Price stickiness along the income distribution and the effects of monetary policy

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Monetary shocks have distributional consequences

- Monetary policy has differential effect across agents:
  - Savers vs. borrowers (Doepke and Schneider 2006)
  - Financially constrained vs. unconstrained (Williamson, 2008)
  - Young vs. old (Wong, 2016)

- Coibion et al. 2017: Monetary shocks increase income inequality

- Mechanism: differential effects on agents income/wealth

- This paper: Alternative mechanism – differential effect on prices
  - Monetary policy differentially affects prices of different goods
  - Households with different income consume different goods
What we do

1) Document two new differences across consumption baskets:
   - High income households consume goods whose prices are:
     - More sticky
     - Less volatile

2) Quantify distributional consequences of monetary shock
   - Factor-Augmented VAR (FAVAR) model
   - Quantitative New-Keynesian DSGE model
     - Inequality affects effectiveness of monetary policy – modestly

Main result: Shock that $\uparrow \pi^{agg}$ by 1% $\rightarrow \pi^{mid} - \pi^{top} = 0.2\%$
A simple model to guide the discussion

- Two periods. State is known at $t = 1$. $S$ possible states at $t = 2$

- $H$ types of households, $J$ types of goods or 'sectors'
  - CPI faced by household $h$: $p_t^h(s) \equiv \sum_j \omega_j^h p_{j,t}(s)$
  - Aggregate CPI: $p_t(s) \equiv \sum_h s^h p_t^h(s) = \sum_j \omega_j p_{j,t}(s)$

- Cont. monopolistically competitive firms in each $j$, same technology
  - $t = 1$: all firms set same price, $p_1$
  - $t = 2$: fraction $1 - \theta_j$ set prices before shocks, $p_2^e = p_1$
  - $t = 2$: fraction $\theta_j$ set prices after shocks, $\bar{p}_2(s)$

- Sectoral inflation:
  \[ \pi_j(s) = \theta_j [\bar{p}_2(s) - p_1] \]
Price rigidities and inflation differences

Difference in inflation across households:

$$\pi^h(s) - \pi^{h'}(s) = [\bar{p}_2(s) - p_1] \sum_j \left[ \omega^h_j - \omega^{h'}_j \right] \theta_j.$$

$$\frac{\pi^h(s) - \pi^{h'}(s)}{\pi(s)} = \frac{\bar{\theta}^h - \bar{\theta}^{h'}}{\bar{\theta}}$$

where $\bar{\theta}^h \equiv \sum_j \omega^h j \theta_j$; $\bar{\theta} \equiv \sum_h s^h \bar{\theta}^h$.

More flexible sectors are more volatile

$$\frac{\sigma_{\pi_j}}{\sigma_{\pi}} = \frac{\theta_j}{\bar{\theta}}$$

More flexible baskets are more volatile

$$\frac{\sigma_{\pi^h}}{\sigma_{\pi}} = \frac{\bar{\theta}^h}{\bar{\theta}}$$
Data

- Household specific inflation:
  \[ \pi_t^h = \sum_j \omega_j^h \pi_{j,t} \]
  - \( \omega_j^h \): Consumption expenditures from the US Consumption Expenditure Survey (CES)
  - \( \pi_{j,t} \): Item-level price indices from BLS (178 goods)

- Household specific average frequency of price changes:
  \[ \bar{\theta}^h = \sum_j \omega_j^h \theta_j \]
  - \( \theta_j \): ELI-level frequencies from Nakamura and Steinsson 2008 (265 goods)
  - *Fraction of prices that change in a month*
Consumption Expenditure Survey

- Two modules: the Interview and the Dairy
  - Expenditure files
    - Collect expenditures on about 600 UCC categories
    - 350 UCCs in the Interview
    - 250 UCCs in the Dairy
  - Income files
  - Characteristics files

- Dairy and interview survey different households each year

- Percentile-level household expenditure share $\omega_{j}^{h}$
Aggregating HHs into percentiles

- Sort households into percentiles in two steps:
  - Aggregate HHs in the Interview survey into percentiles
  - Use Interview income cutoffs to divide HHs from the Diary into percentiles

- Imputed income before tax
  - CES starts to include imputed income since 2004
  - Fisher, Johnson and Smeeding (2015) imputes income back to 1984
Adjusting the expenditure values

Housing

▶ Owner’s equivalent rent of primary residence

“If someone were to rent your home today, how much do you think it would rent for monthly, unfurnished and without utilities?”

○ Response saves in the variable $RENTEQVX$ in the characteristics file

○ Construct an artificial UCC code 999999 to store the value

▶ Separate consumption component from investment component

○ Adjust expenditures on homeowner insurance, maintenance, and major appliances

○ Apply a factor of 0.43
Adjusting the expenditure values

Medical care

- Redistribution factors
  - Redistribute private health insurance and Medicare premiums to medical care services
  - The BLS constructs redistribution factors from the National Health Expenditure (NHE) tables
  - Use NHE table 20 directly

- Allocate reimbursements across all HHs
Concordance

- In-scope expenditures for CPI could be divided into
  - 8 groups
  - 70 expenditure classes
  - 211 item strata (item level)
  - 303 entry level items (ELIs)

- Concordance from UCCs to item strata to ELIs
  - Following BLS document *CPI requirement for CE Appendix B*
Calculating the expenditure shares

- Distinction between the survey period and the expenditure reference period
  - HHs surveyed in Feb. 2017
  - Reports expenditures for Nov. and Dec. 2016 and Jan. 2017

- Calculate the mean value of a calendar year
  - Create $MO\_SCOPe$
  - Annualized average expenditure for each UCC category $k$ at percentile $h$

$$\bar{X}_k^h = \frac{\sum_i FINLWT_i^h \cdot \sum_t C_{i,k,t}^h}{\sum_i FINLWT_i^h \cdot MO\_SCOPe_i^h} \times 12$$

- Expenditure share

$$\omega_j^h = \frac{\bar{X}_j^h}{\sum_j \bar{X}_j^h}$$
Takeaways

1. Households with different incomes consume different goods

2. Heterogeneous effects of monetary policy across goods
   \[ \implies \text{Distributional consequences of monetary policy} \]

- Goods consumed by high-income households are:
  - more sticky
  - less volatile

- FAVAR + DSGE evidence
  - Large effects relative to impact of monetary shocks on prices
  - Inequality affects monetary policy effectiveness - modestly