What Can We Learn from 60 Years of PCE Inflation Data?

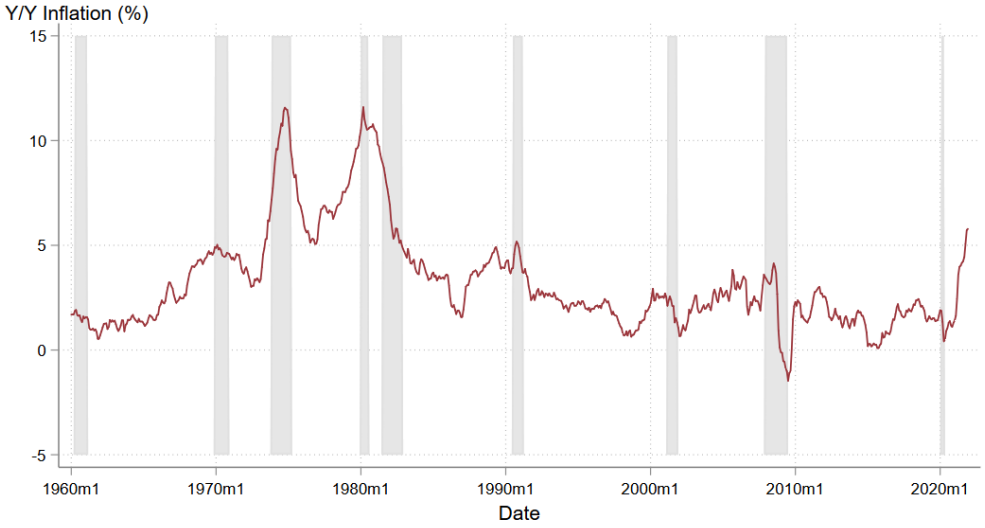
Raphael Schoenle
Brandeis University and CEPR

Dominic Smith
Bureau of Labor Statistics

49th OeNB Economic Conference and 35th SUERF Colloquium

May 24, 2022

Motivation: Long-Term Changes in “Inflation”



Source: Personal Consumption Expenditure Price Index

This Paper - Facts

- A lot is hidden behind aggregate measures of inflation.
- The cross-sectional *distribution* of disaggregated inflation rates has systematically changed between 1960 and 2021.
  1. Extreme increases in inflation more rare, extreme decreases appear
  2. Inflation is granular, and importance of granularity has increased
  3. Ranking of mean versus robust measures of inflation inverts
  4. Decreases in variance and covariance of individual series
- After 1990 inflationary process driven by idiosyncratic shocks.

This Paper - Model

- A heterogeneous production model with idiosyncratic shocks is needed to analyze the inflation stabilization properties of policy
  - Monetary policy regime and measures of aggregate inflation interact through the distribution of inflation rates
- Analyze interaction of AIT versus Taylor rule with core inflation measure, given shocks to oil producing sector:
  - Targeting core rather than headline inflation achieves much of the inflation stabilization from AIT
  - Additive stabilization gains

Related Literature

- Granularity: Gabaix (2011), Foerster et al. (2011), Acemoglu et al. (2012), Alvarez-Blaser et al. (2022)
- Moments (over time): Nakamura and Steinsson (2008), Bils and Klenow (2004), Bhattarai and Schoenle (2016), Gagnon (2009), Alvarez et al. (2016), Midrigan (2011), Bonomo et al. (2020), Karadi et al. (2021), Nakamura et al. (2018), Luo and Villar (2021)
- Implications for monetary policy: Pasten et al. (2019), Rubbo (2020), Molavi et al. (2021), Tahbaz-Salehi and La'O (2022)

Contribution: Long time span of analysis and focus on inflation through lens of multi-sector model

Personal Consumption Expenditure Data from BEA

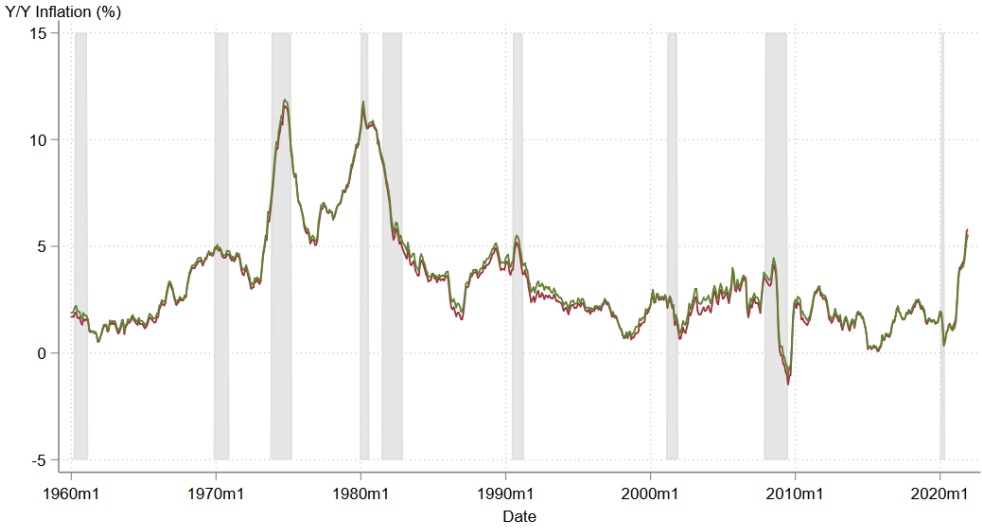
- 196 categories that add up to aggregate inflation:

$$\pi_t = \sum_i w_{it-12}\pi_{it}$$

- Price index and expenditure weights for each category
  - Revised when methodology changes
- Monthly 1960-2021
- E.g. Owner-occupied stationary homes, physician services, tobacco

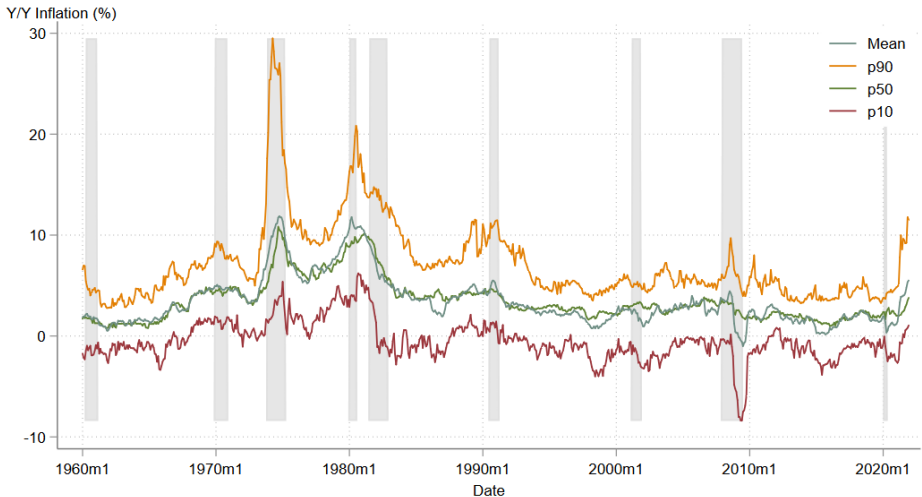
Constructed Series Matches PCE Inflation

Our calculation (green) covers published PCE (red)



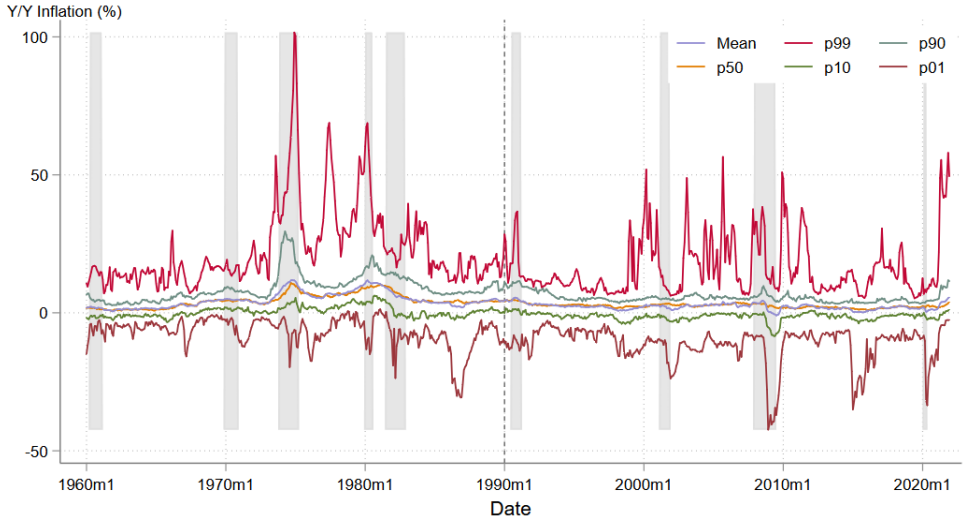
Shift in Tails of Distribution

Time series of cross-sectional price change distribution



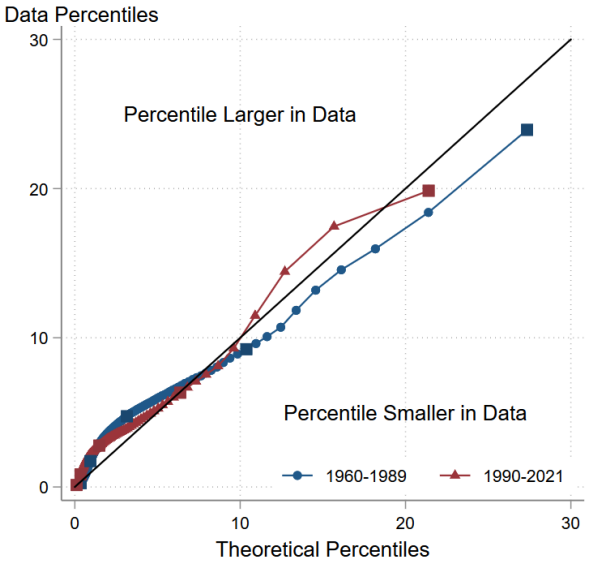
Extreme increases in inflation more rare, extreme decreases appear

Shift in Tails of Distribution



Extreme increases in inflation more rare, extreme decreases appear

Granularity of Inflation Rates: Log-Normal Distribution



- Percentiles very close to 45 degree line
- Actual distribution slightly flatter near 0

Granularity Over Time: Increasing Importance

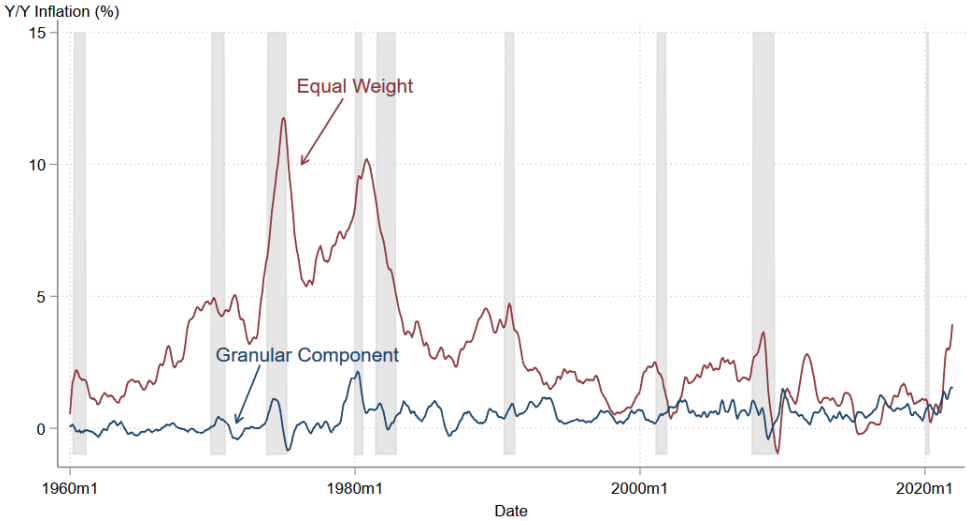
Inflation decomposition, Foerster et al. (2011):

$$\pi_t = \underbrace{\sum_i \frac{1}{N}\pi_{it}}_{\text{Equal Weight}} + \overbrace{\sum_i \left(w_{it-12} - \frac{1}{N}\right)\pi_{it}}^{\text{Granular Residual}}$$

- Granular residual is large when series with large weight systematically differ from other series.
-

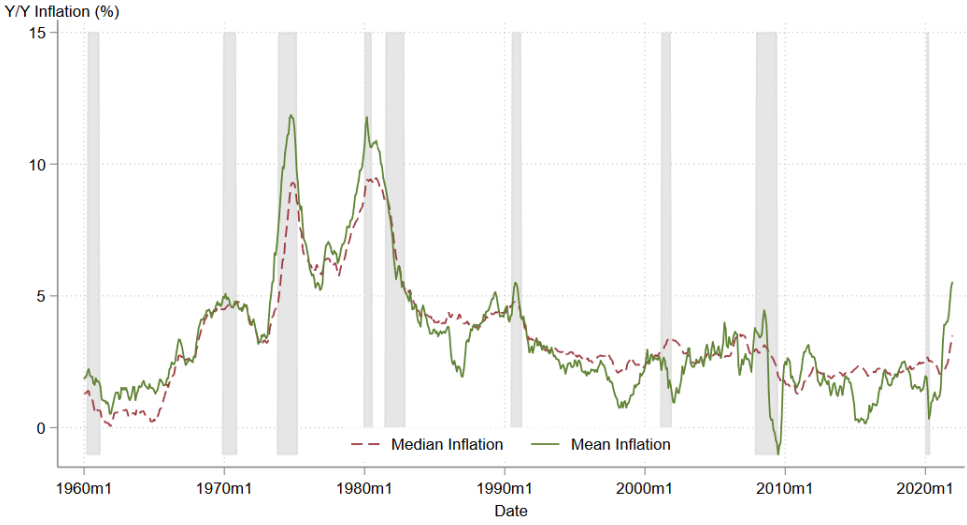
Statistic (Means)	1960-1989	1990-2019	2020-2021
Granular Residual	0.24	0.58	1.01
Equal Weighted	4.32	1.63	1.64

Granularity Over Time: Increasing Importance



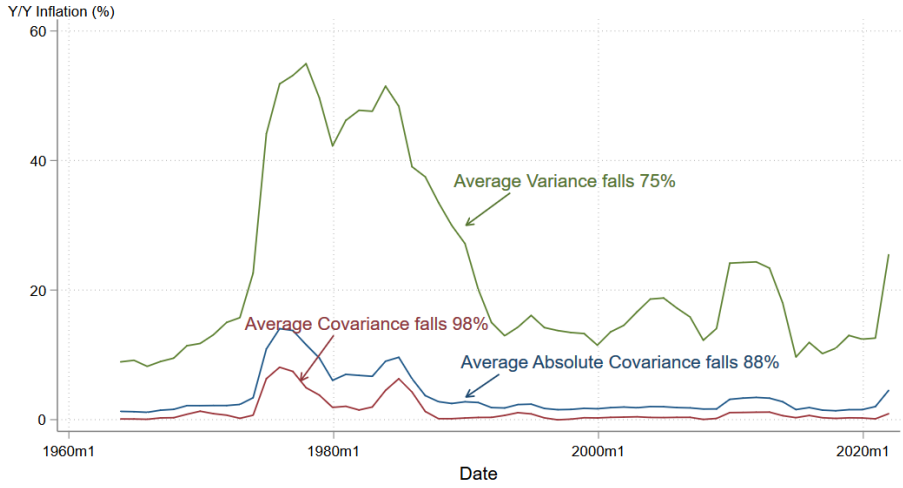
Equal-weighted component dominant in the 1970s/1980s

Mean vs Robust Inflation: Ranking Reversals



Variance and Covariances Decreasing

5-year moving average of series variance and pairwise covariance



Average variance and covariance decline, but covariance more.

Model

- To account for facts: heterogeneous production New Keynesian model with idiosyncratic shocks needed
- Model following Pasten et al. (2019) features heterogeneity in:
  - sector size and sectoral origin of shocks ($N = 341$)
  - intermediate input consumption
  - Calvo pricing frictions
- Monetary policy regime and measures of aggregate inflation interact through the distribution of inflation rates

Monetary Policy and Measures of Inflation

Two monetary policy regimes:

Taylor Rule:

$$i_t = \phi_c c_t + \phi_\pi \pi_{it}$$

Average Inflation Targeting ($T = 6$):

$$i_t = \phi_\pi \frac{\sum_{k=0}^{T} \pi_{t-k}}{T+1}$$

Measures of Inflation:

Headline inflation, and core Inflation

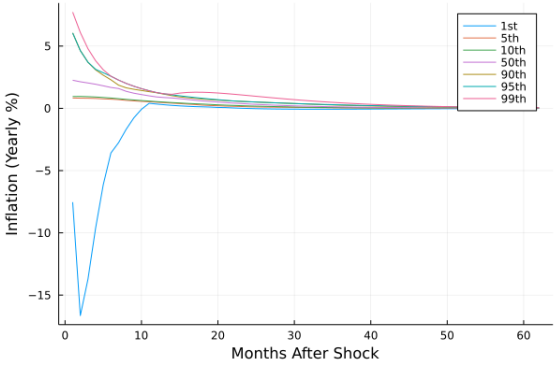
Exercise 1: Idiosyncratic Shocks Needed

	Agg	Idio all	Idio 1-ind	Agg + 1-ind	Agg + all	Oil	Agg + oil
Negative Fat Tails		X	309			X	X
Positive Fat Tails		X	309			X	X
Fat Tails		X	309			X	X
Mean and Median Flip	X	X	341	341	X	X	X
Granular Residual	X	X	341	341	X	X	X
Important Granular Residual	X	X	191	341	X	X	X
Larger Cov than Var Drop		X	158			X	

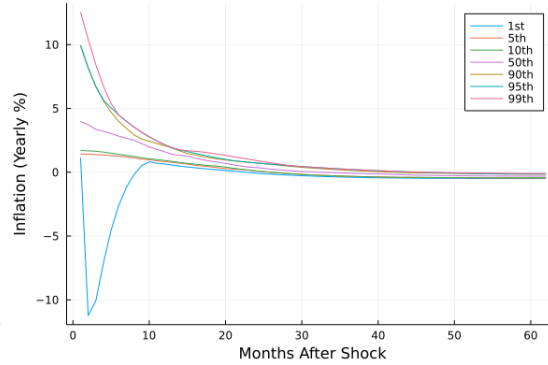
- To match the facts (tails): idiosyncratic shocks needed

Example: mean and median reversal

Exercise 1: Distribution of Inflation Rates (AIT and Taylor)



(AIT)



(Taylor Rule)

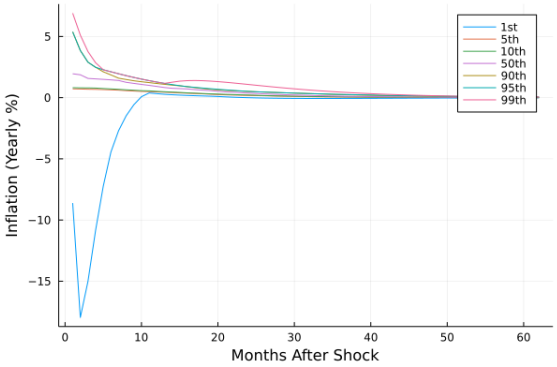
- AIT stabilizes more than Taylor rule (center)

Exercise 2: Policy Interaction with Measure of Inflation

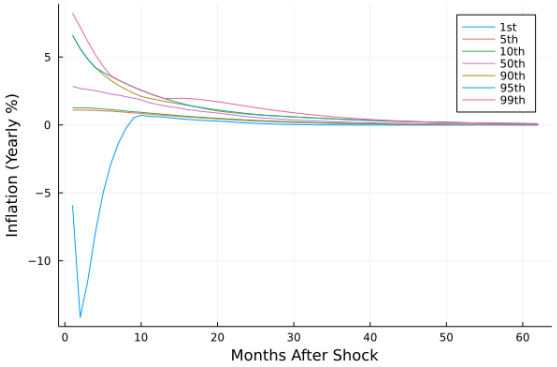
Inflation Measure	Policy Rule	Inflation Impact	$\sigma(\pi)$	$\sigma(C)$
Overall	Taylor	3.871%	0.192%	0.0036
Overall	AIT	1.711%	0.189%	0.0028
Core	Taylor	2.244%	0.189%	0.0038
Core	AIT	1.340%	0.188%	0.0025

- Moving to AIT reduces inflation volatility mostly on impact by 1/2 and stabilizes consumption
- Stabilization of core + no regime shift: achieves most of AIT inflation stabilization, leaving consumption volatility unchanged
  (core focus has similar smoothing properties if non-core shocks)
- Stabilization of core + regime shift: additive stabilization benefits

Exercise 2: Policy Interaction with Measure of Inflation



(AIT + Core)



(Taylor Rule + Core)

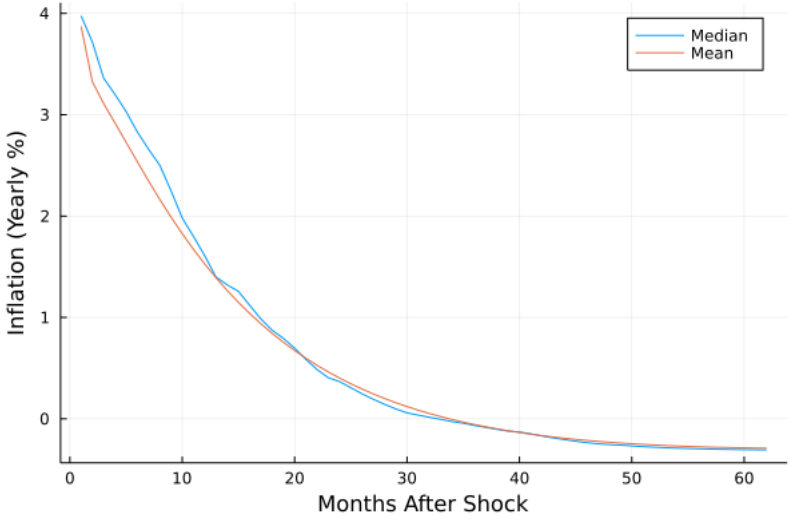
- Targeting core rather than headline reduces spread of the distribution (in the center) more for Taylor than AIT
- Stabilization of core + regime shift: additive stabilization benefits

Conclusion

- The cross-sectional distribution of disaggregated inflation rates has systematically changed between 1960 and 2021.
- In multi-sector heterogeneous production model with idiosyncratic shocks, monetary policy regime and measures of aggregate inflation interact through the distribution of inflation rates
- Application: Targeting core rather than headline reduces inflation volatility, and under AIT creates additive inflation stabilization benefits

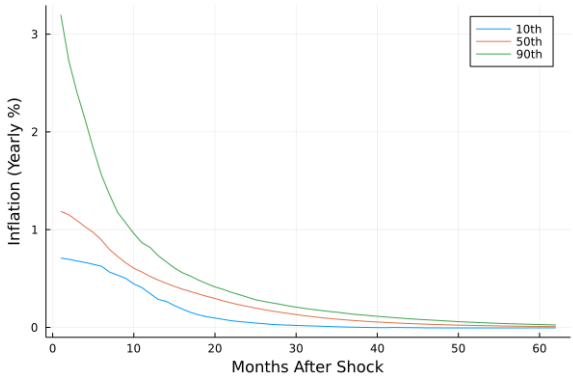
Appendix

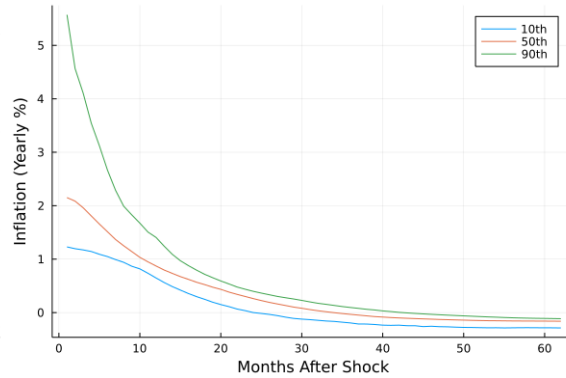
Mean and Median Reversal



Back

Effect on Center of Distribution





Back

Oil Industries FPA = 0.99

Inflation Measure	Policy Rule	Inflation Impact	$\sigma(\pi)$	$\sigma(C)$
Overall	Taylor	6.48	0.231	0.00484
Overall	AIT	3.84	0.238	0.00344
Core	Taylor	6.78	0.231	0.00456
Core	AIT	3.93	0.237	0.00350