The Inattentive Consumer: Sentiment and Expectations

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Motivation

- Nearly all economic decisions are based on agents’ beliefs
- The workhorse approach to modeling beliefs has been full-information rational expectations (FIRE)
- Survey-based measures of beliefs systematically deviate from FIRE
- So how do agents form their economic beliefs? The answer is crucial to understanding macroeconomic dynamics and policy-making

*We need to know more about the manner in which inflation expectations are formed and how monetary policy influences them.* - Janet Yellen
Empirics Overview

- Recent experience: inflation has been procyclical
  - Professional forecasters understand the correlation

- Consumers believe inflation is countercyclical
  - Robust across time, income quartiles, education achieved, and consumer surveys

- Component analysis finds consumer beliefs are driven by one component: sentiment
  - Inflation is negatively related to sentiment
Michigan Survey of Consumers (MSC)

- 1978-present, monthly, consumer survey of $\approx 500$
- Rotating panel (up to 2x)

Example Questions

- **Unemployment:** “How about people out of work during the coming 12 months – do you think that there will be more unemployment than now, about the same, or less?”

- **Personal finances:** “Do you think that a year from now you will be better off financially, or worse off, or just about the same as now?”

- **Inflation:** “By about what percent do you expect prices to go (up/down) on average, during the next 12 months?”
Consumers believe inflation is countercyclical

**Dependent variable:** $E_{j,t} \pi_{t+12}$

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*Sample: January 1978 - May 2017*
**Inflation and Unemployment Expectations**

Consumers believe inflation is countercyclical

*Dependent variable: $E_{jt, t+12}*$

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*Sample: January 1978 - May 2017*
Across groups, consumers believe inflation is countercyclical:

- By education achieved
- Across the income distribution
- By age at the time of survey
- By birth year
• What is driving consumers to consistently believe inflation is countercyclical?

• How do consumers form beliefs?

• Use component analysis, to understand driver(s) of consumer beliefs:
  • Number of important component(s)
  • Characteristics of the key component(s) and loading(s)

• Michigan Survey solicits categorical responses ⇒ use MCA
First Component Loadings

1st dimension explains 76% of the variance

Unemployment* (next year)

-1.5 0.5 1.6

Personal finances* (next year)

-2.4 -0.1 1.0

Personal real income* (next year)

-1.3 0.5 1.4

Personal finances* (last year)

-1.2 -0.1 0.9

Economic policy* (now)

-1.6 0.3 1.6

Inflation\diamond (next year)

-0.8 0.4 0.8

* bad, same, good

\diamond \pi_{t+1} > 4, 0 < \pi_{t+1} \leq 4, \pi_{t+1} \leq 0
The first component is similar to a popular measure of sentiment.

Notes: MSC 1st component = the average of the MCA first components, across consumers for a given month.
1. Consumers believe inflation is countercyclical, in contrast to recent experience

2. The economic beliefs of consumers are driven by a single component: sentiment

3. Inflation expectations and sentiment negatively co-move
What Can Explain the Stylized Facts?

- FIRE ✗
  - FIRE cannot generate consistent deviations from the underlying DGP

- Sticky Information ✗
  - Sticky Information has no predictions about the dimensionality of information that informs consumer beliefs

- Learning ✗
  - Learning results in more accurate beliefs over time

- Rational Inattention ✓
Rationally Inattentive Consumer Model Overview

- Fundamental uncertainty and costly information

- Economizing on information, the consumer reduces the dimensionality of the problem and chooses to obtain a signal that is a linear combination of fundamentals

- The consumer decides to be best informed along the dimension most costly to misunderstand → rationally obtained sentiment

- Optimal information gathering results in covariances of beliefs that can differ from the covariances of the underlying DGP

- Model setups: static (intuition), two-period (nests FIRE), dynamic (IRFs)
Consumer Problem: Static Setup

- The agent consumes and supplies labor

- For each unit of labor, the consumer is paid wage $\frac{W}{\Theta}$
  - where $\Theta$ is labor market slackness and $W$ is a base nominal wage
  - normalize the base wage: $W = 1$

- Assume the consumer knows the base wage, but faces uncertainty about labor market slackness and the price index
  - slackness and price are assumed to be independent
Consumer Problem: Static Setup Continued

- The consumer may obtain optimal signal(s) about the unknowns
  - signal(s) can be any linear combination of the unknowns plus noise
  - signal(s) are costly ($\lambda \times$ Shannon mutual information, $\lambda \geq 0$)

- Timing:
  1. obtain noisy signal(s)
  2. commit to amount of labor supplied $L$
  3. consume according to: $CP = L/\Theta$

- Utility:

$$U \left( L \left( \mathbb{E}[\Theta], \mathbb{E}[P] \right), \Theta, P \right)$$
Log-Quadratic Approximation

- Let $\hat{u}$ be the utility expressed in terms of log-deviations:

$$\hat{u}(l, \theta, p)$$

- Let $\tilde{u}$ be the 2nd-order Taylor approx. of $\hat{u}$ around the steady state:

$$\tilde{u}(l, \theta, p) \approx \hat{u}_l l + \frac{1}{2} \hat{u}_{ll} l^2 + \hat{u}_{l\theta} \theta + \hat{u}_{lp} p$$

where subscripts on $\hat{u}$ denote derivatives w.r.t. the input order variable at the steady state.

- Under full-information, the utility maximizing labor is:

$$l^* = \frac{\hat{u}_{l\theta}}{|\hat{u}_{ll}|} \theta + \frac{\hat{u}_{lp}}{|\hat{u}_{ll}|} p$$
• What are the optimal labor weights on slackness and price?

\[ l^* = \frac{\hat{u}_{12}}{|\hat{u}_{11}|} \theta + \frac{\hat{u}_{13}}{|\hat{u}_{11}|} p \]

• Assume the utility function:

\[ U(L, \Theta, P) = \frac{C^{1-\varphi}}{1-\varphi} - \frac{L^{1+1/\eta}}{1 + 1/\eta} \text{ where } C = \frac{L}{\Theta P} \]

• Then the optimal labor weights are equal:

\[ \frac{\hat{u}_{12}}{|\hat{u}_{11}|} = \frac{\hat{u}_{13}}{|\hat{u}_{11}|} \]
Optimal labor choice:

\[ l^* = \frac{\hat{u}_{12}}{|\hat{u}_{11}|} \theta + \frac{\hat{u}_{13}}{|\hat{u}_{11}|} p \]

\[ = 0.5 \theta + 0.5 p \]

Then:

\[ p = 0 \text{ and } \theta = 0 \Rightarrow l^* = 0 \]
Optimal labor choice:

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\[ = .5\theta + .5p \]

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\[ l^* = 0 \text{ along the } -45^\circ \text{ line} \]
Intuition

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Optimal labor choice:

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Optimal labor choice:

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The agent wants to learn along the 45° line!
Transform into an optimization problem that is a function of
1. expected loss due to misperceptions
2. the cost of information

Eigen-decomposition of loss matrix
1. eigenvectors are the “directions” the agent cares about
2. eigenvalues are a measure of how much the agent cares

The prior ($\sigma_0^2 I$), cost of information ($\lambda$), and the eigenvalues will dictate the precision of the signal(s)

For the consumer problem: one eigenvalue is zero and one is nonzero
$\Rightarrow$ at most, the consumer gets one signal
$\Rightarrow$ positive covariance of slackness and price beliefs
Model Takeaways

1. The consumer reduces the dimensionality of the problem, receiving one signal but facing two unknowns

2. The optimal information gathering results in a positive covariance between consumer beliefs about prices and labor market slackness

3. In a more general setup (adding a savings decision), these main findings still hold
With nominal short-term interest rates at ... their effective lower bound in many countries, the broader question of how expectations are formed has taken on heightened importance ... [C]entral banks have sought additional ways to stimulate their economies, including adopting policies that are directly aimed at influencing expectations of ... inflation.

- Janet Yellen

The first element [of quantitative easing] was to dispel people’s deflationary mindset and raise inflation expectations.

- Haruhiko Kuroda
Conclusion

● Using survey data:
  ● Consumers’ expectations are driven by sentiment
  ● ... believe inflation is countercyclical

● In a rational inattention model:
  ● Consumers learn about a combination of fundamentals $\Rightarrow$ rationally obtained sentiment
  ● ... leading to countercyclical price beliefs

● Monetary policy implications:
  ● Raising inflation expectations may inadvertently cause consumers to become pessimistic