Sentiments

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Motivation

- fluctuations hinge on expectations
- but are these driven by preference and technology shocks?

This paper

1. stay within the core of the neoclassical paradigm
   - competitive, convex, RE, unique equilibrium

2. dispense with aggr shocks in technologies, preferences, etc
This paper

1. stay within the core of the neoclassical paradigm
   - competitive, convex, RE, unique equilibrium

2. dispense with aggr shocks in technologies, preferences, etc

3. yet, obtain rich fluctuations in beliefs, allocations, prices
Key insights

1. decentralization $\rightarrow$ imperfect communication
   $\rightarrow$ extrinsic shocks in expectations of “aggregate demand”

2. trade $\rightarrow$ communication $\rightarrow$ propagation
   $\rightarrow$ waves, boom-and-bust cycles
Roadmap

- baseline model: clean theorems, simple examples
- broader insights
- extension 1: waves, boom-and-bust cycles
- extension 2: quantitative potential
- conclusion
The Model

- continuum of islands
  - repres. household and firm on each island
  - produce and trade differentiated goods
- fundamentals fixed and common knowledge
- trading via random matching
The Model: preferences and technologies

\[ y_{it} = A_i F(K, n_{it}) \]

\[ U_i = \sum_{t=0}^{\infty} \beta^t [U(c_{it}, c^*_{it}) - V(n_{it})] \]

\[ F(k, n) = k^{1-\theta} n^\theta \quad U(c, c^*) = c^{1-\eta} c^{*\eta} \quad V(n) = \frac{1}{\epsilon} n^{\epsilon} \]
at each $t$, each island $i$ is randomly matched to some $j$

- receive exogenous signals
- choose employment/production
- meet current trading partner
- share information
- trade and consume
The Model: matching, trade, and communication

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info dynamics: $\omega_i^t = (\omega_i^{t-1}, \omega_j^{t-1}, x_{it})$
Equilibrium

- Employment and production:

\[ V'(n_{it}) = w_{it} = E_{it}[p_{it}] \frac{\partial y_{it}}{\partial n_{it}} \]
Equilibrium

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- trading:

\[ p_{it} = P \left( y_{jt}, y_{it} \right) \equiv \left( \frac{y_{jt}}{y_{it}} \right)^{\eta} \]
Equilibrium

- employment and production:
  \[ V'(n_{it}) = w_{it} = E_{it}[p_{it}] \frac{\partial y_{it}}{\partial n_{it}} \]

- trading:
  \[ p_{it} = P \left( \frac{y_{jt}}{y_{it}} \right) \equiv \left( \frac{y_{jt}}{y_{it}} \right)^\eta \]

“aggregate demand externality” = \( p_i \) increases with \( y_j \)
Equilibrium

- equil = fixed point in allocations and beliefs of prices (Lucas)
Equilibrium

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- equil = PBE of fictitious game (Morris-Shin)

\[
\log y_{it} = (1 - \alpha) f_i + \alpha E_{it}[\log y_{jt}]
\]
Equilibrium

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\log y_{it} = (1 - \alpha) f_i + \alpha E_{it}[\log y_{jt}]
\]

- contraction mapping

Theorem

The equilibrium exists and is unique, no matter info structure.
Communication, beliefs, and fluctuations

- communication $\rightarrow$ coordination of beliefs of econ activity

- “perfect communication” $\equiv$ prior to trading, $i$ and $j$ share same beliefs about prices $(p_{it})$ and/or allocations $(y_{it}, y_{jt})$
Communication, beliefs, and fluctuations

- Communication $\rightarrow$ Coordination of beliefs of econ activity

- "Perfect communication" $\equiv$ Prior to trading, $i$ and $j$ share the same beliefs about prices ($p_{it}$) and/or allocations ($y_{it}, y_{jt}$)

**Theorem**

*Extrinsic fluctuations along unique equilibrium if and only if communication is imperfect.*
What drives beliefs?

- in general:

\[ y_i = f(A_i, B_i) \quad y_j = f(A_j, B_j) \]

\( A_i \) is TFP, \( B_i \) is expected terms of trade
What drives beliefs?

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\( A_i \) is TFP, \( B_i \) is expected terms of trade

- Perfect communication: \( B_i = B_j \)

\[ (y_i, y_j, B_i, B_j) = f(A_i, A_j) \]

\[ \Rightarrow \text{beliefs pinned down by fundamentals} \]
What drives beliefs?

- in general:
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  \[ (y_i, y_j, B_i, B_j) = f(A_i, A_j) \]
  
  \( \Rightarrow \) beliefs pinned down by fundamentals

- imperfect communication: \( B_i \neq B_j \)
  
  \( \Rightarrow \) beliefs free to move with extrinsic shocks ("sentiments")
Sentiment shocks: simple example

\[ x_i = (x_i^1, x_i^2) \]

\[ x_i^1 = \log A_j + \varepsilon_i \]
\[ x_i^2 = x_j^1 + \zeta \]
Sentiment shocks: simple example

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\[ x_i^1 = \log A_j + \varepsilon_i \quad x_i^2 = x_j^1 + \zeta \]

**Proposition**

*In equilibrium,*

\[ Y_t = \Phi \zeta_t \quad \overline{E_{it}} Y_t = \Psi \zeta_t \]
Sentiment shocks: richer example

\[ \log A_{it} = \bar{a}_t + a_i \]

\[ x_i = (x_i^1, x_i^2, \ldots, x_i^H) \]

\[ x_{it}^1 = \log A_{jt} + \varepsilon_{it}^1 \quad x_{it}^h = x_{jt}^{h-1} + \varepsilon_{it}^h \quad \varepsilon_{it}^h = \zeta_t^h + u_{it}^h \]
Sentiment shocks: richer example

\[
\log A_{it} = \bar{a}_t + a_i
\]

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x_i = (x_i^1, x_i^2, \ldots, x_i^H)
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\]

\[
\varepsilon_{it}^h = \zeta_t^h + u_{it}^h
\]

**Proposition**

\[
\exists \xi_t = \Xi(\zeta_t^1, \ldots, \zeta_t^h) \text{ and } \nu_t \perp (\bar{a}_t, \xi_t) \text{ such that}
\]

\[
Y_t = \Phi \bar{a}_t + \xi_t
\]

\[
\mathbb{E}_{it} y_{jt} = \Phi \bar{a}_t + \Psi \xi_t
\]

\[
\mathbb{E}_{it} Y_t = \Phi \bar{a}_t + \Lambda \xi_t + \nu_t
\]
Broader insights (1)

- **Arrow-Debreu / standard macro**
  - expectations perfectly aligned across agents
  - expectations and outcomes pinned down by fundamentals

- **imperfect communication**
  - extrinsic variation in expectations
  - “coordination failure” and “animal spirits” along unique equil
Broader insights (2)

- which kind of expectations are we talking about?

- first-order beliefs of endog outcomes (GDP, inflation, etc) *not* higher-order beliefs of exog fundamentals

- only the former matter / can be estimated
What’s next

1. communication → waves / boom-and-bust cycles

2. RBC-like extension → quantitative potential
Contagion and boom-and-bust cycles

- two regions: “North” and “South”

- TFP differs across regions, info differs both across and within
  - uninformed: know only local TFP
  - partially informed: signals about the other region
  - fully informed: know entire state of nature
Contagion and boom-and-bust cycles

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- TFP differs across regions, info differs both across and within
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- sentiment shock hits only few islands and only at $t = 0$

- communication → propagation → waves / cycles
Contagion and boom-and-bust cycles

Beliefs and Macroeconomic Activity

Population Dynamics

- Aggregate Output $Y_t$
- Average Forecast $F_{tb}^a$
- Average Forecast $F_{tb}^b$

- Uninformed
- Exuberant
- Informed
Quantitative potential

- extension with investment and utilization
- baseline RBC, but sentiment shocks instead of TFP shocks

<table>
<thead>
<tr>
<th>Output</th>
<th>U.S. Data (std. dev.)</th>
<th>Correlation (corr(X,Y))</th>
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<th>Correlation (corr(X,Y))</th>
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<tr>
<td>Y</td>
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<td>I</td>
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<td>LW</td>
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Quantitative potential

- extension with investment and utilization
- baseline RBC, but sentiment shocks instead of TFP shocks

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Conclusion

- **contribution:**
  - imperfect communication $\rightarrow$ extrinsic fluctuations
  - within otherwise conventional unique-equl DSGE models
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- **interpretation:**
  - shocks to expectations
  - animal spirits, news shocks, uncertainty shocks
  - demand shocks