Heterogeneous Attention to Inflation and Monetary Policy

Monetary policy with heterogeneous, inattentive households

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Motivation

Suggestive Evidence: CASiE Survey

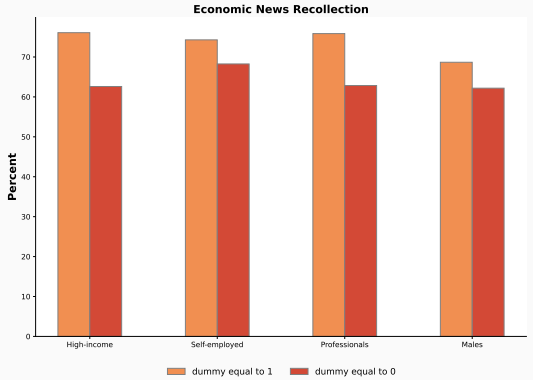


Figure 1: Percentage of Households Recalling Economic News. *The figure shows the percentage of households who answer "Yes" to the question "During the last few months, have you read or heard any news of changes in economic conditions?"*

This paper

Q: How does household-level attention to inflation vary with **socio-demographic characteristics**? How does it affect **monetary policy transmission**?

(i) present cross-country empirical evidence
- using survey-data on household expectations for the US (SCE) and Australia (CASiE)

(ii) build a HANK-model with inattentive households
- to study monetary transmission
- quantify effects

Main Findings

Q: How does household-level attention to inflation vary with **socio-demographic characteristics**?

- A: High-income households are more attentive to inflation than low-income households

Q: How does it affect **monetary policy transmission**?

- Anchored inflation expectations improve inflation-output trade-off
- Caveat: The welfare costs of contractionary policy are disproportionally borne by the low-income households, even more so with inattention
  - better trade-off is achieved through a larger increase in hours worked at the bottom of the income distribution

Our paper brings together multiple literatures

1. Empirical evidence on household expectations:
   - Over- and under-reaction: Kučinskas and Peters (2022), Coibion and Gorodnichenko (2015), Bordalo et al. (2020)
   - Inflation expectations: Kučinskas and Peters (2022), Malmendier and Nagel (2016), Weber et al. (2023), Coibion et al. (2020), Pfäuti (2021)
2. Behavioral frictions in macroeconomics:
   - limited information: Sims (2003), Maćkowiak, Matějka, and Wiederholt (2023), Gabaix and Laibson (2022)
   - bounded rationality: Gabaix (2020), Gabaix (2014)
3. Monetary policy in HANK-models:
   - FIRE: Auclert (2019), Acharya, Challe, and Dogra (2023), Luetticke (2021)
   - non-FIRE: Auclert, Rognlie, and Straub (2020), Bardóczy and Guerreiro (2023)

We: study heterogeneous attention to inflation expectations and monetary policy

Empirical Evidence

Measuring Attention: Pfäuti (2021) + cross-sectional characteristics

Attention can be measured by estimating the following specification:

$$\pi^e_{t+1,t} = \beta_i + \beta_1 \pi^e_{t,t-1} + \beta_2^g I_g \left(\pi_t - \pi^e_{t,t-1}\right) + \nu_{i,t} \tag{1}$$

where I_g are type dummies, and $\gamma^g = \frac{\hat{\beta}_2^g I_g}{\hat{\beta}_1}$ is the measure of attention.

Shock-specific attention can be estimated as follows:

$$e_{i,t+1} = \beta_i + \beta_1^g I_g u_t^m + \nu_{i,t} \tag{2}$$

where u_t^m is either the chosen shock or a variable instrumented by the shock (Kučinskas and Peters, 2022) (e.g. FFR), $e_{i,t+1}$ is the forecast error and $\gamma^g = 1 - \frac{\hat{\beta}_1^g I_g}{J_t^m}$.

Heterogeneous Attention: Estimation Results of Equation (1)

Table 1: CASiE

Shocks	High-income	Self-employed	Male
γ_1	0.24***	0.24***	0.23***
γ_2	0.11**	0.11***	0.10***
No. of observations	214	126	214

Table 2: SCE

Shocks	High-income	Self-employed	Male
γ_1	0.09***	0.14**	0.09***
γ_2	0.06***	0.05*	0.06***
No. of observations	68	67	68

Shock-Specific Attention: Local Projections, Equation (2)

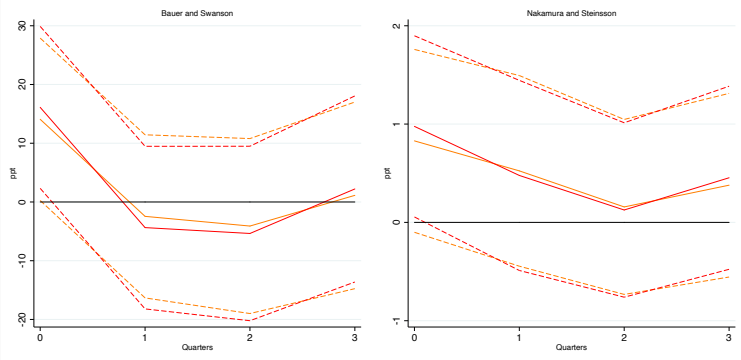


Figure 2: Responses of Inflation Forecast Errors to Monetary Policy Shocks, SCE. *The figure shows in percentage points the impulse-responses of inflation forecast errors to externally constructed US monetary policy shocks. Responses of high-income households are shown in red, responses of lower-income households are shown in orange.*

Quantitative Model

Heterogeneous Agents with Inattention

Road map for the household problem:

- Households are **inattentive** to inflation
  - Each household gets a Bewley-type idiosyncratic shock (transitory)
  - J household groups based on skills following Faia et al. (2022) (permanent)

  $\rightarrow$ transitory income inequality, heterogeneous labour supply

  - Household groups are different also in terms of attention to inflation
  - Household problem is in nominal terms
- The steady state is common knowledge, i.e. solved under fully rational expectations
- For the dynamics, we then need to incorporate households' beliefs

  $\rightarrow$ follow Gabaix (2014)

A household in group j with talents g solves the following Bellman equation:

$$
\begin{aligned}
V_j^g(e_t, a_{t-1}^n, \phi_t) &= \max_{c_t, n_t, o_t} u(c_t, n_t) + \phi_t^o + \beta \mathsf{E}_{j,t}^g V_j^g(e_{t+1}, a_t^n, \phi_{t+1}) \\
\text{s.t.} \quad P_t c_t + a_t^n &= \eta_t^o e_t W_t^o n_t + (1 + i_{t-1}^a) a_{t-1}^n \\
a_t^n \geq 0, \quad u(c_t, n_t) &= \frac{c_t^{1-\sigma} - 1}{1-\sigma} - \varphi \frac{n_t^{1+\nu}}{1+\nu}
\end{aligned}
\tag{3}
$$

where the vector of occupation choice $o \in \{1, ..., O, O+1\}$, η_t^o is the occupation-specific vector of skills and ϕ_t is the $(O+1)$-vector of occupational amenities across all occupations and the non-employment state.

Q: What happens if $\mathsf{E}_{j,t} \neq 1$?

The Expectation Matrix

- Assume: households observe all current and past prices
- For the beliefs, we follow the empirical specification:

$$E_{j,t}\pi_s = \gamma^g E_t\pi_s + (1-\gamma^g)\, E_{j,t-1}\pi_s \quad \forall s > t \tag{4}$$

- Defining the expectation matrix (in the case of FIRE: $E(i,j) = 1\ \forall i,j$)

$$E = \begin{pmatrix} 1 & \gamma^g & \gamma^g & \gamma^g & \dots \\ 1 & 1 & \gamma^g + (1-\gamma^g)\gamma^g & \gamma^g + (1-\gamma^g)\gamma^g & \dots \\ 1 & 1 & 1 & \gamma^g + (1-\gamma^g)(\gamma^g + (1-\gamma^g)\gamma^g) & \dots \\ \vdots & \vdots & \vdots & \vdots & \ddots \end{pmatrix} \tag{5}$$

The Rest of the Model

- **Production**: Monopolistic competition, Phillips curve:
  $\log(1+\pi_t) = \kappa(mc_t - \frac{1}{\mu_p}) + \frac{Y_{t+1}}{Y_t}\log(1+\pi_{t+1})\Psi_{t,t+1}$
- **Asset Market**: household holds assets (=equity as share of firms) and gets a return (dividend)
- **Monetary Policy**: $i_t = r_t^* + \phi_\pi \pi_t + \phi_y y_t$
- All markets (labour, goods, assets) **clear**

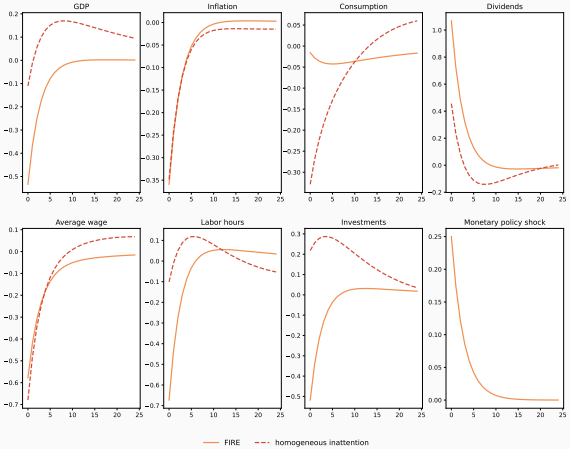
Calibration

Table 3: Parameter Values and Description

Parameter	Description	Value US
Production Function		
δ	Capital depreciation	0.02
K	Capital to output ratio	10.0
κ	Slope of the price Phillips curve	0.1
Households		
σ	EIS	0.5
ρ	Inverse Frisch elasticity	1
ρ_e	Autocorrelation of earnings	0.966
σ_e	Cross-sectional std of log earnings	0.92
Asset Markets		
r	Real interest rate	0.0125
Monetary and Fiscal Policy		
ϕ_π	Coefficient on inflation in Taylor rule	1.5
ϕ_y	Coefficient on output gap in Taylor rule	0.0

Results

Monetary Policy Shock, USA



FIRE:

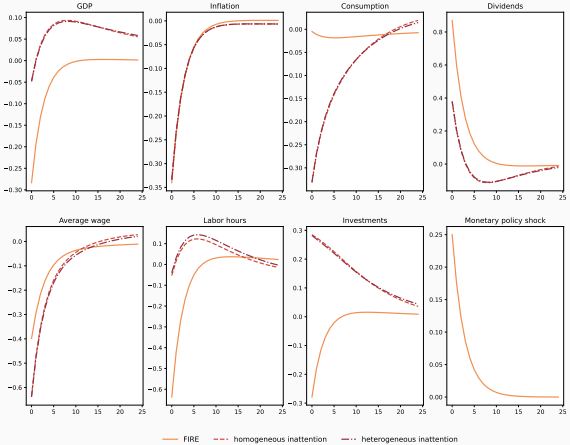
$i_t \uparrow \rightarrow \pi_t \downarrow \& Y_t \downarrow \rightarrow I_t \downarrow \& L_t \downarrow \rightarrow W_t \rightarrow C_t \downarrow$

Inattention:

$i_t \uparrow \rightarrow \pi_t \downarrow \& Y_t \downarrow \rightarrow$ HHs don't observe the drop in prices and real income increase

$\rightarrow C_t \downarrow \rightarrow MPC \uparrow \rightarrow L_t \uparrow \rightarrow W_t \downarrow \rightarrow I_t \uparrow \& Y_t \uparrow$

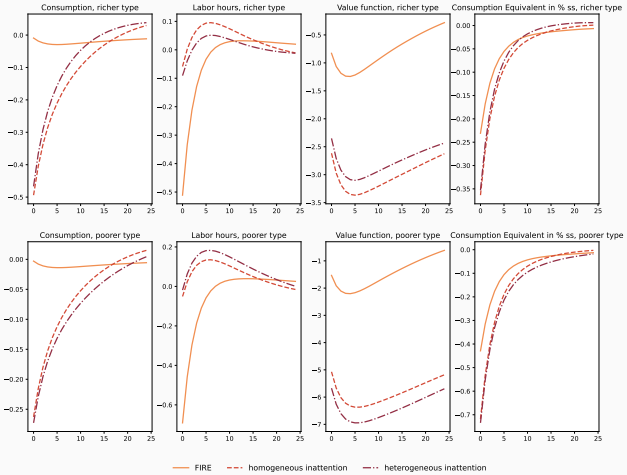
Monetary Policy Shock, with Permanent Component of Income Inequality



More pronounced effects?:

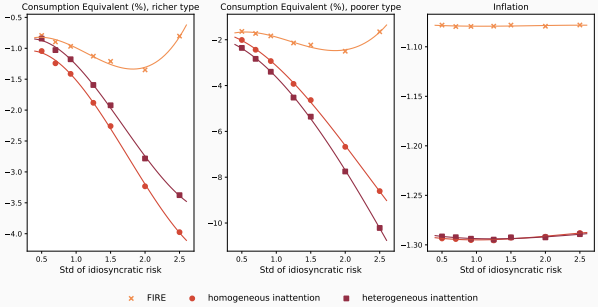
- very small effects
- biggest effect of L_t

Monetary Policy Shock, Heterogeneity Across Types



- high-income HHs have higher attention and smoothing motive: $i_t \uparrow \rightarrow C_t^1 \downarrow > C_t^2 \downarrow$ and $S_t^1 > S_t^2$
- dominant income effect (indirect GE):
  - low $\gamma_2 \rightarrow$ larger $W_t/P_t \downarrow \rightarrow L_t \uparrow$
  - high $\gamma_1 \rightarrow W_t/P_t \uparrow \rightarrow L_t \downarrow$
- larger drop in welfare for poorer households who are at the bottom of the distribution due to missing smoothing mechanism

The Role of Transitory Income Inequality



- idiosyncratic risk amplifies the difference in welfare costs
- along the increase in idiosyncratic risk, heterogeneous attention has opposite effects on high- and low-income households compared to homogeneous attention

Conclusions

This paper:

- studies the effects of heterogeneity of inflation expectations among households and their effects for monetary policy transmission
- high-income households pay more attention to inflation

Implications for Monetary policy:

- better trade-off than under FIRE even in HANK
- caveat: better trade-off is achieved through larger decrease in welfare among low-earners following a contractionary monetary policy shock
- idiosyncratic risk amplifies the difference in welfare costs between low- and high-income earners in response to monetary policy shocks

Appendix

Summary Statistics Australia

Variable	Median	25%	75%	1%	99%
Inflation expectations	5.0	2.0	6.0	-2.0	15.0
CPI inflation	2.5	1.7	3.1	-0.3	7.3
Romer-Romer shocks	0.008	-0.06	0.08	-0.40	0.35
Romer-Romer aug. shocks	0.008	-0.07	0.09	-0.50	0.38
Level shocks	0.0	-0.10	0.03	-2.16	2.24
Oil news shocks	-0.05	-0.35	0.37	-1.58	1.30
Oil news shocks precovid	-0.005	-0.38	0.39	-1.44	1.35
Male	1.0	0.0	1.0	0.0	1.0
Income level	\$40-90k	$\leq$ \$40k	$\geq$ \$90k	$\leq$ \$40k	$\geq$ \$90k
Self-employed	0.0	0.0	0.0	0.0	1.0
Education	above school	school or below	above school	school or below	above school
Home-owners	1.0	1.0	1.0	0.0	1.0
Age	$\geq$ 45	34-45	$\geq$ 45	18-34	$\geq$ 45
Not urban	0.0	0.0	1.0	0.0	1.0
Full-time workers	1.0	0.0	1.0	0.0	1.0

Summary Statistics USA

Variable	Median	25%	75%	1%	99%
1 year inflation expectation	3.0	2.0	6.0	-25.0	49.0
CPI Inflation	2.17	1.41	3.35	-3.86	9.21
Nakamura and Steinsson	0.00	0.00	0.19	-1.37	1.99
Bauer and Swanson	0.0	0.0	0.01	-0.08	0.05
Oil news shocks, pre-Covid	-0.09	-0.46	0.39	-1.69	1.36
Oil news shocks	-0.05	-0.36	0.38	-1.66	1.49
Male dummy	1.0	0.0	1.0	0.0	1.0
Income level	\$40-99k	$<$ \$40k	$\geq$ \$100k	$<$ \$40k	$\geq$ \$100k
Self-employed	0.0	0.0	0.0	0.0	1.0
Education	College	Some College	College	High School	College
Home-owners	1.0	0.0	1.0	0.0	1.0
Age dummy	40-60	$<$ 40	$>$ 60	$<$ 40	$>$ 60
Full-time workers	1.0	0.0	1.0	0.0	1.0
Number of observations	144,192				

Australian Domestic Shocks

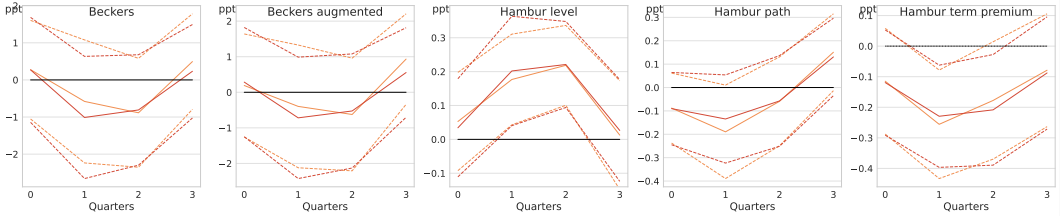


Figure 3: Responses of Inflation Forecast Errors to Domestic Monetary Policy Shocks. The figure shows in percentage points the impulse-responses of inflation forecast errors to externally constructed monetary policy shocks. Responses of high-income households are shown in red, responses of lower-income households are shown in orange. Dotted lines show 90% confidence intervals.

The Rest of the Model: Monopolistic competition

The firm solves:

$$J_t(k_{t-1}) = \max_{p_t, k_t, l_t, L_t} \left\{ \frac{p_t}{P_t} y_t - w_t L_t - l_t - \frac{\eta}{2\kappa} \ln(1+\pi_t)^2 Y_t + \frac{J_{t+1}(k_t)}{1+r_{t+1}} \right\}$$

$$\text{s.t.} \quad k_t = (1-\delta)k_{t-1} + l_t \tag{6}$$

$$p_t = \left(\frac{Y_t}{y_t}\right)^{\frac{1}{\eta}} P_t; \quad y_t = z_t k_{t-1}^{\nu} L_t^{1-\nu} \tag{7}$$

where $\frac{\eta}{2\kappa} \ln(1+\pi_t)^2 Y_t$ is the quadratic price adjustment cost (necessary to study monetary policy), such that we get the Phillips curve:

$$\log(1+\pi_t) = \kappa(mc_t - \frac{1}{\mu_p}) + \frac{Y_{t+1}}{Y_t} \log(1+\pi_{t+1}) \Psi_{t,t+1} \tag{8}$$

where $\mu_p = \frac{\eta}{\eta-1}$ and $\Psi_{t,t+1}$ is the stochastic discount factor and is equal to $\frac{1}{1+r_{t+1}}$.

The Rest of the Model: Asset Market, Policy

Asset market:

- real return on equity: $\frac{d_{t+1}+v_{t+1}}{v_t}$
- no-arbitrage condition: $v_t = \frac{d_{t+1}+v_{t+1}}{1+r_{t+1}}$
- return on households' assets: $(1 + i_t^a) = \frac{d_t+v_t}{v_{t-1}}(1 + \pi_t)$,

where v_t is the price of equity and d_{t+1} the firm dividend

Monetary policy:

- Taylor-type rule: $i_t = r_t^* + \phi_\pi \pi_t + \phi_y(Y_t - Y_{ss})$,

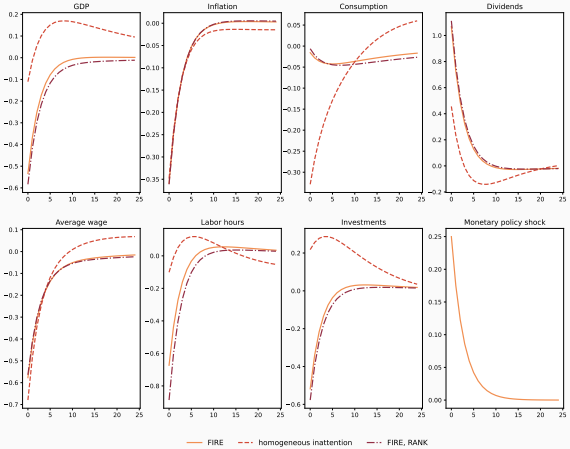
where i_t is the monetary policy interest rate, r_t the real interest rate, r_t^* is the natural interest rate, which is equal to the real interest rate in the steady state, and $1 + r_t = \frac{1+i_{t-1}}{1+\pi_t}$.

Model Solution

One (household) block would then be: $\{\pi_t; W_t; i_t^a\} \to \{C_t\}$

$$\begin{pmatrix} dC_0 \\ dC_1 \\ dC_2 \\ \vdots \end{pmatrix} = \begin{pmatrix} 1J^{FI}_{0,0} & \gamma^g J^{FI}_{0,1} & \gamma^g J^{FI}_{0,2} & \gamma^g J^{FI}_{0,3} & \dots \\ 1J^{FI}_{1,0} & 1J^{FI}_{1,1} & \gamma^g J^{FI}_{1,2} + (1-\gamma^g)\gamma^g J^{FI}_{0,1} & \gamma^g J^{FI}_{1,3} + (1-\gamma^g)\gamma^g J^{FI}_{0,2} & \dots \\ 1J^{FI}_{2,0} & 1J^{FI}_{2,1} & 1J^{FI}_{2,2} & \gamma^g J^{FI}_{2,3} + (1-\gamma^g)(\gamma^g J^{FI}_{1,2} + \gamma^g(1-\gamma^g)J^{FI}_{0,1}) & \dots \\ \vdots & \vdots & \vdots & \vdots & \ddots \end{pmatrix} \begin{pmatrix} d\pi_0 \\ d\pi_1 \\ d\pi_2 \\ \vdots \end{pmatrix} + \dots$$

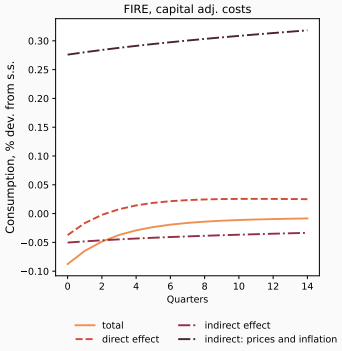
HANK vs. RANK: Monetary Policy Shock, USA

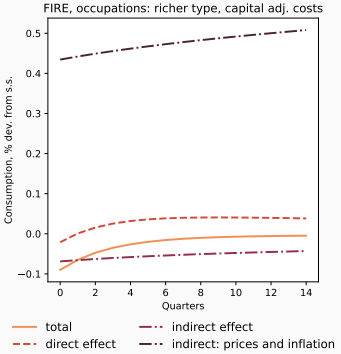


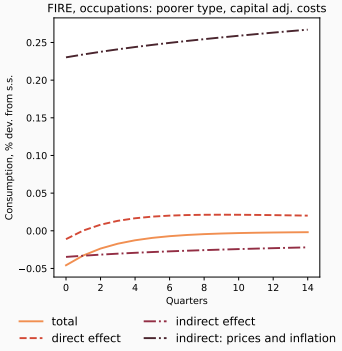
HANK vs. RANK:

- RANK underestimates underestimates the fall in GDP because it abstracts from precautionary savings

Monetary Policy Shock, Direct and Indirect Effects







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