Rational Inattention, Communication Policy and the Blissful Ignorance

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- Does this choice is independent of the conduct of the monetary policy?

- What is the social value of information about future shocks?
Introduction

• Suppose a central bank has more information than agents about the future. Should the central bank release this information?
  • Does this choice is independent of the conduct of the monetary policy?

• What is the social value of information about future shocks?

• I solve a dynamic OLG monetary model where the CB sees the next $T$ shocks and releases this information to rational inattentive agents.
Results

tightness

\[ \Delta W > 0 \]

\[ \Delta W < 0 \]
Results: a shorter $T$

tightness

$\Delta W > 0$

$\Delta W < 0$

inattent.
More attentive agents are able to explain an higher fraction of a more volatile price process.
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A tighter monetary policy reduces the sensitivity of price volatility to information.
Why?

- More attentive agents are able to explain an higher fraction of a more volatile price process.

- A tighter monetary policy reduces the sensitivity of price volatility to information.

- A shorter horizon (a smaller $T$) reduces the ability to forecast the future price.
Connections with the literature

- The social value of public information.
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- The social value of public information.
- Communication about News.
Connections with the literature

- The social value of public information.
- Communication about News.
- Rational Inattention.
Connections with the literature

- The social value of public information.
- Communication about News.
- Rational Inattention.
- Transparency and Monetary Policy.
A classical OLG model
1 A classical OLG model
2 Benchmark case: $T = \infty$
Outline

1. A classical OLG model
2. Benchmark case: $T = \infty$
3. Finite horizon
Outline

1. A classical OLG model
2. Benchmark case: \( T = \infty \)
3. Finite horizon
4. Equivalent communication policies
A classical OLG model

Benchmark case: $T = \infty$

Finite horizon

Equivalent communication policies

Conclusions
Model
For each generation $t > 1$ there is a continuum of agents $i \in (0, 1)$ having a two period endowment

$$(w_{t,0}, w_{t,1}) \equiv (2, 2w) \quad \text{with } w \in (0, 1),$$

which perishes in one period.
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which perishes in one period.

Preferences over consumption are

$$u(c_{i,t,0}, c_{i,t,1}) = \ln(c_{i,t,0}) + \ln(c_{i,t,1}),$$

s.t.

$$c_{i,t,0} = w_{t,0} - \frac{M_{i,t}^d}{P_t} \quad \text{and} \quad c_{i,t,1} = w_{t,1} + \frac{M_{i,t}^d}{P_t+1}.$$
Model

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- Money supply follows

$$m_t^s = \frac{1}{1 - w} \left( u_t + \phi (\pi_t - u_t) \right),$$

where $\phi \leq 0$ measures the degree of tightness of the monetary policy with

$$u_t \sim \mathcal{N}(0, 1) \ \text{i.i.d.}$$
At $t = 0$ Nature extracts the whole sequence of money supply shocks $u_0^\infty$. 
Model: available information

- At $t = 0$ Nature extracts the whole sequence of money supply shocks $u_0^\infty$.
- The current price and the past ones are public information freely available.
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At time $t$ the central bank (but not agents) knows $u^{t+T}$ with $T \in \{1, 2, ..., \infty\}$. 
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- At time $t$ the central bank (but not agents) knows $u_{t+T}$ with $T \in \{1, 2, \ldots, \infty\}$.

- The central bank’s expectation about the future price is

$$\pi_{t+1}^T \equiv \mathbb{E} \left[ \pi_{t+1} | u_{t+T} \right]$$
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The CB communicates $\omega_t = \{\pi_{t+1}^T\}$. 
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At time $t$ the central bank (but not agents) knows $u_t^{t+T}$ with $T \in \{1, 2, \ldots, \infty\}$.

The central bank’s expectation about the future price is

$$\pi_t^{T+1} = E \left[ \pi_{t+1} \mid u_t^{t+T} \right]$$

The CB communicates $\omega_t = \{\pi_t^{T+1}\}$.

I show that $\omega_t = \{u_t, \pi_t^{T+1}\}$ or $\omega_t = \{u_t, u_t^{t+T}\}$ are equivalent cases.
Agents are rational inattentive to the central bank reports.
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That is, agent \(i\) receives the following signals

\[
\omega_{i,t} \equiv (\omega_t + \eta_{i,t})
\]

where is \(\eta_{i,t}\) are independent zero-centred disturbances whose variance \(\sigma\) is endogenous to the information problem.
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That is, agent $i$ receives the following signals

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where $\eta_{i,t}$ are independent zero-centred disturbances whose variance $\sigma$ is endogenous to the information problem.

The distribution of the noisy signals are determined in equilibrium to satisfy

$$H \left( \pi_{t+1}^T | \pi_t \right) - H \left( \pi_{t+1}^T | \pi_t, \omega_{i,t} \right) \leq K$$
Definition For given \( \{w, K, T\} \) and CB policies \((\phi, \varpi)\), an equilibrium is a series of prices and agents’ expectations

\[
\{\pi_\tau, \{E^i_\tau \pi_{\tau+1}\}_I\}_{\tau=0}^\infty
\]

such that individual expected consumption is Bayesian optimal, all markets clear and the agents’ allocation of attention is optimal.
Utility maximization implies

\[ m_{i,t}^d - \pi_t = -\frac{w}{1 - w} \left( E_t^i \pi_{t+1} - \pi_t \right) \]

where small cases denote log-deviations and \( E_t^i \pi_{t+1} \equiv E[\pi_{t+1} | \Omega_{i,t}] \).
Model: optimization and market clearing

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\[ m^d_{i,t} - \pi_t = -\frac{w}{1 - w} \left( E^i_t \pi_{t+1} - \pi_t \right) \]

where small cases denote log-deviations and \( E^i_t \pi_{t+1} \equiv E[\pi_{t+1}|\Omega_{i,t}] \).

- Market clearing implies

\[ \pi_t = \beta \bar{E}_t \pi_{t+1} + u_t \]

where \( \beta \equiv w/(1 - \phi) \), and

\[ \bar{E}_t \pi_t \equiv \int_0^1 E[\pi_{t+1}|\Omega_{i,t}] \, di \]

is the average expectation across agents.
I consider a second-order approximation of the individual expected welfare loss due to an individual forecasting mistakes, that is, given $\pi_t$ and $\pi_{t+1}$. It is written as

$$L_i, t = w_1 + w_2 Z_1 E_i t \pi_t + \pi_{t+1}$$

This specification implies that the signals agents get are normally distributed with $\eta_i, t \sim N(0, \sigma)$. 
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This specification implies that the signals agents get are normally distributed with $\eta_{i,t} \sim N(0, \sigma)$. 
Infinite-PF Benchmark
The CB has $\infty$-$PF$ and communicates $\omega_t = \pi_{t+1}^\infty$. 

Notice that $\pi_{t+1}^\infty = \pi_t + 1$.

Agents forecasting strategy is $E_i \pi_t + 1 = a_i \pi_t + b_i \beta + a_i \pi_{t+1} + \eta_t$, where $a_i$ and $b_i$ are constant weights to be determined in equilibrium.
Benchmark case

- The CB has $\infty$-PF and communicates $\omega_t = \pi_t^\infty$.

- Notice that $\pi_t^\infty = \pi_{t+1}$.
Benchmark case

- The CB has $\infty$-PF and communicates $\omega_t = \pi_{t+1}^\infty$.

- Notice that $\pi_{t+1}^\infty = \pi_{t+1}$.

- Agents forecasting strategy is

\[
E_t^i \pi_{t+1} = a_i \pi_t + b_i \left( \beta^{-1} - a_i \right) \left( \pi_{t+1} + \eta_{i,t} \right)
\]

where $a_i$ and $b_i$ are constant weights to be determined in equilibrium.
Derivation of the current price

- Aggregation across agents gives

\[ \bar{E}_t \pi_{t+1} = a \pi_t + b (\beta^{-1} - a) \pi_{t+1} \]

where \( b \equiv \int b_i \, di \) and \( a \equiv \int a_i \, di \).
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- Substituting for \( \pi_{t+1} = \beta \bar{E}_{t+1} \pi_{t+2} + u_{t+1} \) we have

\[ \bar{E}_t \pi_{t+1} - a \pi_t = b \left( \bar{E}_{t+1} \pi_{t+2} - a \pi_{t+1} + \beta^{-1} u_{t+1} \right) \]
Derivation of the current price

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- Substituting for \( \pi_{t+1} = \beta \bar{E}_{t+1} \pi_{t+2} + u_{t+1} \) we have

\[ \bar{E}_t \pi_{t+1} - a \pi_t = b ( \bar{E}_{t+1} \pi_{t+2} - a \pi_{t+1} + \beta^{-1} u_{t+1} ) \]

- Iterating we get

\[ \bar{E}_t \pi_{t+1} - a \pi_t = \beta^{-1} b \sum_{\tau=0}^{\infty} b^\tau u_{t+1+\tau}. \]
The current price reflects the "fundamental" value

\[ \pi_t = (1 - \beta a)^{-1} \sum_{\tau=0}^{\infty} b^\tau u_{t+\tau} \]
The current price reflects the "fundamental" value

\[ \pi_t = (1 - \beta a)^{-1} \sum_{\tau=0}^{\infty} b^\tau u_{t+\tau} \]

The current price is a public signal of the future price

\[ \pi_t = b\pi_{t+1} + (1 - \beta a)^{-1} u_t, \]

with \( b \in (0, 1) \).
The informational constraint is

\[ H(\pi_{t+1}^\infty | \pi_t) - H(\pi_{t+1}^\infty | \pi_t, \omega_i, t) = \frac{1}{2} \log \left( \frac{\text{Var}(\pi_{t+1}^\infty | \pi_t)}{\text{Var}(\pi_{t+1}^\infty | \pi_t, \omega_i, t)} \right) \leq K, \]
The informational constraint is

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In equilibrium we get

\[ \sigma = \kappa \left( 1 - b^2 \right) \sigma_\pi, \]

with \( \kappa \equiv (e^{2K} - 1)^{-1} \) being a measure of inattention.
**Proposition** For given \( \{w, K, T\} \) and CB’s policies \( \phi, \omega = \{\pi_{t+1}^\infty\} \), a unique REE stationary price process exists with

\[
\begin{align*}
a_i &= a = \frac{\kappa}{1 + \kappa} b, \\
b_i &= b = \frac{1 + \kappa - \sqrt{(1 + \kappa)^2 - 4\kappa\beta^2}}{2\kappa\beta}.
\end{align*}
\]
A second-order approximation of welfare loss is

\[ W \simeq -\frac{1}{2} \left( \theta_m \text{Var} (\Delta \pi^e_{t+1}) + \theta_{\pi,m} \text{Cov} (\Delta \pi^e_{t+1}, \Delta \pi_t) + \theta_{\pi} \text{Var} (\Delta \pi_t) \right) \]

where \( \Delta \pi^e_{t+1} \) is the individual forecasting mistake and \( \Delta \pi_t \) is inflation.
A second-order approximation of welfare loss is

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where \( \Delta \pi_{t+1}^e \) is the individual forecasting mistake and \( \Delta \pi_t \) is inflation.

\( \text{var} \left( \Delta \pi_{t+1}^e \right) \) is the dominant effect: it should compensate welfare loss from aggregate volatility (see Roca 2010).
A second-order approximation of welfare loss is

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where $\Delta \pi^e_{t+1}$ is the individual forecasting mistake and $\Delta \pi_t$ is inflation.

$\text{var} (\Delta \pi^e_{t+1})$ is the dominant effect: it should compensate welfare loss from aggregate volatility (see Roca 2010).

But in this setup it is not the case: A blissful ignorance effect arises!
Welfare analysis: the forecast error variance

\[ \text{FEV} \]

\[ k \]
Proposition In the case the CB has infinite-horizon perfect foresight, that is with $\pi_{t+1}^\infty = \pi_{t+1}$, there exists a unique threshold value $\kappa^* > 1$ such that

$$\text{Var}(\pi_{t+1}|\omega_i,t, \pi_t)|_{\hat{\kappa}} > \lim_{\kappa \to \infty} \text{Var}(\pi_{t+1}|\omega_i,t, \pi_t)|_{\kappa} = 1$$

for any $\hat{\kappa} > \kappa^*$ if and only if $\beta > 1/\sqrt{2}$, whereas

$$\sup_\kappa \{ \text{Var}(\pi_{t+1}|\omega_i,t, \pi_t)|_{\kappa} \} = 1 \text{ otherwise.}$$
Welfare analysis: the full case

![Graph showing welfare analysis over a range of values for k. The graph has a Y-axis labeled W with values ranging from 0.0 to 2.5 and an X-axis labeled k with values ranging from 0 to 10. There are multiple colored lines representing different cases.](attachment:graph.png)
Finite horizon
The CB announces $\omega = \{\pi^{T}_{t+1}\}$. 
Finite horizon

- The CB announces $\omega = \{\pi^T_{t+1}\}$.

- Agents now forecast the future price according to

$$E_t^i \pi_{t+1} = a_i \pi_t + b_i \left( \beta^{-1} - a_i \right) \left( \pi^T_{t+1} + \eta_{i,t} \right)$$

and choose volatility of $\eta_{i,t+\tau}$.
Finite horizon

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- Agents now forecast the future price according to

$$E_t^i \pi_{t+1} = a_i \pi_t + b_i \left( \beta^{-1} - a_i \right) \left( \pi^T_{t+1} + \eta_{i,t} \right)$$

and choose volatility of $\eta_{i,t+\tau}$.

- The ALM of the current price is

$$\pi_t = b \pi_{t+1} + (1 - \beta a)^{-1} u_t - (1 - \beta a)^{-1} b^{T+1} u_{t+1+T}$$
The current price is the unique one that reflects a "fundamental" value

\[ \pi_t = (1 - \beta a)^{-1} \sum_{\tau=0}^{T} b^\tau u_{t+\tau} \]
Finite horizon: the current price

- The current price is the unique one that reflects a "fundamental" value

\[ \pi_t = (1 - \beta a)^{-1} \sum_{\tau=0}^{T} b^\tau u_{t+\tau} \]

- The current price is now a public signal of the T-PF forecast

\[ \pi_t = b\pi_{t+1}^T + (1 - \beta a)^{-1} u_t \]
Finite horizon: forecast error variance

- The informational constraint is

\[ H\left(\pi_{t+1}^T|\pi_t\right) - H\left(\pi_{t+1}^T|\pi_t,\omega_{i,t}\right) = \frac{1}{2} \log \left( \frac{\text{Var}\left(\pi_{t+1}^T|\pi_t\right)}{\text{Var}\left(\pi_{t+1}^T|\pi_t,\omega_{i,t}\right)} \right) \leq K, \]
Finite horizon: forecast error variance

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\[ H \left( \pi_{t+1}^T | \pi_t \right) - H \left( \pi_{t+1}^T | \pi_t, \omega_i, t \right) = \frac{1}{2} \log \left( \frac{\text{Var} \left( \pi_{t+1}^T | \pi_t \right)}{\text{Var} \left( \pi_{t+1}^T | \pi_t, \omega_i, t \right)} \right) \leq K, \]

- Equilibrium a and b are the same as before!
The informational constraint is

\[ H(\pi_{t+1}^T | \pi_t) - H(\pi_{t+1}^T | \pi_t, \omega_{i,t}) = \frac{1}{2} \log \left( \frac{\text{Var}(\pi_{t+1}^T | \pi_t)}{\text{Var}(\pi_{t+1}^T | \pi_t, \omega_{i,t})} \right) \leq K, \]

Equilibrium \(a\) and \(b\) are the same as before!

But the conditional variance of prices is now

\[ \text{Var}(\pi_{t+1}^T | \omega_{i,t}^T, \pi_t) = \text{Var}(\pi_{t+1}^T | \omega_{i,t}^T, \pi_t) + (1 - \beta a)^{-2} b^{2T}. \]
Welfare analysis: forecast error variance for $T=2$
Proposition In the case the CB has finite-horizon $T$ perfect foresight there exists a unique threshold value $\kappa^*(T)$ such that

$$\text{Var} \left( \pi_{t+1} | \omega_{i,t}^T, \pi_t \right) | \hat{\kappa} > \lim_{\kappa \to \infty} \text{Var} \left( \pi_{t+1} | \omega_{i,t}^T, \pi_t \right) | \kappa = 1$$  \hspace{1cm} (1)

for any $\hat{\kappa} > \kappa^*(T)$ if and only if $\beta > 1/\sqrt{2}$, whereas

$$\sup_{\kappa} \{ \text{Var}(\pi_{t+1} | \omega_{i,t}, \pi_t) | \kappa \} = 1 \text{ otherwise. In particular, given a certain } \beta > 1/\sqrt{2} \text{ then } \kappa^*(T) < \kappa^*(T+1).$$
Extensions
Equivalent communication policies: I

- The CB announces $\omega = \{\pi_t^\infty, u_t\}$.
Equivalent communication policies: I

- The CB announces $\omega = \{\pi_{t+1}, u_t\}$.

- Agents now forecast the future price according to

$$E_t^i \pi_{t+1} = \hat{a}_i \pi_t + \hat{b}_i \left( \beta^{-1} - \hat{a}_i \right) \left( \pi_{t+1} + \eta_{i,t} \right) + \hat{c}_i \left( u_t + \phi_{i,t} \right)$$

and chose volatility of $\eta_{i,t}$ and $\phi_{i,t}$. 

Notice that $u_t + \phi_{i,t}$ only re-uses the public information conveyed by the current price. Now agents choose the precision of the private information about the noise blurring the public information. Entropy constraint fixes the posterior conditional volatility on $\pi_{t+1}$ irrespective of the source of the mistake.
The CB announces $\omega = \{\pi_{t+1}^\infty, u_t\}$.

Agents now forecast the future price according to

$$E^i_t \pi_{t+1} = \hat{a}_i \pi_t + \hat{b}_i \left( \beta^{-1} - \hat{a}_i \right) \left( \pi_{t+1} + \eta_{i,t} \right) + \hat{c}_i \left( u_t + \phi_{i,t} \right)$$

and chose volatility of $\eta_{i,t}$ and $\phi_{i,t}$.

Notice that $u_t + \phi_{i,t}$ only refines the public information conveyed by the current price. Now agents choose the precision of the private information about the noise blurring the public information.
Equivalent communication policies: I

- The CB announces $\omega = \{\pi_{t+1}^\infty, u_t\}$.

- Agents now forecast the future price according to

$$E_t^i \pi_{t+1} = \hat{\alpha}_i \pi_t + \hat{\beta}_i (\beta^{-1} - \hat{\alpha}_i) (\pi_{t+1} + \eta_{i,t}) + \hat{\gamma}_i (u_t + \phi_{i,t})$$

and chose volatility of $\eta_{i,t}$ and $\phi_{i,t}$.

- Notice that $u_t + \phi_{i,t}$ only refines the public information conveyed by the current price. Now agents choose the precision of the private information about the noise blurring the public information.

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Agents now forecast the future price according to

$$E_t^i \pi_{t+1} = \bar{a}_i \pi_t + \left( \bar{c}_i + \beta^{-1} \right) \sum_{\tau=1}^{\infty} \bar{b}_{\tau,i} \left( u_{t+\tau} + \eta_{i,t+\tau} \right) + \bar{c}_i \left( u_t + \eta_{i,t} \right)$$

and chose volatility of $\eta_{i,t+\tau}$.
The CB announces $\omega = \{u_t^\infty\}$.

Agents now forecast the future price according to

$$E_t^i \pi_{t+1} = a_i \pi_t + \left( \tilde{c}_i + \beta^{-1} \right) \sum_{\tau=1}^{\infty} b_{\tau,i} \left( u_{t+\tau} + \eta_{i,t+\tau} \right) + \tilde{c}_i \left( u_t + \eta_{i,t} \right)$$

and chose volatility of $\eta_{i,t+\tau}$.

Now agents choose the precision about each single noise composing the state $\pi_{t+1}$. At the end this is equivalent to knowing $\pi_{t+1}$ with a certain precision.
The CB announces $\omega = \{u_t^\infty\}$.

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Again, the entropy constraint fixes the posterior conditional volatility on $\pi_{t+1}$ irrespective of the source of the mistake. I find an equivalence fixing $\bar{b}_{\tau,i} = \bar{b} \bar{b}_{\tau+1,i}$. 

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**Equivalent communication policies: II**

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  and chose volatility of $\eta_{i,t+\tau}$.
- Now agents choose the precision about each single noise composing the state $\pi_{t+1}$. At the end this is equivalent to knowing $\pi_{t+1}$ with a certain precision.
- Again, the entropy constraint fixes the posterior conditional volatility on $\pi_{t+1}$ irrespective of the source of the mistake. I find an equivalence fixing $\bar{b}_{\tau,i} = \bar{b} \bar{b}_{\tau+1,i}$.
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- Information about the future can be welfare detrimental if agents are not attentive enough and the monetary policy is not tight enough.
Conclusions

- What is the social value of information about the future?

- This paper develops a simple recursive machinery to study informational frictions in dynamic models.

- Information about the future can be welfare detrimental if agents are not *attentive enough* and the monetary policy is not *tight enough*.

- As less information is available (a shorter horizon) then the notion of *attentive enough* becomes more stringent.
Thank you