Information-driven business cycles

Ryan Chahrou & Robert Ulbricht

Discussion by G. Chevillon
ESSEC Business School & CREST, Paris

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Motivation of the paper

Main idea:

- Propose a methodology for solving and estimating DSGE models with incomplete information.
- Relies on solving the aggregate model with full information.
- Without solving for the disaggregate incomplete information equilibrium.
Overview

- Prototypical NK model where agents have incomplete information.
- Introduce informational “wedges” instead of usual expectational errors
  - e.g. partial information for agents $i$, $\mathcal{J}_it \subset \mathcal{I}_t$ (full information):
    aggregate expectational error solves

$$
\epsilon_t = E \left[ \cdot | \int \mathcal{J}_it \, di \right] - E \left[ \cdot | \mathcal{I}_t \right]
$$

- (aggregate) wedge solves

$$
\tau_t = \int E \left[ \cdot | \mathcal{J}_it \right] \, di - E \left[ \cdot | \mathcal{I}_t \right]
$$

- Paper proposes an estimation methodology to that does not involve solving for incomplete information equilibrium
  - minimal exclusion restrictions for information sets of individual agents
  - mix bootstrapped GMM + simulations + priors on parameters
- Study the impact of wedges on business cycle dynamics

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The paper

DSGE models where agents have incomplete information

- Agents $i$ of type $a \in \{h, f, b\}$ possess information $\mathcal{I}_{it}^a$ with aggregate $\mathcal{I}_t^a \subset \mathcal{I}_t$

- 3-equation aggregate new Keynesian model derived with expectations conditional on each set of agents’ information
  
  - PC involves $E[\cdot | \mathcal{I}_{it}^h]$, IS involves $E[\cdot | \mathcal{I}_{jt}^f]$, Taylor rule $E[\cdot | \mathcal{I}_{bt}^b]$.

- Related “Primal” economy under complete information $E_t[\cdot] \equiv E[\cdot|\mathcal{I}_t]$

- Informational “wedges” (where complete information $\mathcal{I}_t = \{\mathcal{I}_{it}^h\} \cup \{\mathcal{I}_{jt}^f\} \cup \{\mathcal{I}_{bt}^b\}$).

\[
\begin{bmatrix}
\tau_t^h \\
\tau_t^f \\
\tau_t^b
\end{bmatrix}
\equiv
\begin{bmatrix}
\int_i E[\lambda'X_t|\mathcal{I}_{it}^h] \, di \\
\int_j E[\mu'X_t|\mathcal{I}_{jt}^f] \, dj \\
E[\nu'X_t|\mathcal{I}_{bt}^b]
\end{bmatrix}
- \begin{bmatrix}
E[\lambda'X_t|\mathcal{I}_t] \\
E[\mu'X_t|\mathcal{I}_t] \\
E[\nu'X_t|\mathcal{I}_t]
\end{bmatrix}
\]

- Conditional expectations as projections to understand Theorem 1
Given the Primal eqm $X$ and the individual wedges $\tau_{jt}^h$, candidate individual information sets must be orthogonal to the wedges.
Questions on the Primal/Wedge decomposition

- What is the rationale in using minimum assumptions on agent’s information? (robustness?)
  i.e. What do wedges represent
  - if postulated $I_t \subsetneq$ actual full info (news shocks...), does the misspecification appear in the wedges?
  - if postulated individual information $\subsetneq I_t^h$: wedges artificially correlate with ‘true’ info (e.g. historic aggregates) as in your case?

- How are the inclusion restriction imposed? (link with the Wold decomposition?)

- How is the aggregate economy different from complete info + serially correlated errors? (e.g. Milani, Fanelli)
Propose a generating process for \((a_t, \tau_t^h, \tau_t^f, \tau_t^b)\) and estimate model parameters \(\psi\) as

\[
\hat{\psi} = \text{argmin}_{\psi} \left( \hat{\Omega} - \Omega(\psi) \right)' V^{-1} \left( \hat{\Omega} - \Omega(\psi) \right)
\]

\(\Omega\) is simulated vectorized autocovariance matrix (up to \(k\) lags) of \((y_t, \pi_t, n_t, i_t, a_t)'\), \(\hat{\Omega}\) empirical estimate, \(V\) diagonal with bootstrapped variance estimates of \(\hat{\Omega}\).
Issues to clarify about econometrics & empirics

Econometrics

- why $V$ diagonal? artificially imposes identification? (Gospodinov et al, 2016)
- $a_t \equiv y_t - \alpha n_t$ induces reduced rank in (nondiagonal) $V$?
- heteroscedasticity? (Bloom, Jurado et al. 2015...)
- What if wedges are persistent?
  e.g. risk preference and/or habits? or simply aggregation of AR(2), see Granger (1980)
  $\rightarrow$ you may replace orthogonality restriction on $\tau_t$ with that on the corresponding innovations
- $\Omega$ obtained by simulation $\rightarrow$ what distribution for the innovations to $a_t, \tau_t$

Empirics

- HP filtered: assumes individual agents have perfect foresight of aggregate? (as opposed to e.g. Lorenzoni (2009), Blanchard et al. 2013).
- Measure of fit + estimation uncertainty?
- past aggregates are not part of agents’ information set?
- impact of weak identification:
  $\rightarrow$ clarify the link between between rank of $V$, # of orthogonality conditions, weak role of wedges in some IRFs, and the bivariate VMA structure for expectational shocks $u_t$
A PROMISING FIRST DRAFT!