Discussion of

"Decentralization, Communication, and the Origins of Fluctuations"

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Objective of this Paper (My Interpretation)

- Construct an example economy in which aggregate "sentiment shocks" generate business cycle fluctuations even though
  - Equilibrium is unique (vs. sunspot literature)
  - Sentiment shocks don't affect preferences, technology or policy (vs. real business cycle and New Keynesian business cycle literature)
  - Economy is neoclassical: perfect competition, rational expectations, convex technology and consumption sets, no externalities

Outline of the Discussion

- Key model elements
- Central result (for the example).
- Comments: Is this the new theory of the origin of business cycles?

Model: Technology

- $i \in [0, 1]$ islands

- Technology: Each island produces a unique good with

$$y_{it} = A_i n_{it}^{\vartheta} k_{it}^{1-\vartheta}$$

where A_i is fixed for each island. Cross-sectional distribution: $\log A_i \sim N(0, \sigma_A^2)$.

Model: Preferences and Endowments

- Preferences over home consumption c_{it}, labor n_{it} and trading partner's consumption c^*_{it}.

$$\sum_t \beta^t \left[\left(\frac{c_{it}}{1-\eta} \right)^{1-\eta} \left(\frac{c^*_{it}}{\eta} \right)^{\eta} - \frac{(n_{it})^{\varepsilon}}{\varepsilon} \right]$$

- Endowments $k_{it} = 1$ of the fixed factor

Model: Trading and Timing

- Two sub-periods $1, 2$ within each time period t

- Stage 1:
  - Island i learns that it can trade with island j
  - Both islands receive private signals $(\tilde{\omega}_{it}, \tilde{\omega}_{jt}) = ((x_{it}, s_{it}), (x_{jt}, s_{jt}))$
  - Firms choose (y_{it}, n_{it}, k_{it}), workers choose n_{it}

Model: Trading and Timing

- Stage 2:
  - Trade takes place: island i sells goods c^*_{jt} to j at price p_{it} and buys goods c^*_{it} at prices p^*_{it}
  - Exchange information.

- Key: each island chooses production, labor supply *before* information is exchanged. Information sets in i, j differ in stage 1. Thus uncertainty about terms of trade p_{it}/p^*_{it} when allocations are chosen.

Model: Information

- Signal $\tilde{\omega}_{it} = (x_{it}, s_{it})$

$$
\begin{aligned}
x_{it} &= \log A_j + \varepsilon_{it} \text{ with } \varepsilon_{it} \sim N(0, \sigma_\varepsilon^2) \\
s_{it} &= x_{jt} + \xi_t + u_{it} \text{ with } u_{it} \sim N(0, \sigma_u^2)
\end{aligned}
$$

- Aggregate "sentiment shock" $\xi_t \sim N(0, \sigma_\xi^2)$: only source of business cycle fluctuations even though doesn't affect fundamentals, or i's information about j's technology. Note: (s_{it}, s_{jt}) positively correlated.

- Evolution of information: $\omega_{i0}^1 = (A_i, \tilde{\omega}_{i0})$, and recursively $\omega_{it}^2 = (\omega_{it}^1, \omega_{jt}^1) = \omega_{jt}^2$ and $\omega_{it+1}^1 = (\omega_{it}^2, \tilde{\omega}_{it+1})$.

Model: Equilibrium

Allocations $\{n_{it}(\omega_{it}^1), y_{it}(\omega_{it}^1), c_{it}(\omega_{it}^2), c_{it}^*(\omega_{it}^2)\}$ and prices $\{w_{it}(\omega_{it}^2), r_{it}(\omega_{it}^2), p_{it}(\omega_{it}^2), p_{it}^*(\omega_{it}^2)\}$ such that

- Given prices, household maximize utility subject to budget constraints
- Given prices, firms maximize, subject to technological feasibility
- Markets clear

$$
\begin{aligned}
c_{it}(\omega_{it}^2) + c_{jt}^*(\omega_{it}^2) &= y_{it}(\omega_{it}^1) \\
c_{it}^*(\omega_{it}^2) + c_{jt}(\omega_{it}^2) &= y_{jt}(\omega_{it}^1)
\end{aligned}
$$

Model: Characterization of Equilibrium

- Household problem

$$E_0 \sum_t \beta^t \left[\left(\frac{c_{it}(\omega_{it}^2)}{1-\eta} \right)^{1-\eta} \left(\frac{c_{it}^*(\omega_{it}^2)}{\eta} \right)^{\eta} - \frac{\left(n_{it}(\omega_{it}^1) \right)^{\varepsilon}}{\varepsilon} \right] \text{ s.t.}$$

$$p_{it}(\omega_{it}^2) c_{it}(\omega_{it}^2) + p_{it}^*(\omega_{it}^2) c_{it}^*(\omega_{it}^2) = w_{it}(\omega_{it}^2) n_{it}(\omega_{it}^1) + r_{it}(\omega_{it}^2)$$

- Key first order condition

$$\left(n_{it}(\omega_{it}^1) \right)^{\varepsilon-1} = E\left[\lambda_{it}(\omega_{it}^2) w_{it}(\omega_{it}^2) | \omega_{it}^1 \right]$$

Model: Characterization of Equilibrium

- Plugging in other equilibrium conditions yields (after some algebra)

$$\left(n_{it}(\omega_{it}^1)\right)^{\varepsilon} = \vartheta E\left[y_{it}(\omega_{it}^1)^{1-\eta} y_{jt}(\omega_{jt}^1)|\omega_{it}^1\right]$$

- When choosing labor supply island i has to form expectations about $y_{jt}(\omega_{jt}^1)$, since this will determine terms of trade $p_{it}(\omega_{it}^2)/p_{it}^*(\omega_{it}^2)$.

- But $y_{jt}(\omega_{jt}^1)$ depends on A_j and island j's expectations about island i's productivity A_i. Thus both signals (x_{it}, s_{it}) will affect y_{it}.

Main Results

- Recall

$$
\begin{aligned}
x_{it} &= \log A_j + \varepsilon_{it} \text{ with } \varepsilon_{it} \sim N(0, \sigma_\varepsilon^2) \\
s_{it} &= x_{jt} + \xi_t + u_{it} \text{ with } u_{it} \sim N(0, \sigma_u^2)
\end{aligned}
$$

- Proposition 3 (first part): There exists a unique competitive equilibrium for this economy, with

$$
\begin{aligned}
\log(y_{it}) &= \phi_0 + \phi_a \log(A_i) + \phi_x x_{it} + \phi_s s_{it} \\
E\left[\log(p_{it}) | \omega_{it}^1\right] &= \psi_0 - \psi_a \log(A_i) + \psi_x x_{it} + \psi_s s_{it}
\end{aligned}
$$

with $(\phi_a, \psi_a) > 0, (\phi_x, \psi_x) > 0$ and crucially, $(\phi_s, \psi_s) > 0$.

Main Results: Intuition

- $(\phi_a, \psi_a) > 0$: output increases, expected price decreases in own productivity. Standard result.

- $(\phi_x, \psi_x) > 0$: larger x_{it} signals larger productivity of island j, thus higher production of j, thus better terms of trade for i. Island i expects a larger price for own products and produces more.

- $(\phi_s, \psi_s) > 0$. larger s_{it} makes island i believe that j expects higher productivity of i, thus better terms of trade for j, thus higher production in j, which in turn signals better terms of trade for i. Thus i expects higher prices and produces more.

Main Results

- Proposition 3 (second part): Aggregation yields (with $\Phi_\xi > 0$):

$$\log(Y_t) = \int \log(y_{it})di = \Phi_0 + \phi_s \xi_t$$

- Sentiment shock ξ_t induces aggregate fluctuations.

- Why: positive realization of ξ_t increases s_{it} for all i, makes all island more optimistic about terms of trade and produce more.

- Note: with common information sets every island believing in improved terms of trade is inconsistent with rational expectations.

Comments I: Modeling Choices

- Fixed capital stock. Business cycle model without investment. Model is essentially a static (two sub-period) model. Only potential dynamics comes from updating of information in each island.

- Trade in goods across islands. Why no asset trade in centralized markets (and communication through it)?

- Why do preferences change with the trading partner?

Comments II: Quantitative Relevance

- Aggregate fluctuations driven by correlated shocks to higher-order beliefs s_{it}. Magnitude determined by ϕ_s:

$$Var(\log Y) = \left[\frac{\hat{\alpha}^2 \gamma_\varepsilon^2}{(1-\hat{\vartheta})[(1+\hat{\alpha})\gamma_\varepsilon^2(1+\gamma_\varepsilon^2) + (1-\hat{\alpha}^2+\gamma_\varepsilon^2)\gamma_\xi^2]} \right]^2 * \sigma_\xi^2$$

with

$$\hat{\vartheta} = \frac{\vartheta}{\varepsilon} \text{ and } \hat{\alpha} = \frac{\eta}{\eta + \frac{1-\hat{\vartheta}}{\hat{\vartheta}}} \text{ and } \gamma_\varepsilon = \frac{\sigma_\varepsilon^2}{\sigma_A^2} \text{ and } \gamma_\xi = \frac{\sigma_\xi^2}{\sigma_A^2}$$

Comments II: Quantitative Relevance

- Treating $(\gamma_\varepsilon, \gamma_\xi)$ as fixed, sufficiently large aggregate sentiment shocks can generate aggregate fluctuations as large as you want.

- If $\eta = 0$ (no trade), $\sigma_\varepsilon^2 = 0$ (no confusion about trading partner's productivity), σ_ξ^2 (no aggregate sentiment shocks), $\vartheta = 0$ or $\varepsilon \to \infty$ (deterministic endowment economy), then $Var(\log Y) = 0$ and no aggregate fluctuations either.

- Have a sense of how large are $(\varepsilon, \vartheta, \eta)$. But how big are $(\gamma_\varepsilon, \gamma_\xi, \sigma_\xi^2)$?

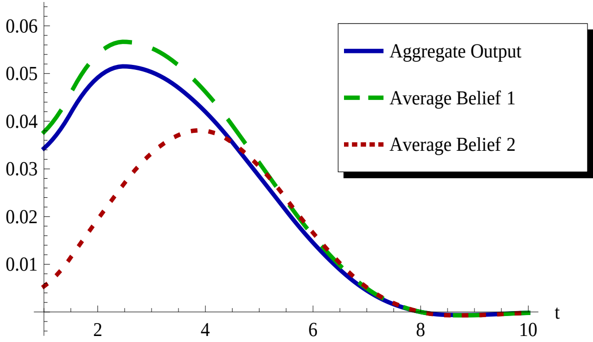
Comments II: Quantitative Relevance

- Dynamics: Note: if ξ_t is iid, so is $\log(Y)$.

- But can generate desired (hump-shaped) dynamics of output in response to a ξ_t innovation by assuming "right" process for ξ_t:

$$\Delta\xi_t = \mu\Delta\xi_{t-1} + v_t$$

  with $\mu \in (0, 1)$.



0.06
0.05
0.04
0.03
0.02
0.01
2
4
6
8
10
t
Aggregate Output
Average Belief 1
Average Belief 2

Comments III: The Big Picture

"Yet, no serious progress has been made in our formalizations of the origins of fluctuations: much like the prototypical RBC model, any state-of-the-art DSGE model ultimately attributes the bulk of fluctuations to *exogenous shocks* in technologies and preferences, or some mysterious "wedges" [...] The notion that fluctuations are driven by shocks to fundamentals such as preferences and technologies is ubiquitous within the modern macroeconomic paradigm, but remains hardly convincing outside its realm." [footnote with the usual rants from Krugman and Shiller]

"Motivated by these considerations, this paper develops a *novel formalization* of the origins of fluctuations. [...] It seeks to accommodate the view that booms and recessions, or bubbles and crashes alike, are fueled by waves of optimism and pessimism that may be entirely disconnected from fundamentals."

Comments III: The Big Picture

- Very ambitious paper! New theory of business cycles? Perhaps.

- But...aggregate shock ξ_t

  - Looks a lot like the old sunspot shock to me (although this paper does not rely on multiple equilibria).

  - Is certainly as exogenous as the technology shocks z_t in the RBC model.

  - At least we know how to measure z_t in the data. How about ξ_t? Data on expectations/consumer sentiments?

Conclusion

- [Not surprisingly...] I am with Prescott rather than with Keynes (and Shiller and Krugman and Buiter and...) on this one!

- But: spent last 30 years on RBC, last 20 years on New Keynesian business cycle model.

- Looks like a coherent alternative model to me, so would be interested to see quantitative properties worked out with disciplined (by data) choices of $(\gamma_\varepsilon, \gamma_\xi, \sigma_\xi^2)$.