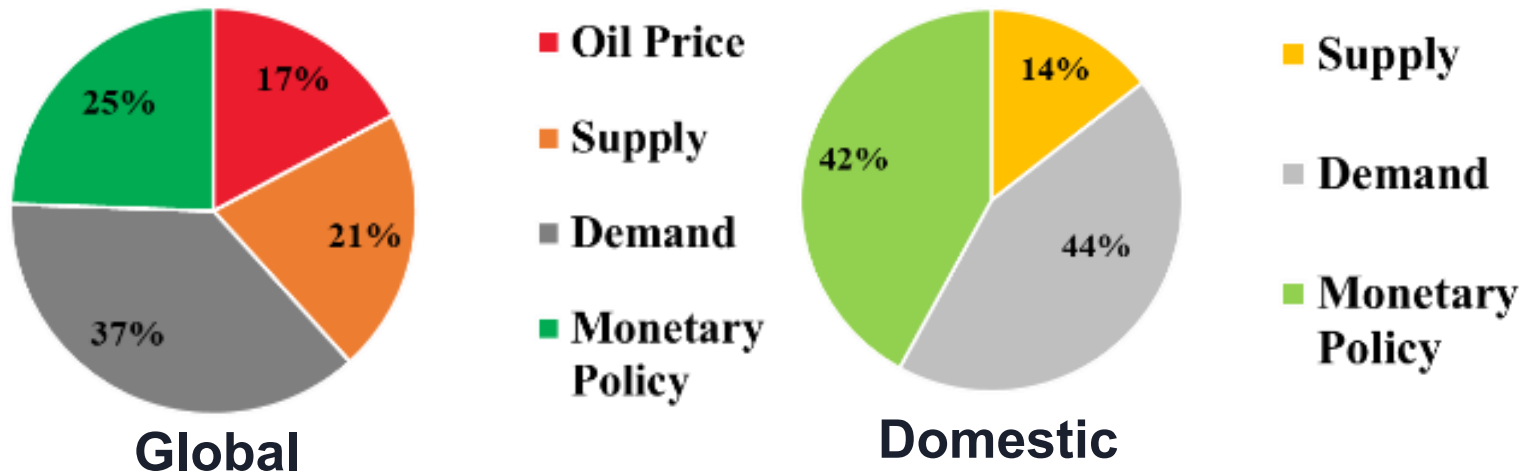
- **Maybe not....**
- **Unless global shocks have different characteristics and/or different implications for monetary policy....**
- **Analysis in “Heaven or Earth” tests if global shocks differ from domestic shocks along different dimensions**



A. Different Sources of Shock?

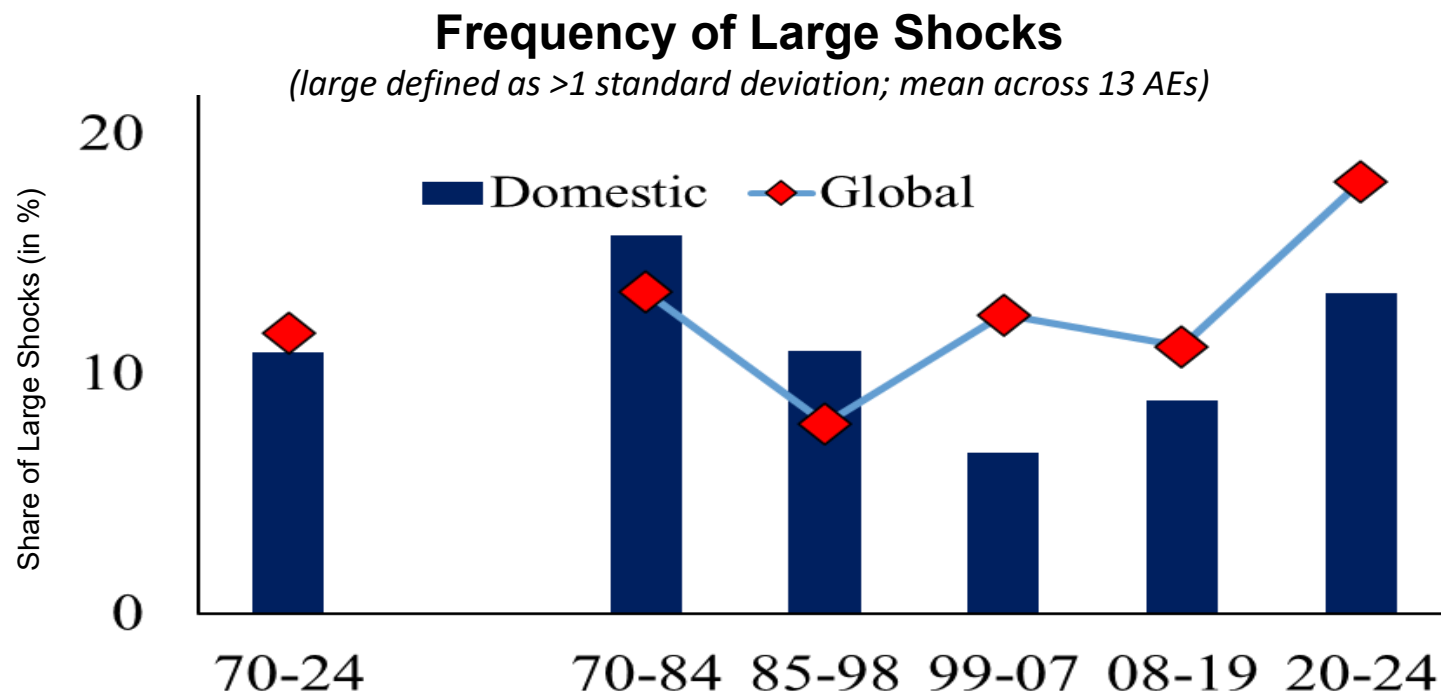


Contribution of 7 Shocks to Variation in Interest Rates: 1970-2024
(% of variation, mean across 13 AEs)



YES: Larger role of **supply shock** in global shocks
Larger role for **monetary policy** in domestic shocks

B. Different Size/Volatility of Shocks?



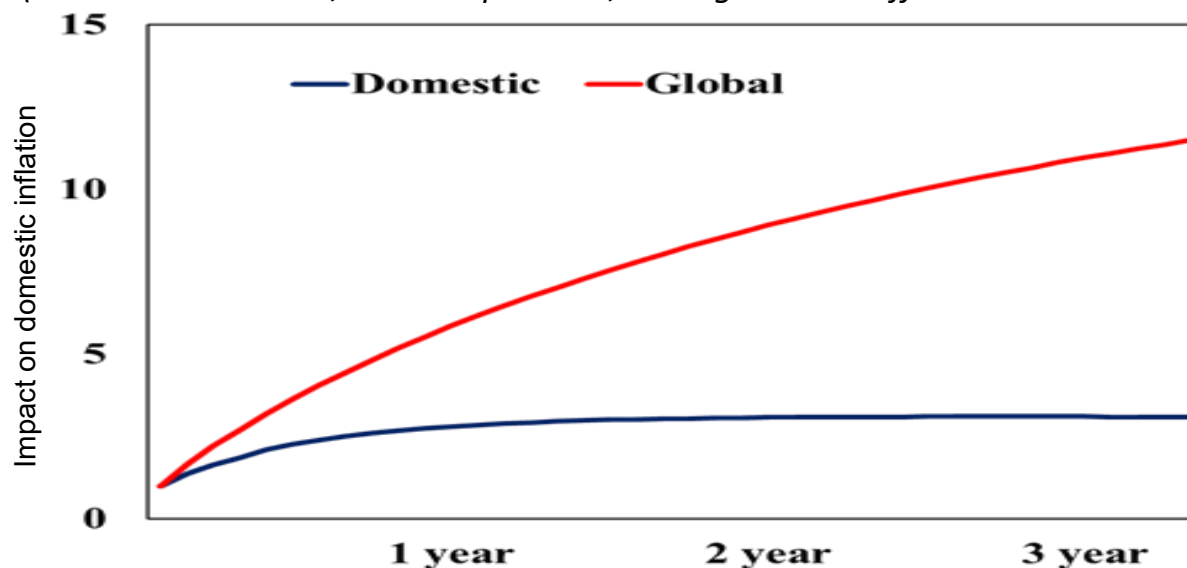
YES: More large global shocks than domestic shocks since 1998
Volatility larger for global shocks even controlling for source of shock

C. Different Persistence of Inflation?



Persistence of Shock Transmission

(mean across 13 AEs, initial impacts= 1, average across different structural shocks)



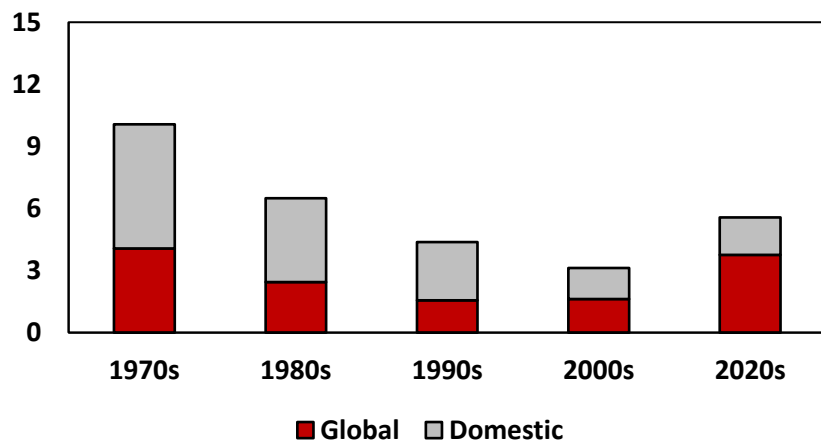
YES: More persistent impact of global shocks on inflation
Even if control for shock type (i.e. just supply or demand)

D. Asymmetric Effects on Rate Levels?

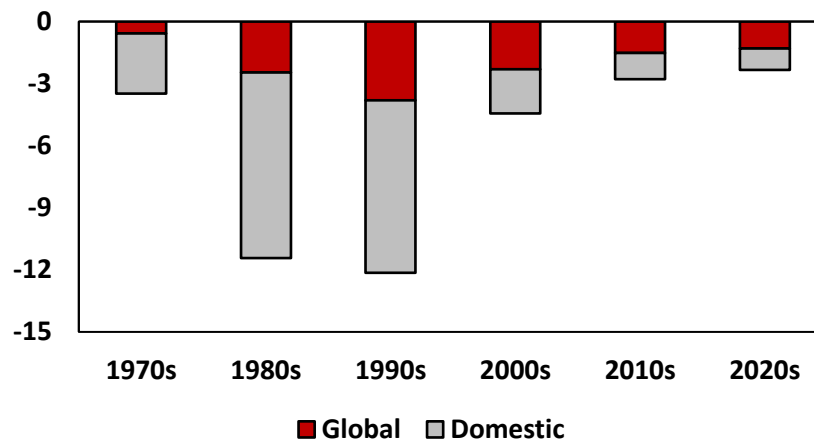


Impact on Level of Interest Rates

(in percentage points, average across 13 AEs)



Tightening Episodes



Easing Episodes

YES: Global shocks more important for tightening monetary policy



Summary and Implications.....



Nature of shocks driving monetary policy has changed

- More dominant role of global shocks
- Global shocks are more challenging by key metrics:
 - Greater supply component → world of trade-offs
 - Larger and more persistent → require stronger response
 - **Nonlinearity:** Cavallo et al (2023), Dedola et al (2024), Schnabel (2025)
 - **Persistence:** Ascari et al (2024), Bai et al (2024), Alvarez and Koren (2025)
 - More often negative (higher inflation/slower growth)
 - Ball and Mankiw (1994), Weber and Wasner (2023), Kharroubi et al (2023)

Therefore managing “trade-offs” becoming harder for central banks





2. How Have Central Banks Managed these Trade-offs?

50+ Years of Rate Cycles



To Begin: Defining Rate Cycles



Constructed new database of “rate cycles” for 24 advanced economies

- A rate cycle consists of a tightening and easing phase
 - Similar to a “business cycle” with an expansionary and contractionary phase
- “Trade-offs” paper: monthly data for 1970-2024 for 24 advanced economies
- Work in progress: monthly data for 1970-2026 for ~115 countries (AE, EM, FM, OD)

Adapt business cycle methodology identifying local peaks/troughs in policy rates

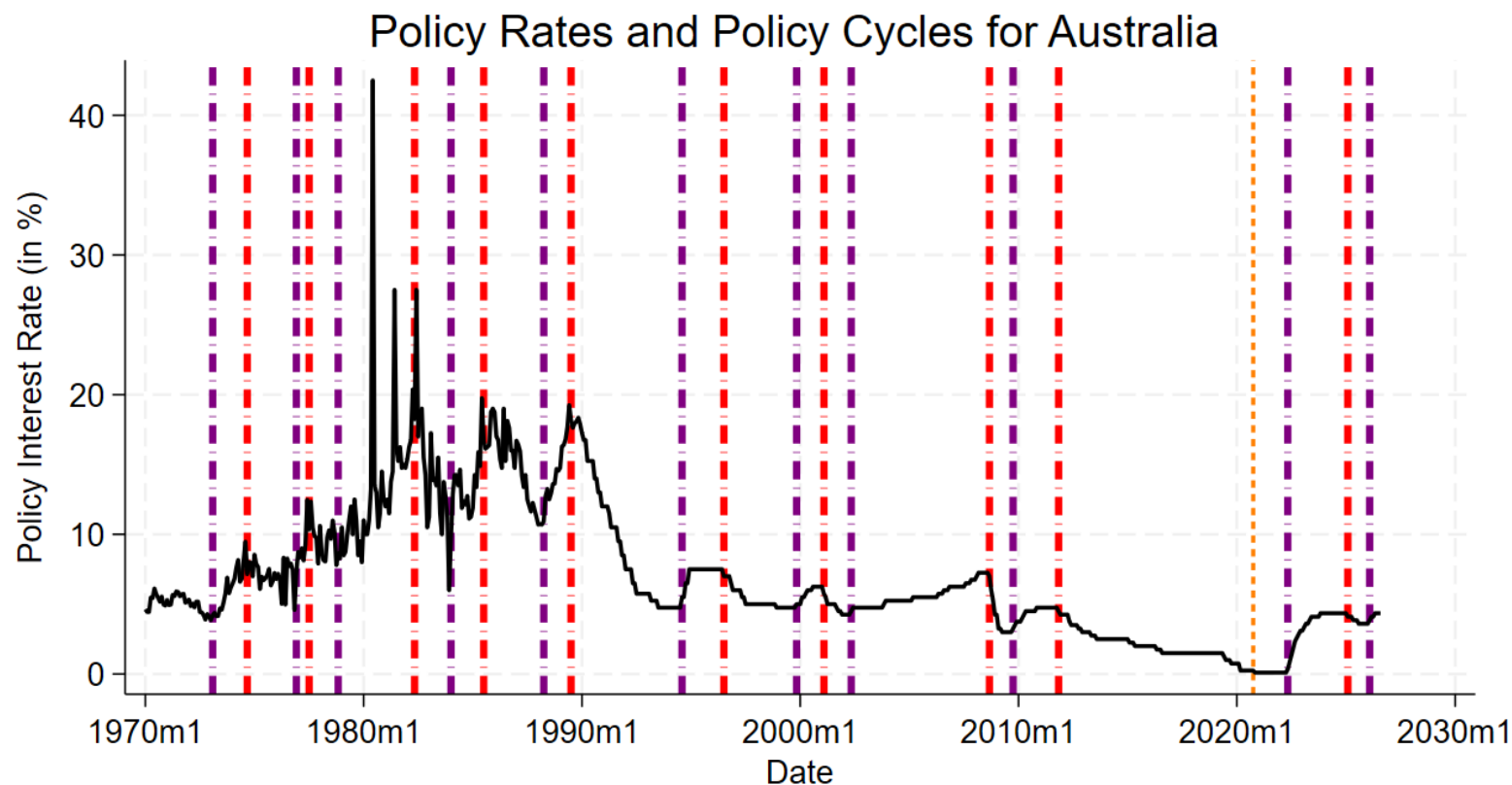
- Use BBQ algorithm proposed by Bry and Boschan (1971), developed in Harding and Pagan (2002)
- Incorporate information on balance sheet policies
- Adjustments for periods with no change in rates and plateaus

Result for this analysis: a database of “rate cycles”

- 223 distinct phases (112 tightening and 111 easing) in initial paper
- **~750 in current work**
- **Useful tool for future research**



Example: Rate Cycles in Australia



Notes: Purple/red are start of hiking/easing cycles. Orange dashed lines are QE announcements. Rates clipped at 50.

Characteristics of Rate Cycles



Statistics on central bank strategies

- *Duration*: length of phase
- *Amplitude*: total change in rates
- *Number* of rate changes
- *Pace*: average size of rate changes
- *Initial velocity*: rate change over 1st 6 months
- *Holding period*: length rates on hold at phase end

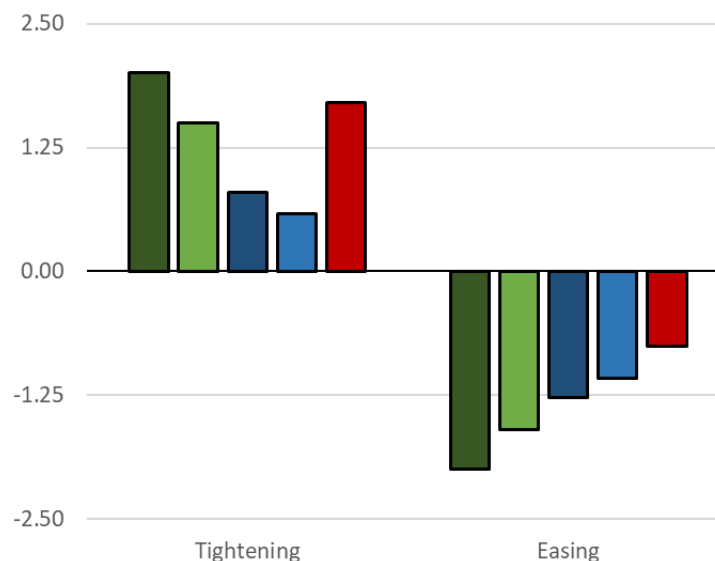
Evolution of macroeconomic variables

- Activity (GDP & IP growth)
- Labor market (employment, unemployment)
- Inflation (headline, core)

Many comparisons

- Across countries, over time
- Across easing & tightening phases

Initial Velocity of Rate Phases
Hikes over 1st 6 months of tightening phase



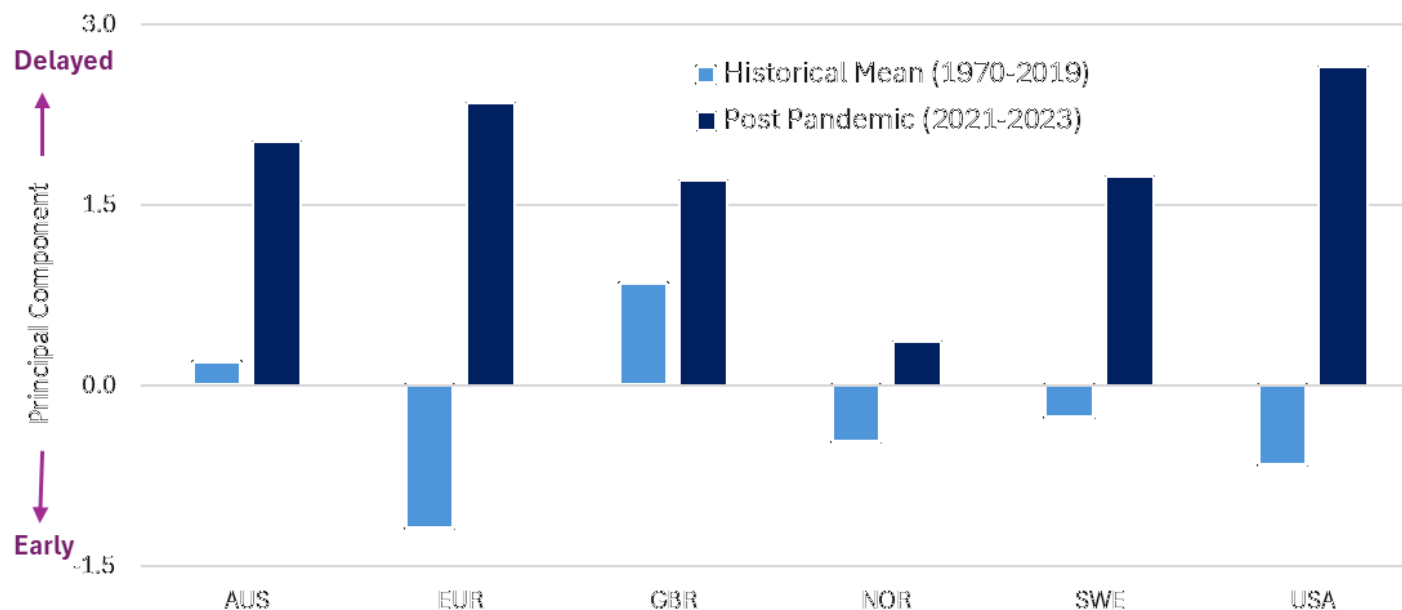
■ 1970-1984 ■ 1985-1998 ■ 1999-2007 ■ 2008-2019 ■ 2020-2024



New Measure: Timing of First Rate Hike



Timing of First Rate Hike (Relative to macroeconomic indicators)



Notes: A higher value of the index indicates a slower start to the tightening phase based on the underlying macroeconomic variables. This index is calculated as the first principal component of four macroeconomic indicators that can influence the timing of the first rate hike: headline inflation, core inflation, the unemployment gap, and output gap.



Why so Slow? Balancing Trade-offs?



Extensive literature on measuring the trade-offs for monetary policy

- ***too many papers to cite....including this conference***
- *Phillips curve trade-off* between activity and inflation
- “*Sacrifice ratio*” measuring output losses per inflation reduction
 - Ball 1994, Cecchetti and Rich 2001, Cecchetti et al 2023, Tetlow 2024



Calculating Sacrifice Ratios



For each country and tightening phase (plus 12-month lag):

Inflation Reduction (IR): $IR_{cp} = \pi_{cp}^{IP} - \pi_{cp}^{IT}$

with *Inflation Peak* $= \pi_{c,p}^{IP} = \max(\pi_{cp})$ and *Inflation Trough (subsequent)* $= \pi_{c,p}^{IT} = \min(\pi_{c,p,t})$

Based on monthly CPI index (PCE for US) or core

Accumulated Negative Output Gap (ANOG): $ANOG_{cp} = (\sum_{t=0}^x OG_{ct})/12$, for $OG_t < 0$

with OG_{ct} = output gap in month t for country c

Baseline measure of output gap: OECD measure or HP filter (based on Havers data)

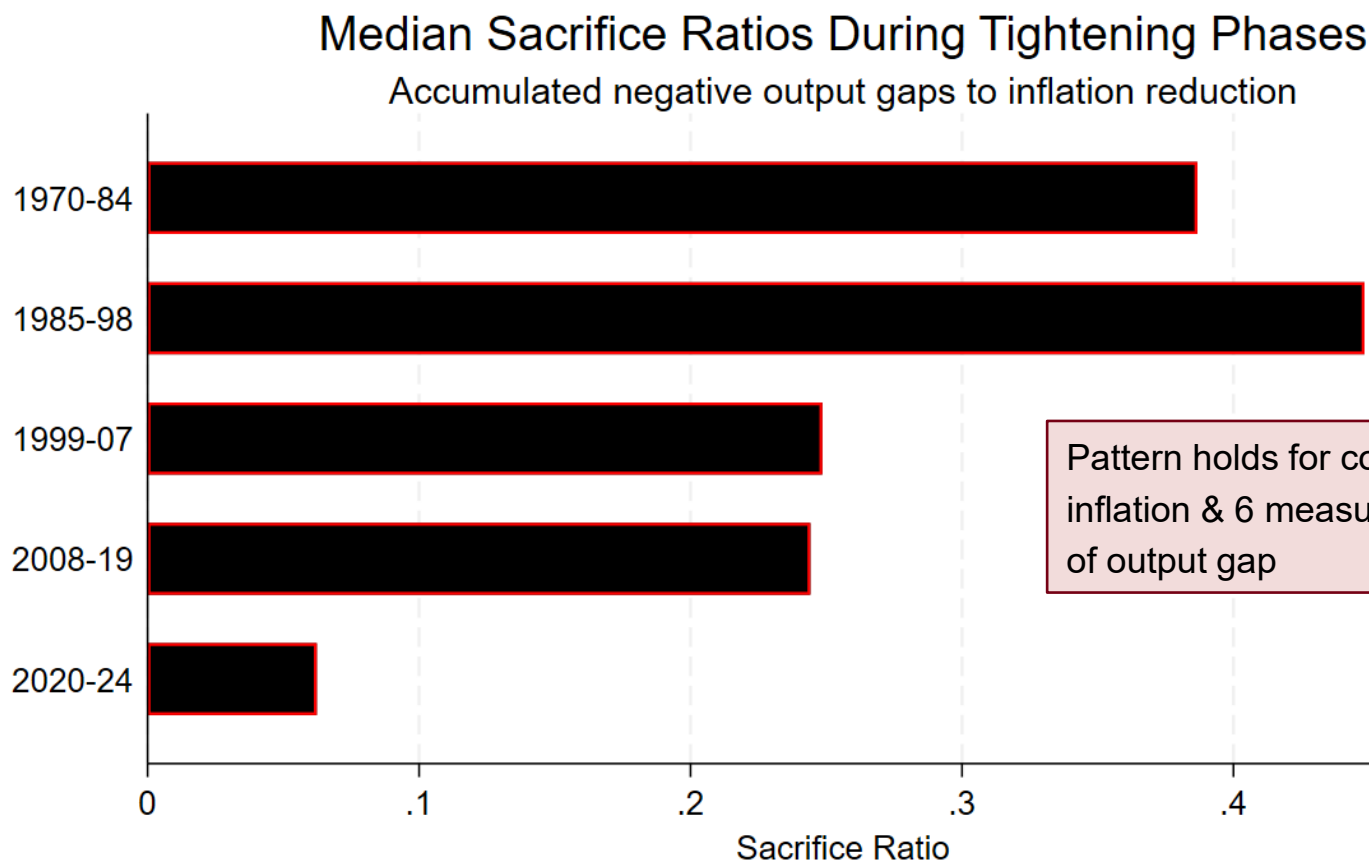
- 5 alternate measures: other filters (Hamilton, Baxter-King); other data sources & calculation methods; unemployment & employment gaps

Sacrifice Ratio (SR): $SR_{cp} = ANOG_{cp} / IR_{cp}$

Cumulative output losses per inflation reduction



Resounding Success Post-Pandemic????



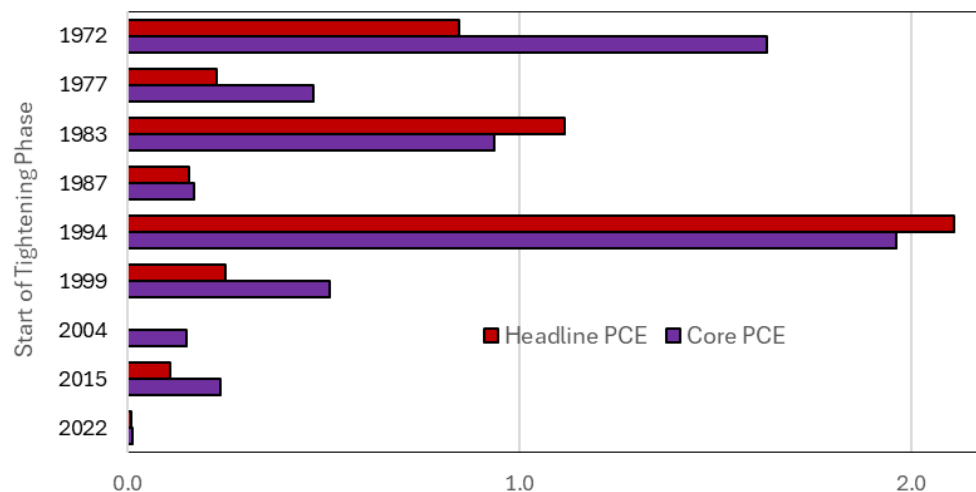
Notes: Sample of 24 advanced economies. Inflation is from peak to subsequent trough for CPI inflation (and PCE for US). Output gaps based on HP filter. Window is each country's tightening phase plus a 12-month lag.



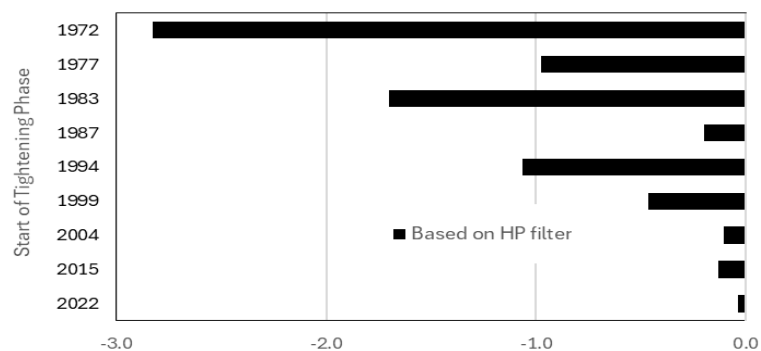
Closer Look at US in Historical Context



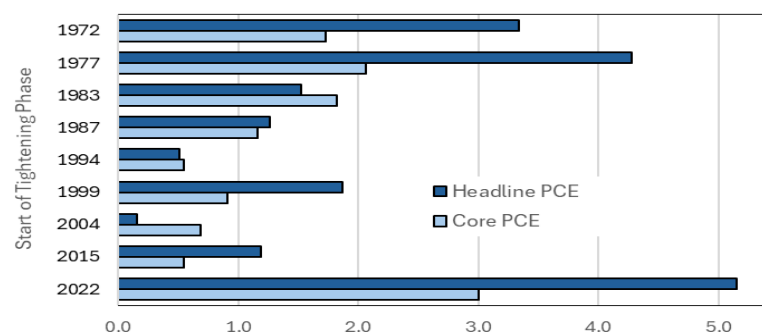
Sacrifice Ratios



ANOGs (as % of GDP)



Inflation Reduction (in pp)

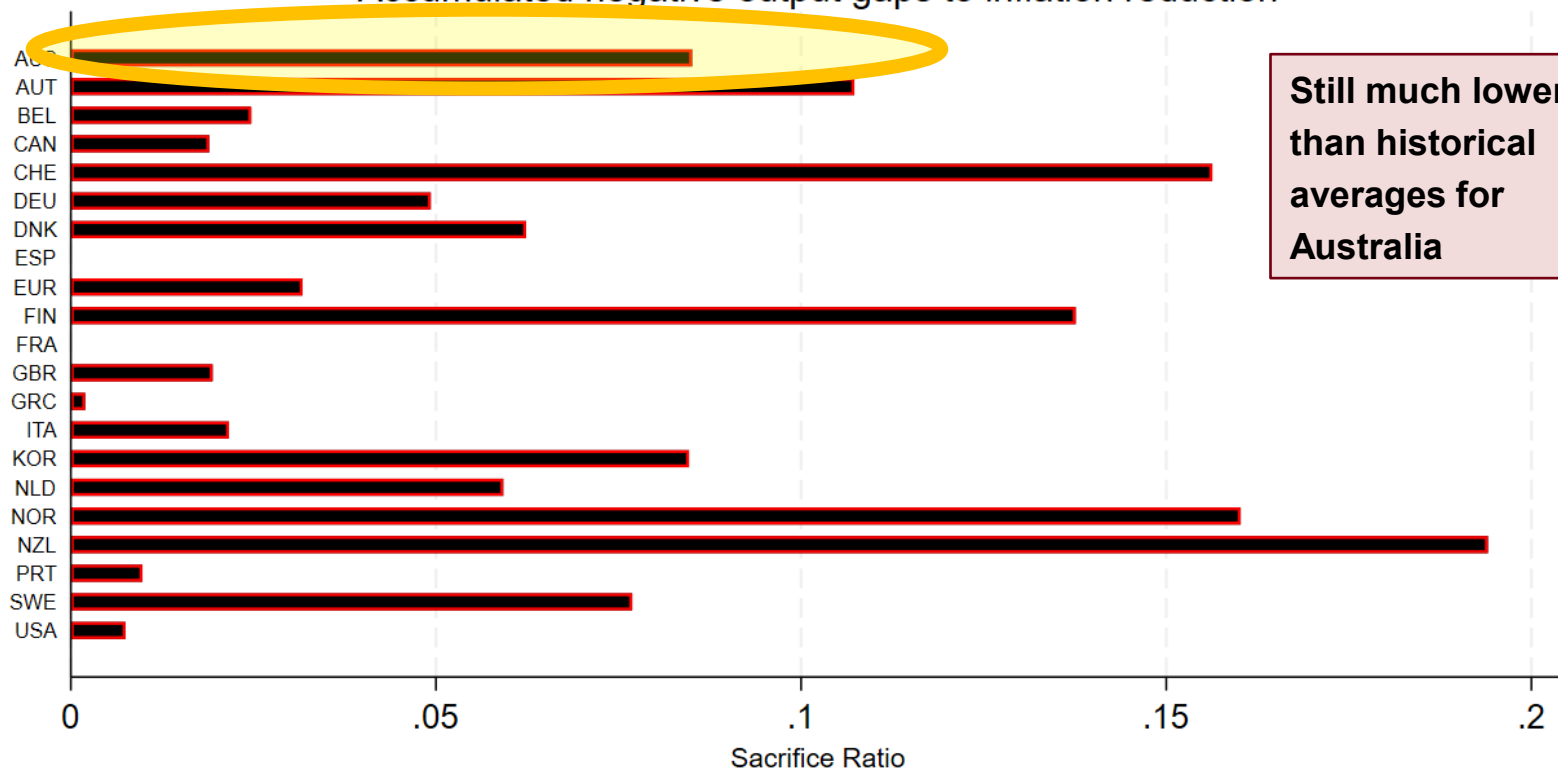


Australia: More “Sacrifice” than Average AE



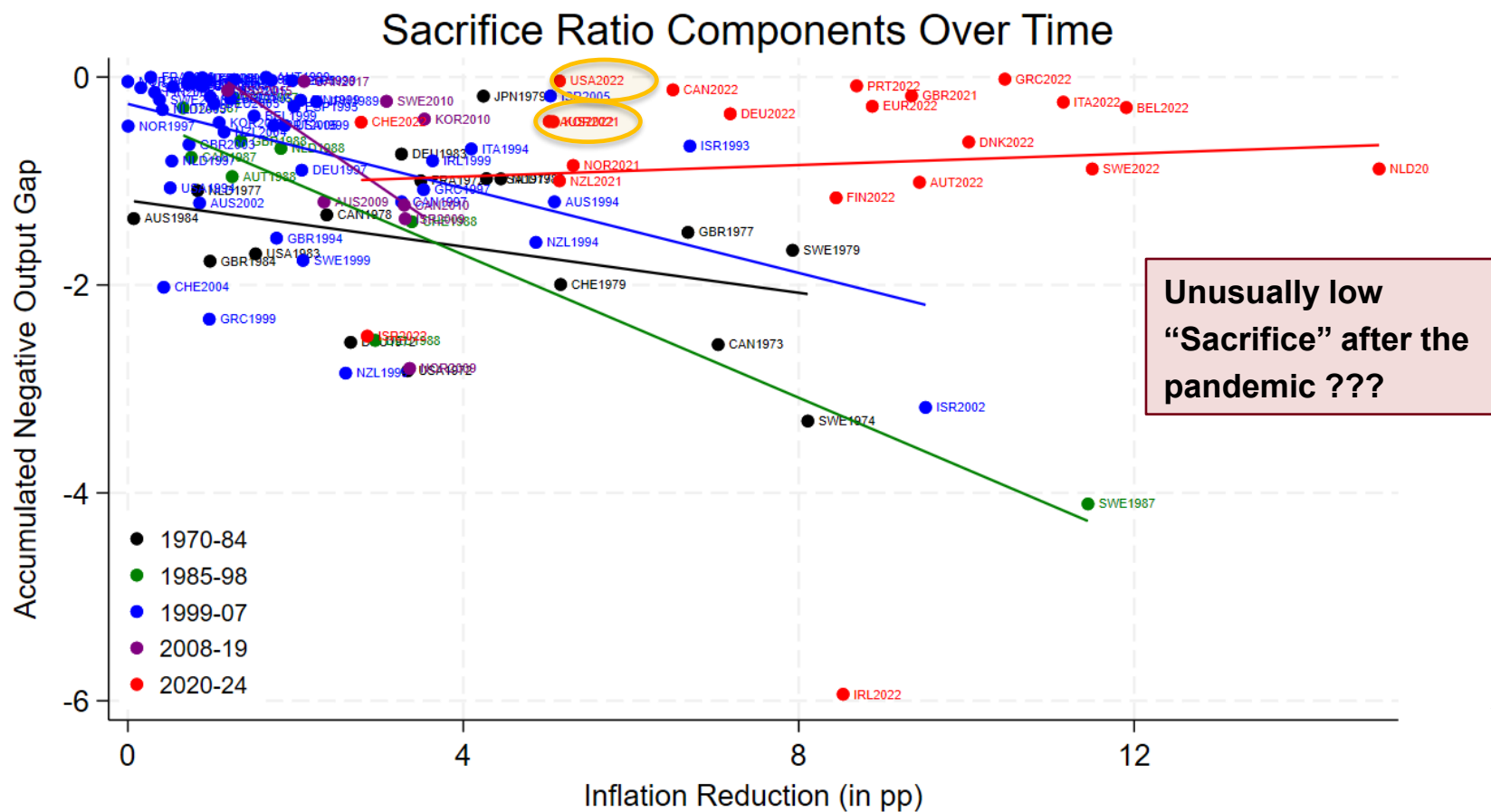
Sacrifice Ratios During Post-Pandemic Tightening

Accumulated negative output gaps to inflation reduction



CPI inflation reduction is from peak to subsequent trough. Excludes Israel and Ireland.

Closer Look at Sacrifice Ratio Components





3. Were the Trade-offs Muted? Or Mismeasured?

Moving Beyond Conventional Measures

What's Missing in Discussion of Trade-offs?



△ **PRICE LEVEL AND PATH TO GET THERE!!!**

- Accumulated change in inflation rates (above 2%)
- “Successful” return of inflation to target can correspond to very different changes in price level

Recent research (and votes) highlights the importance of the price level for households, firms, politics....

- Households believe inflation diminishes purchasing power and is “unfair”
 - *Coibion et al '23, Stantcheva '24, Binetti et al '24; Cournede & Moccero '09, Honkapohja & Mita '20*
- Non-linear effects of price shocks: larger shocks cause more frequent price adjustments, more attention to inflation, weaken inflation anchor
 - *Khalil and Lewis '24, Alvarez et al '24, Burns et al '21, Beaudry et al '24*
- Elevated inflation → voting gains for anti-system & populist parties
 - *Federle, Mohr and Schularick '24*

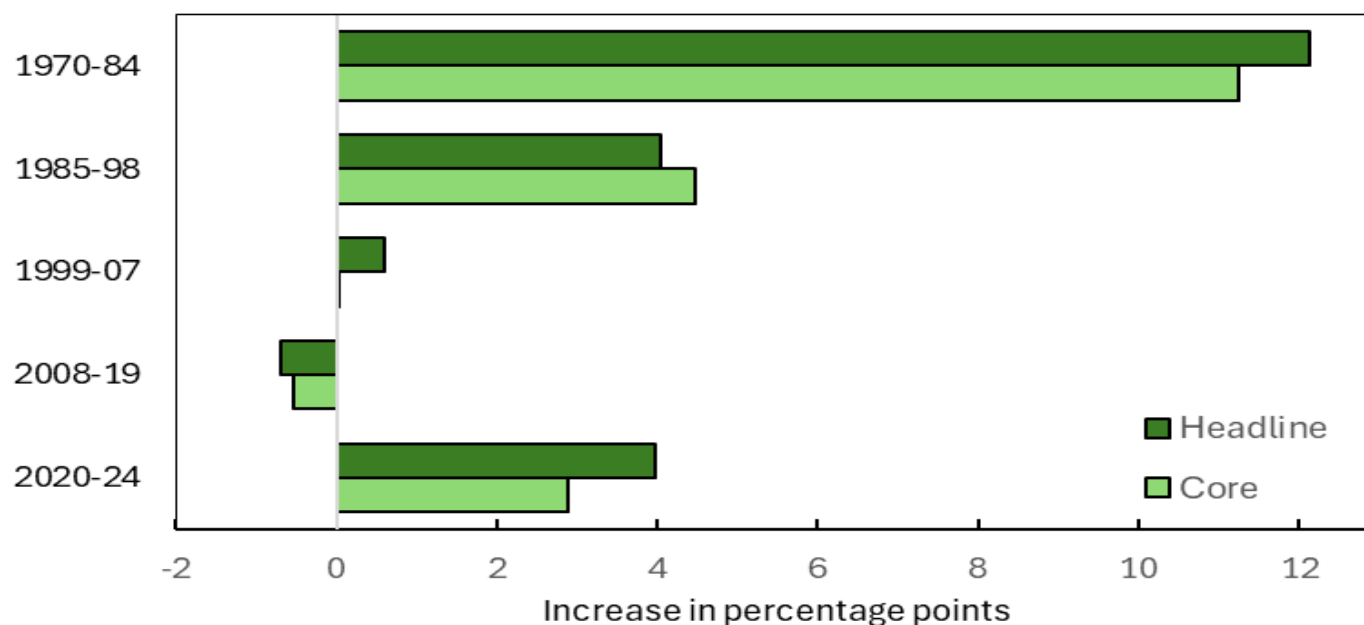


Not Such a Resounding Success....



Median Excess Change in Price Level Per Year

Over tightening phases, “excess” is > 2% inflation

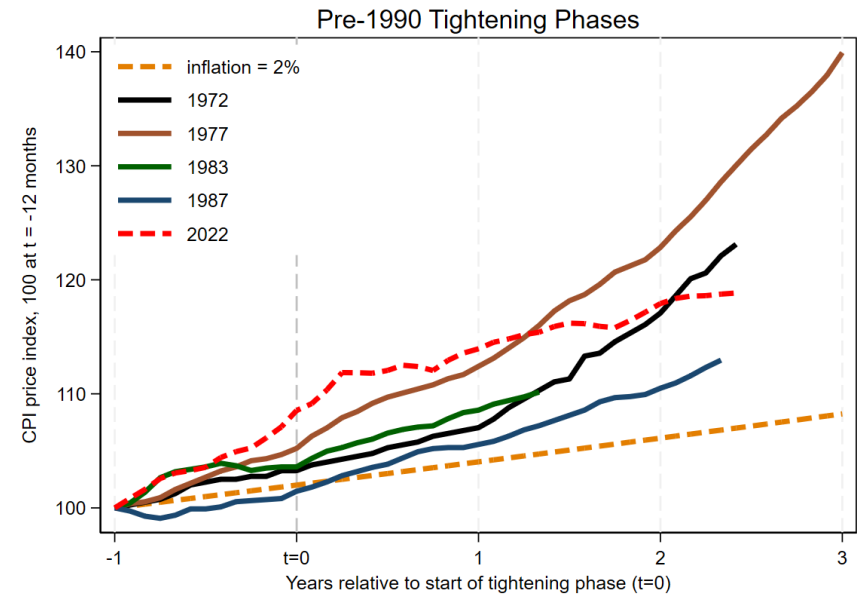
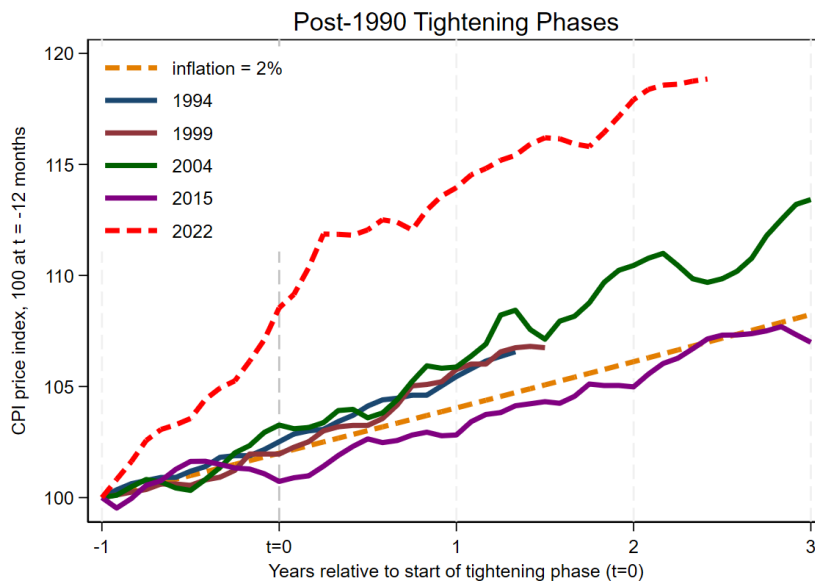


Notes: Median across the sample of 24 advanced economies. Excess price level change is calculated over each country-phase for tightening periods, starting from a 12-month lead before the first rate hike and ending after a 12-month lag after the tightening phase ends.

What's Missing? Impact on the Price Level



The Evolution of the Price Level in the **United States** Over Tightening Phases, based on the Consumer Price Index



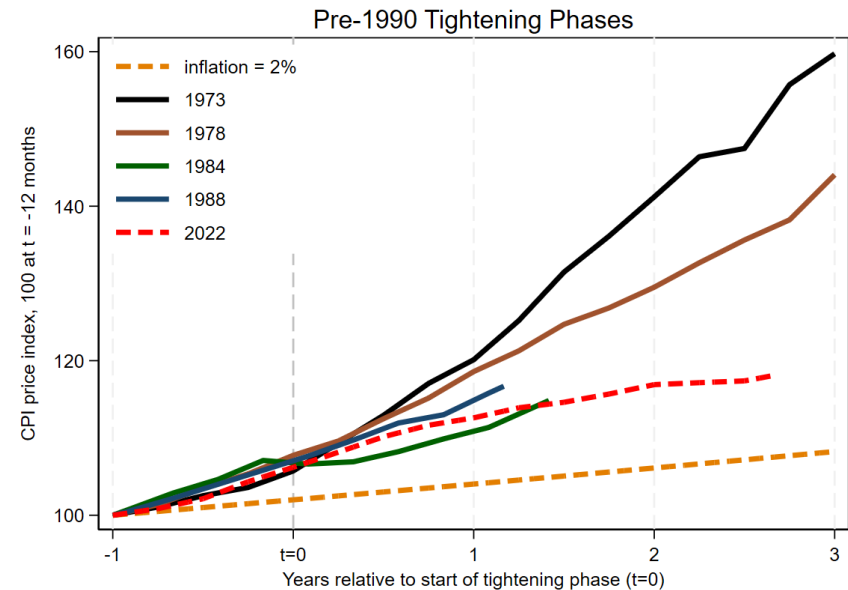
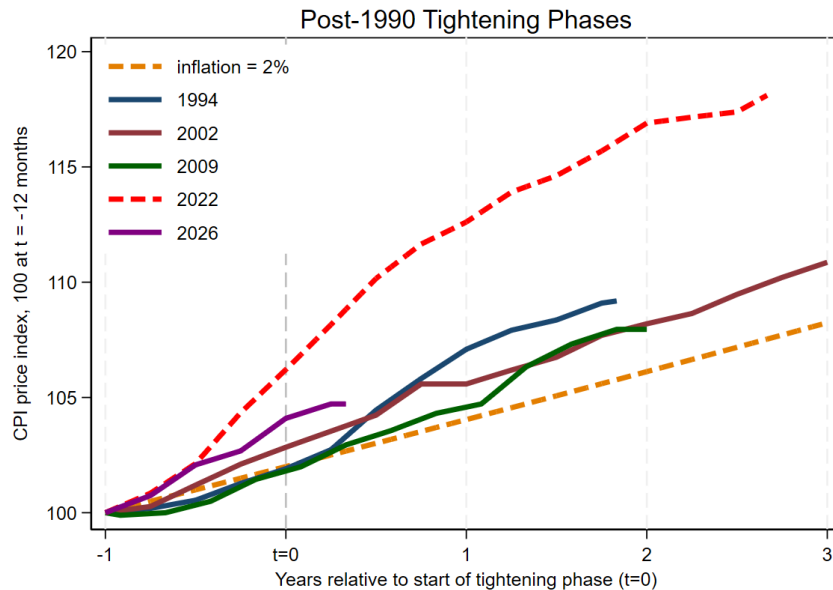
CPI price index (t=year), 100 one year before the start of the tightening phase. Dashed orange: price level with 2% inflation from $t = -12$. Dashed red: post-pandemic tightening phase. Each line ends in the last month of the phase (ongoing phases: last month with data).



Australia: Impact on the Price Level



The Evolution of the Price Level in **Australia** *Over Tightening Phases, based on the Consumer Price Index*



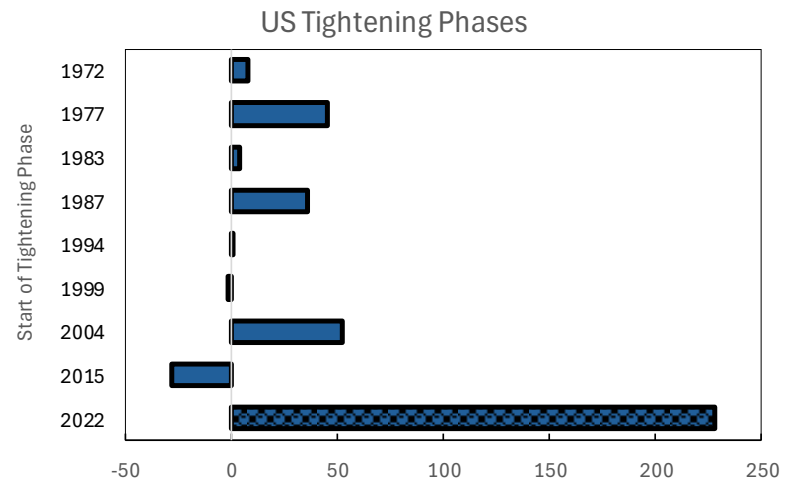
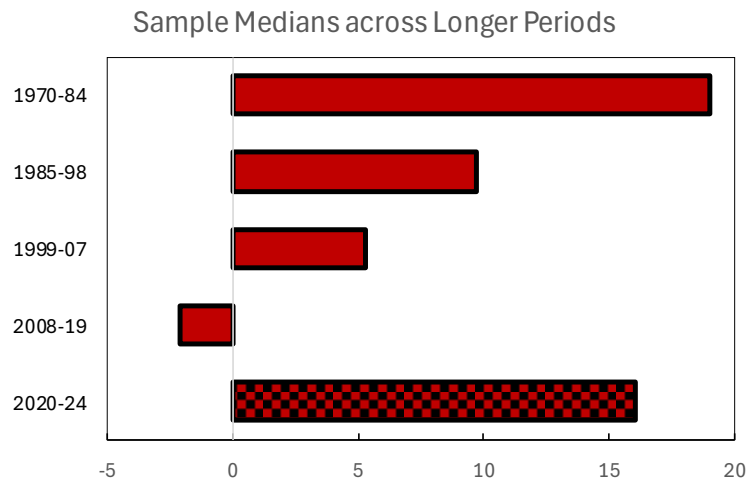
CPI price index (Haver), 100 one year before the start of the tightening phase. Dashed orange: price level with 2% inflation from $t = -12$. Dashed red: post-pandemic tightening phase. Each line ends in the last month of the phase (ongoing phases: last month with data).

Post-Pandemic: Different Trade-off



Price-Output Trade-off Ratios during Tightening Phases

(Ratio of Excess Price Level Change to ANOG)



Closest precedent: “Phillips curve multiplier” in Barnichon and Mesters (2021): expected cumulative change in inflation caused by a monetary shock that lowers expected unemployment by 1pp

Notes: The Price-Output Trade-off Ratio is calculated as the ratio of the Excess Price Level Change (relative to that which would occur if inflation was 2%) to the Accumulated Negative Output Gap (ANOG) over each tightening phase. Output gaps are based on the HP filter. The headline and core price indices are based on the monthly CPI indices for all economies except the US (which is based on the PCE indices).



4. What are the Lessons for Central Banks Today?

Summary



Key questions (and answers):

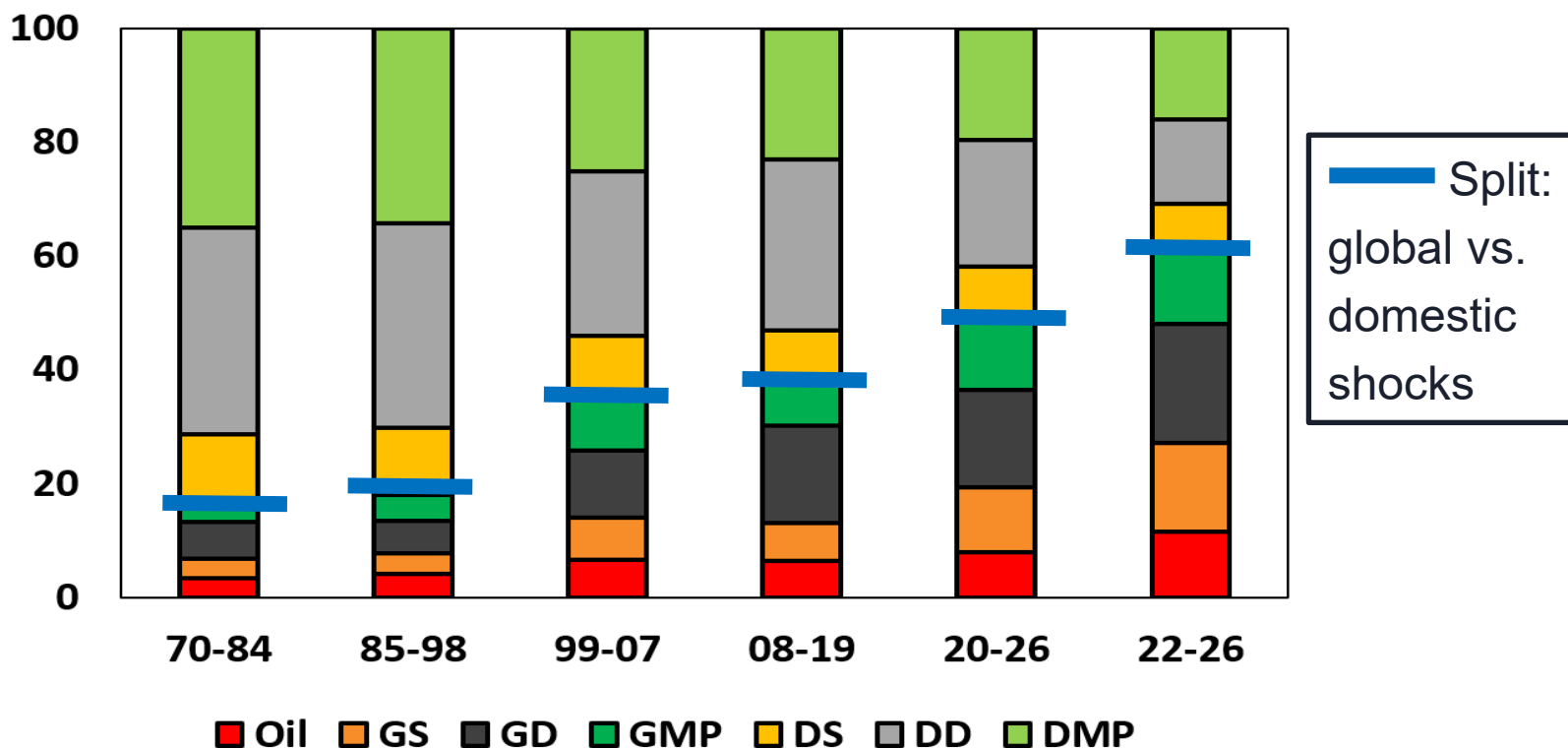
- 1) **Have the trade-offs facing central banks become more challenging?**
 - *Yes...due to changing nature of the shocks driving monetary policy*
- 2) **How have central banks managed these trade-offs over time?**
 - *Post-pandemic appeared successful based on conventional measures...*
- 3) **But—were the trade-offs muted? Or mismeasured?**
 - *Additional metrics: impact on the price level and adjustment path*
- 4) **What are the lessons for central banks today?**
 - *Comparisons based on the analyses from today*
 - *Shock decompositions*
 - *Rate cycles*
 - *Trade-offs: conventional Sacrifice Ratio, adding price level*



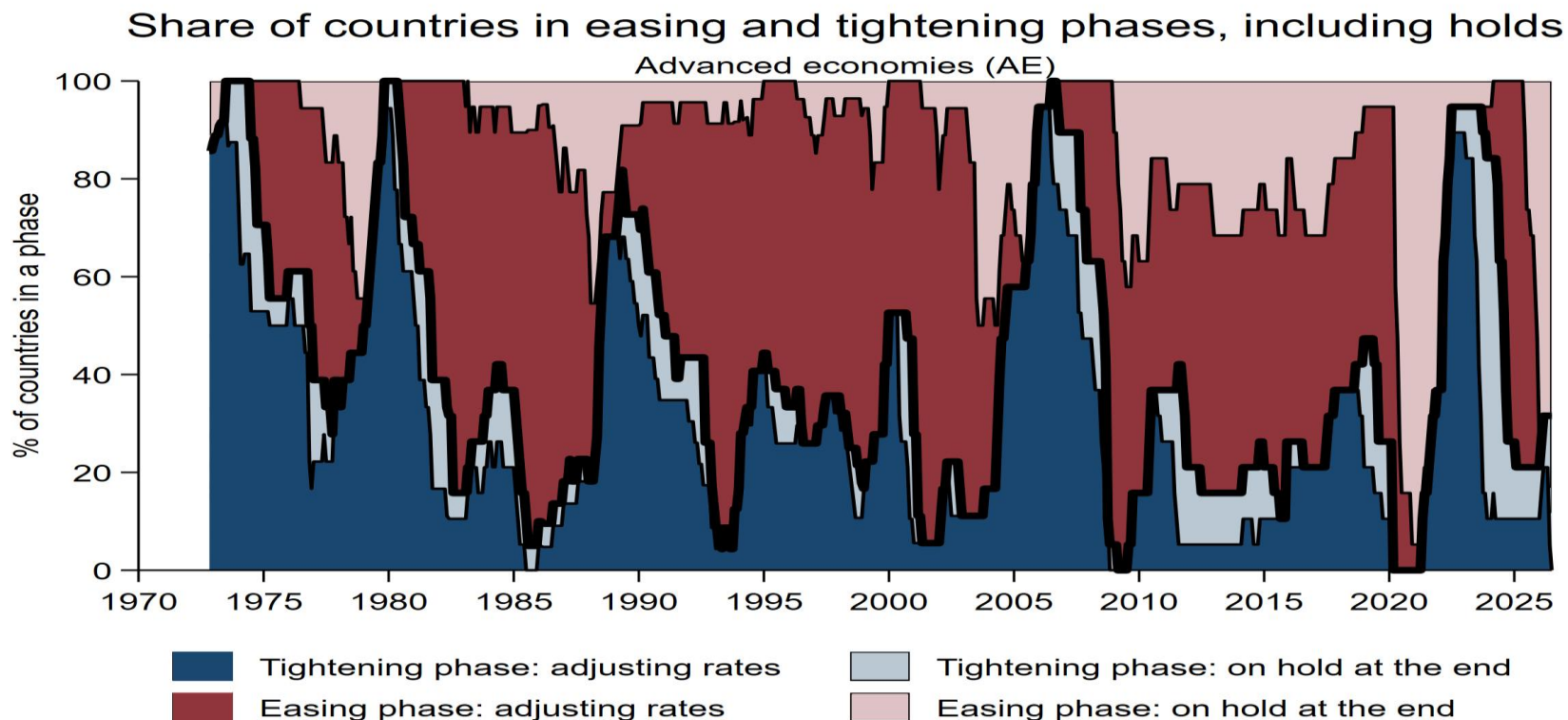
Role of Global Shocks Continues to Grow → Challenging Trade-offs



Drivers of Domestic Monetary Policy
(% of variation explained by each shock)



Today: Holds and Turning Points



Share of countries in each phase, as % of the countries in a tightening or easing phase, each month. Lighter shades: on hold at the end of the phase (after the last hike of a tightening phase; after the last cut and the start of the last new QE program of an easing phase). Countries are counted from their first turning point. AE includes the euro area from 1999 and AE euro area members before entry. A group is shown only when at least 5 countries are in the group.

Updated with data through July 2026

A “Mini-me” of the 2022 “No Sacrifice” Adjustment?



	Output gap 2026 (% of potential)	Ch unemp rate, 12 mo (pp)	Inflation (% y/y)		Price level vs 2% path	
			CPI	Core	5 yrs (%)	3 yrs (%)
Australia	-0.7	0.2	3.5	3.6	13.3	3.6
Canada	-0.2	-0.5	3.0	2.8	9.1	1.4
Euro area	-0.8	0.2	2.9	2.2	13.1	1.6
Japan	0.0	0.0	1.7	n.a.	3.9	2.0
Korea	-1.3	0.2	2.8	2.6	6.7	1.5
New Zeala	-2.5	0.3	4.1	1.8	14.3	3.6
Norway	0.0	-0.3	3.0	2.9	12.4	3.1
Sweden	-1.6	0.5	0.2	0.1	12.5	-2.4
Switzerlan	0.0	0.2	0.4	0.5	-3.3	-4.2
UK	-0.4	0.2	2.8	2.9	17.3	3.9
US	-0.3	-0.2	3.4	2.5	11.9	3.1
Average	-0.7	0.1	2.5	2.2	10.1	1.6
Median	-0.4	0.2	2.9	2.5	12.4	2.0

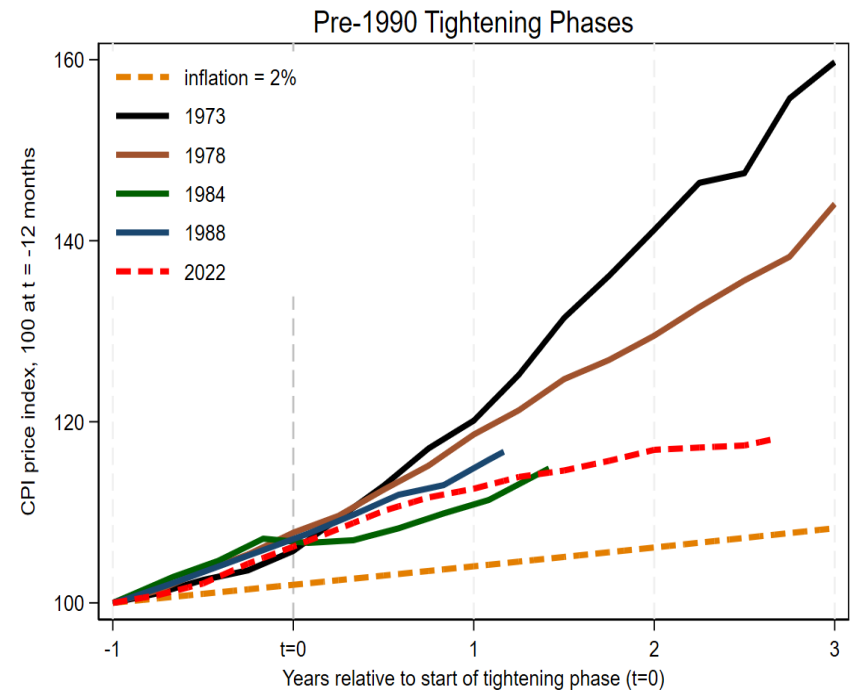
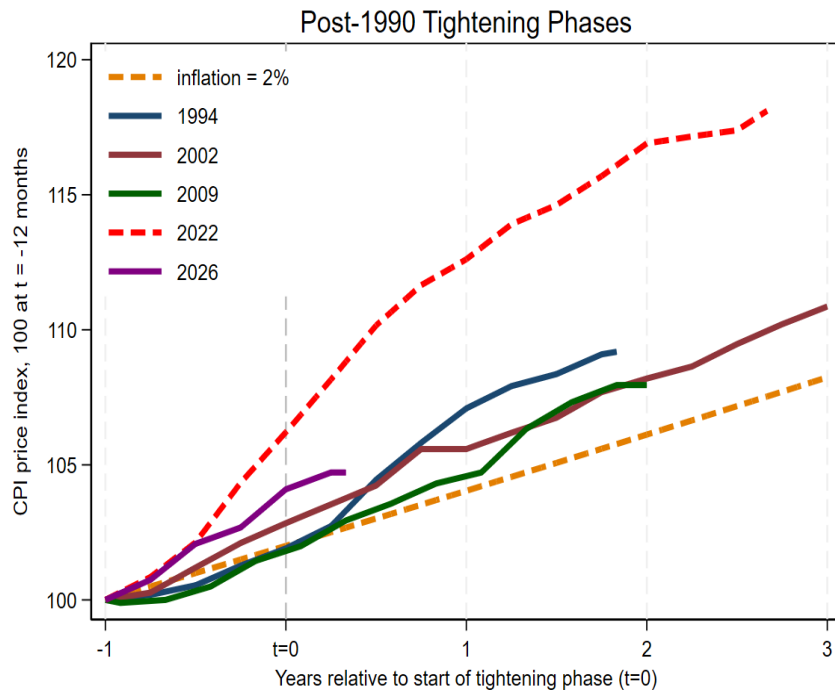
Note: updated through July 2026



Australia: Caution Warranted.....



Australia: price level over tightening phases



CPI price index (Haver), 100 one year before the start of the tightening phase. Dashed orange: price level with 2% inflation from $t = -12$. Dashed red: post-pandemic tightening phase. Each line ends in the last month of the phase (ongoing phases: last month with data).

Lessons for Today



Situation today:

- Outsized role of global shocks for monetary policy continues...
- Central banks appear to be largely following the 2021 playbook
 - Greater weight on output stabilization, less on inflation, hope “transitory”

Less inflationary pressure building than 2022...but risks... caution merited

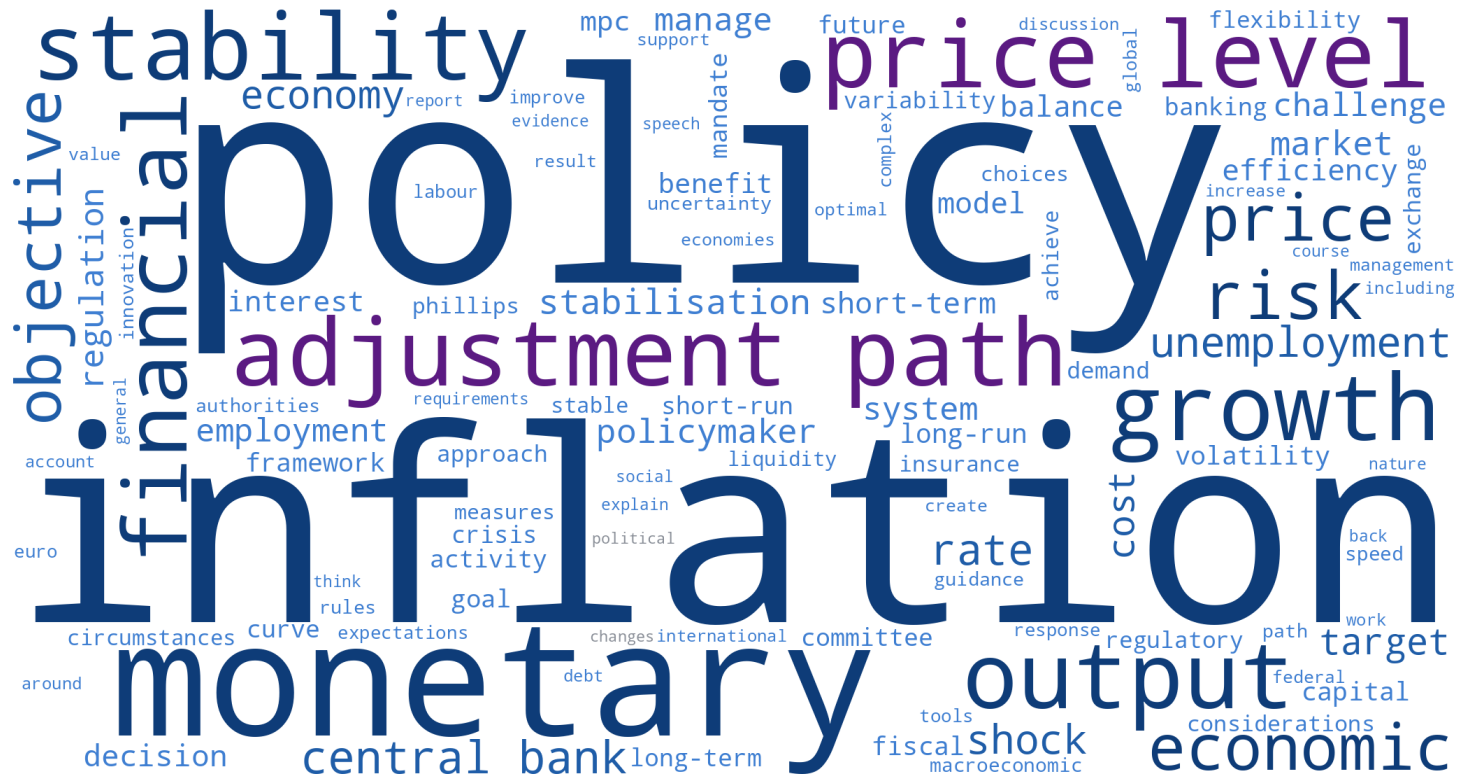
- Continue to underweight price level & adjustment path
- **Legacy effects:** greater price sensitivity given last price shock

Suggestion: more attention to price level when weighing trade-offs

- Does not imply strict price level targeting
- Could involve:
 - Clarify “price stability” not just inflation, but length/magnitude of deviations
 - More explicit discussion/modelling in communication
 - Commit to “more forceful” response if inflation deviates by more/longer



Words within ten words of each mention; size reflects frequency. Common filler words removed; plurals merged.





EXTRA



Explaining Trade-offs across Countries and Time



What drives these “Trade-offs” over time and across countries?

– For Sacrifice Ratio (and components) and Accumulated Price Level Change (vs 2%)

$$Tradeoff_{cp} = \alpha + \beta * CB_Strategy_{cp} + \delta * Country_Characs_{cp} + \gamma * OilShocks_{cp} + \varepsilon_{cp}$$

- **Focus: Central Bank Strategy**
 - **Timing of first rate hike:** relative to evolution of macroeconomic variables
 - **Aggressiveness of rate hikes:** first principal component based on 5 characteristics of rate cycles (from above)
 - # rate hikes, pace, total amplitude, initial velocity, use of “supersized” hikes
- **Other control variables:**
 - Country Characteristics (from prior literature explaining traditional Sacrifice Ratio): **central bank credibility**, trade and financial openness, exchange rate regime, labor market flexibility
 - Shocks: focus on global oil shocks (normalized in terms of total variance); many others
- **Details:** Data for 1970-2024 for 23 countries (include individual EA members)
 - Standard errors clustered by country and over the five long periods



Regression Results: Explaining Trade-offs



	SACRIFICE RATIO (ANOG/IR)					ACCUMULATED NEGATIVE OUTPUT GAP (ANOG)				
Delayed Start	-0.0546*		-0.0782***	-0.0527	-0.0482	-0.304*		-0.130	-0.165*	-0.186*
	(0.0211)		(0.0147)	(0.0309)	(0.0357)	(0.132)		(0.0824)	(0.0651)	(0.0852)
Aggressiveness		0.0361*	0.0788***	0.00539	0.00501		-0.607***	-0.527***	-0.373**	-0.371**
		(0.0139)	(0.0132)	(0.0248)	(0.0256)		(0.0397)	(0.00870)	(0.0957)	(0.0999)
Central Bank				-0.141**	-0.132**				0.266*	0.226*
Credibility				(0.0334)	(0.0394)				(0.115)	(0.0946)
Labor Market					-0.0273					0.121
Flexibility					(0.0261)					(0.0993)
Oil Shocks					0.00183					-0.00514
					(0.00719)					(0.0254)
Observations	88	88	88	88	88	108	108	108	108	108
R-squared	0.040	0.010	0.079	0.212	0.216	0.121	0.257	0.274	0.319	0.325

	INFLATION REDUCTION (IR)					EXCESS PRICE LEVEL CHANGE (EPLC)				
Delayed Start	1.704***		1.560***	1.565***	1.476***	2.926*		2.362*	2.328*	2.492**
	(0.136)		(0.120)	(0.0973)	(0.147)	(1.356)		(1.070)	(0.872)	(0.839)
Aggressiveness		1.195*	0.494**	0.586**	0.581**		2.917	1.932	1.372	1.398
		(0.508)	(0.141)	(0.157)	(0.160)		(1.801)	(1.228)	(1.053)	(1.024)
Central Bank				0.239	0.0697				-1.448	-1.128
Credibility				(0.279)	(0.186)				(0.983)	(0.882)
Labor Market					0.532					-0.956
Flexibility					(0.322)					(0.466)
Oil Shocks					-0.0458					0.0937
					(0.0288)					(0.0462)
Observations	136	137	136	136	135	136	137	136	136	135
R-squared	0.512	0.173	0.538	0.543	0.563	0.399	0.279	0.505	0.554	0.569



Key Results



Policy <i>green/good, red/pain</i>	Sacrifice Ratio	Output Losses (accumulated)	Inflation Reduction	Excess Price Level Change (accumulated)
Delayed liftoff	Green	Grey	Green	Red
More aggressive hikes	Red	Red	Green	White
Central bank credibility	Green	Green	White	Light Green

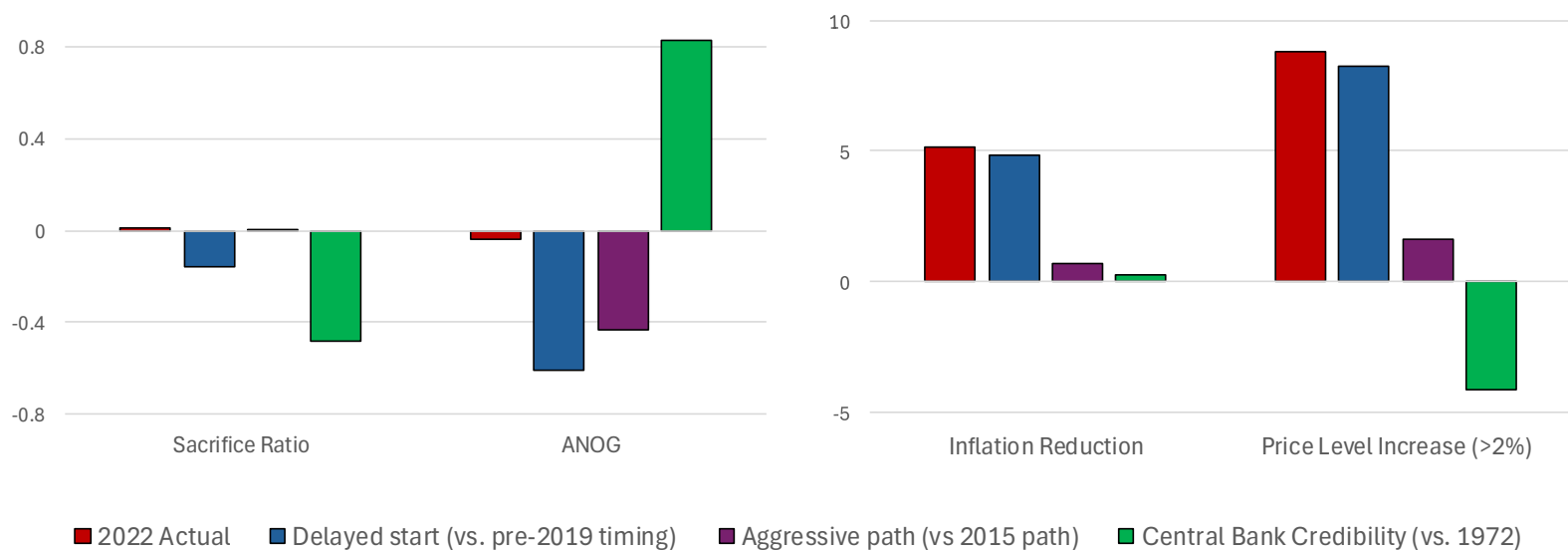
- **Important caveats:**
 - Limited observations/omitted variables, endogeneity
 - No controls for fiscal/other govt policies & easing of supply constraints
- **Results robust to extensive series of sensitivity checks**
- **Results consistent with post-pandemic adjustment**
- **Results supported by simulations with FRB/US model**



Magnitudes of Different Strategies



Impact of Different Strategies for US



Notes: Graph shows estimated impact of changing one variable based on coefficient estimates from baseline regression and assuming no other changes.

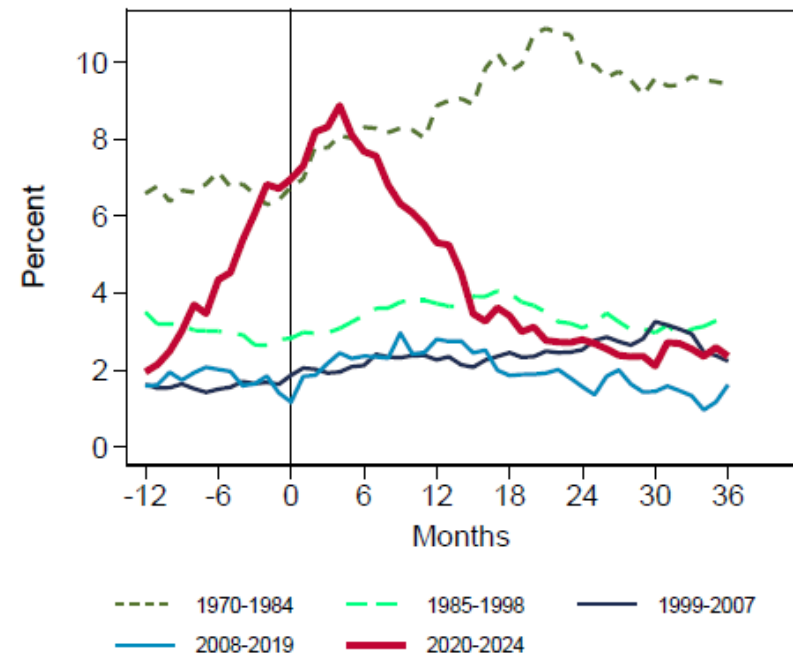
Activity and Inflation around Rate Cycles



Evolution of macro variables (12-month)

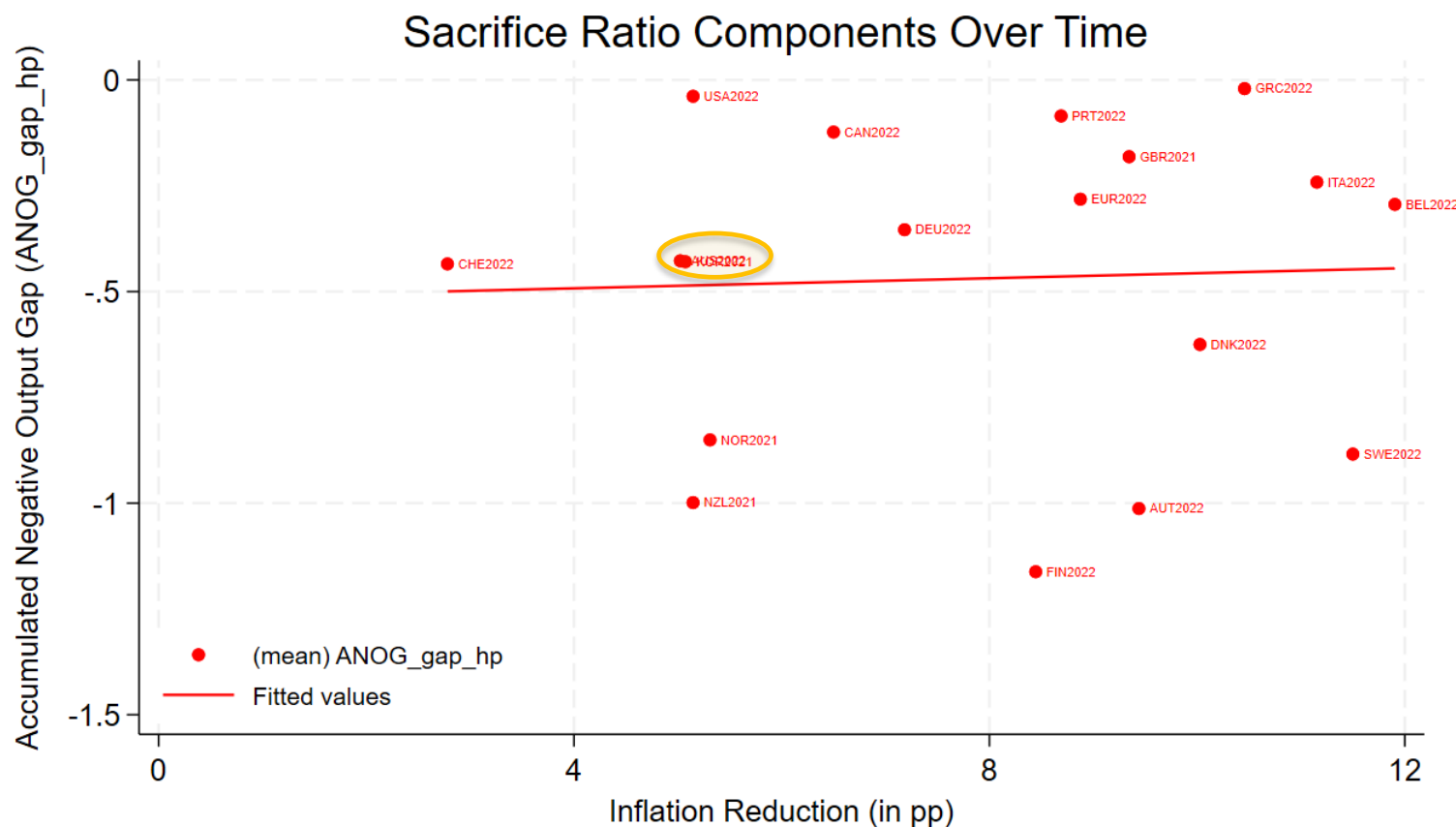
- Activity:
 - *GDP growth*
 - *IP growth*
- Labor market:
 - *growth in employment*
 - *change in unemployment*
- Inflation
 - *headline CPI (PCE for US)*
 - *core*

Median CPI (PCE) Inflation over Tightening Phases



Sacrifice Ratio Components

Cross-Country Variation Post-Pandemic

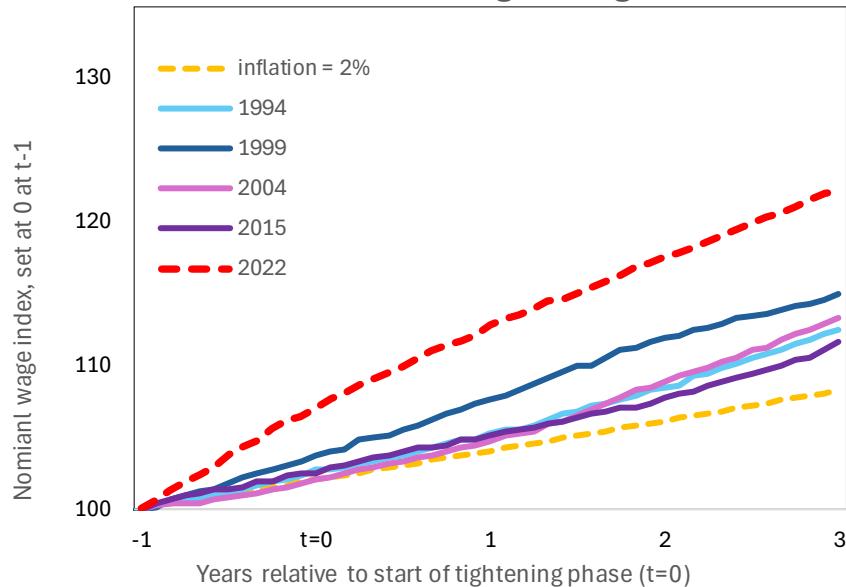


Impact on US Nominal Wages

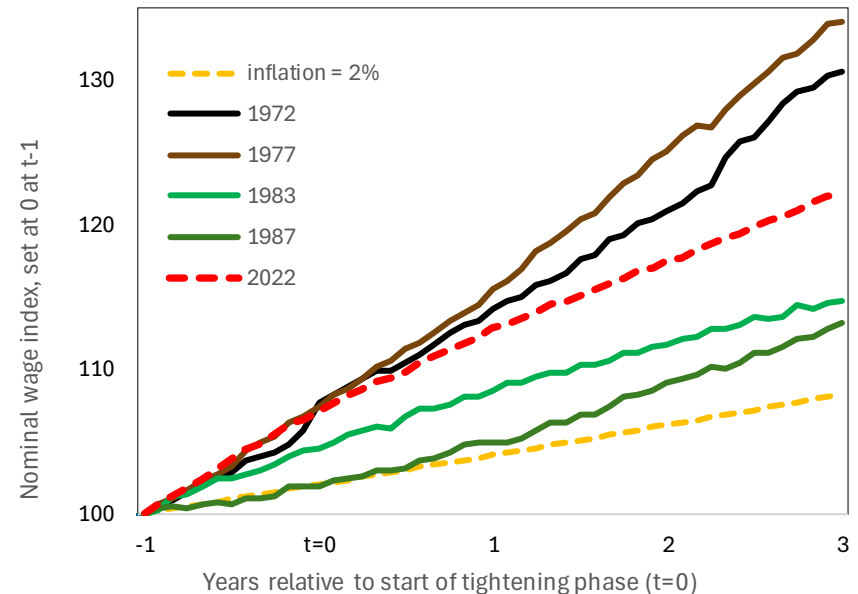


The Evolution of US Nominal Wages

Post-1990 Tightening Phases



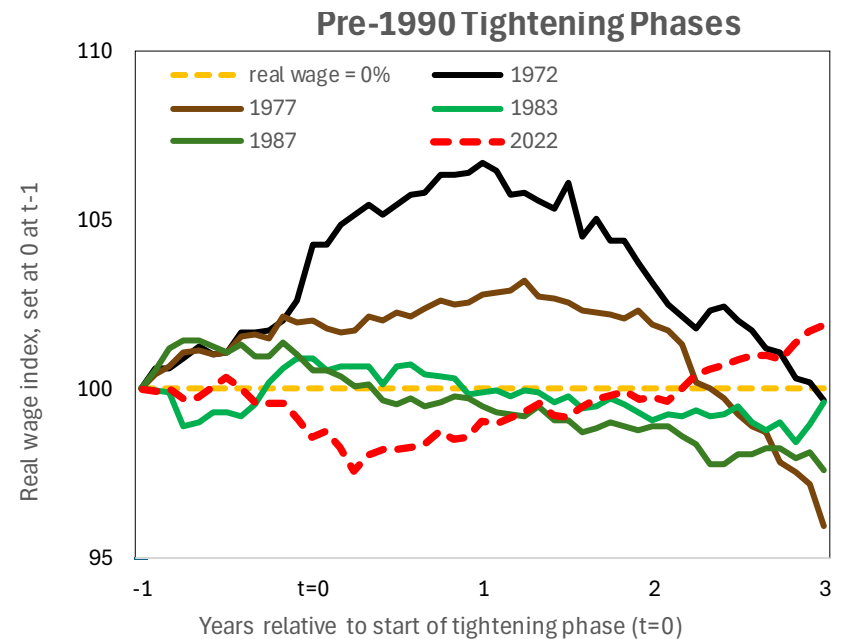
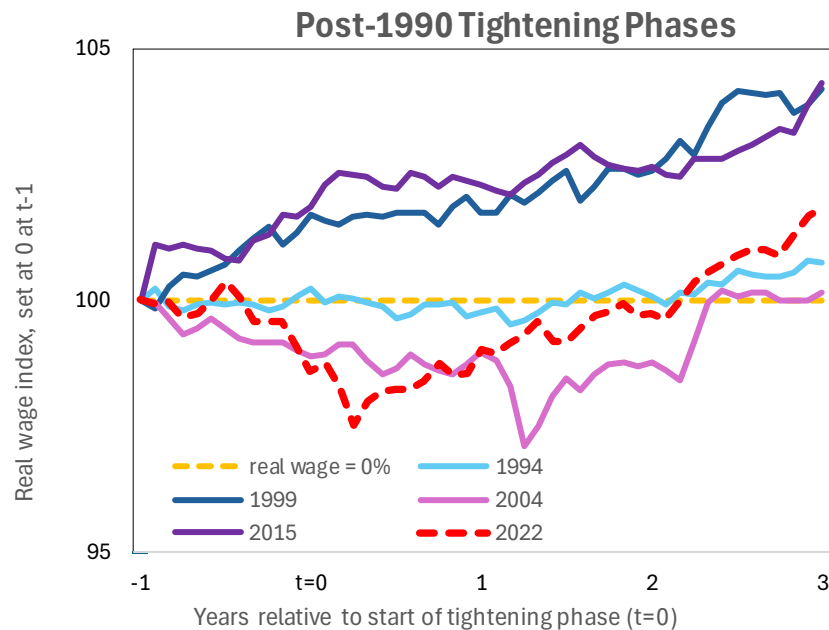
Pre-1990 Tightening Phases



Impact on US Real Wages



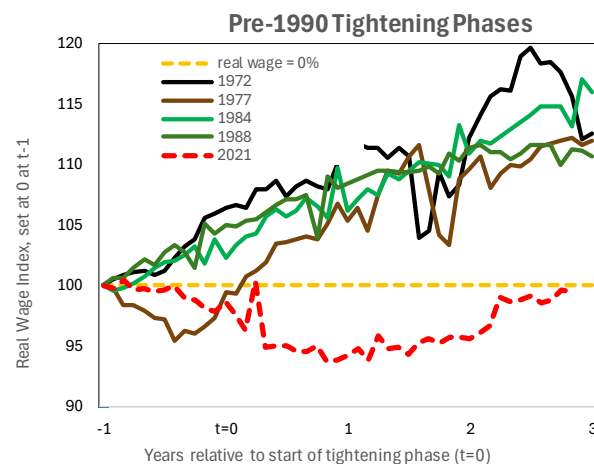
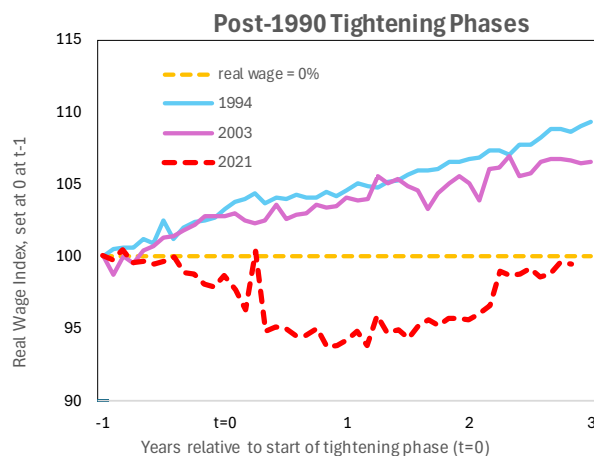
The Evolution of US Real Wages



Impact on Real Wages in UK and Germany



UK Real Wages



German Real Wages

