Discussion of

“Precautionary Demand for Money in a Monetary Business Cycle Model”

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Motivation

- Velocity is more volatile than output and procyclical in data.
- However, standard CIA model implies constant (consumption) velocity (always binding CIA constraint).
- Agents hold exactly the amount of money necessary for desired cash-good purchase, when there is a positive cost of holding money.
- How can we break the (too tight) link between nominal output/consumption and money balance?
Intuition: CIA and Preference Shock

- CIA + aggregate preference shock after money balance is chosen.

- Variable velocity with precautionary money demand.

- But the velocity fluctuates too little compared with data because aggregate consumption fluctuates too little. (quantitative puzzle, Hodrick et al. (1991))

- Why idiosyncratic shock helps?

- Idiosyncratic preference shock might help because size of the shock is substantially larger: $SD = 18\%$
  (compare with $SD = 0.5\%$ for aggregate consumption).

- Volatility of idiosyncratic preference shocks is the key in calibration.
What They Did

- Standard RBC model plus:
  - CIA constraint.
  - Cash goods and credit goods.
  - Idiosyncratic preference shock.
  - TFP and monetary policy shocks.

- Investigate, theoretically and quantitatively, cyclical properties of the model, with a focus on velocity.

- A version of their paper has search friction.
Main Findings

<table>
<thead>
<tr>
<th></th>
<th>Data</th>
<th>Benchmark</th>
<th>No Shock</th>
</tr>
</thead>
<tbody>
<tr>
<td>$SD% (V_y)$</td>
<td>1.7</td>
<td>1.4</td>
<td>0.7</td>
</tr>
<tr>
<td>$SD% (V_c)$</td>
<td>1.4</td>
<td>1.1</td>
<td>0.02</td>
</tr>
<tr>
<td>$corr (V_y, y)$</td>
<td>0.64</td>
<td>0.50</td>
<td>0.99</td>
</tr>
<tr>
<td>$corr (V_c, y)$</td>
<td>0.45</td>
<td>0.005</td>
<td>-0.82</td>
</tr>
</tbody>
</table>

- The model replicates cyclical properties of $V_y$ and $V_c$ substantially better than the no-shock model. In particular, volatility of $V_y$ and $V_c$. 
- Very good performance for other real and nominal variables, too.
- Adding search friction does not change the properties of the model in quantitatively significant way.
Key Mechanism: Precautionary Demand for Money

- Cash-good consumption requires money (CIA).

- Agents decide money holding before preference shock $\theta \in \{\theta_h, \theta_\ell\}$ (shock to MU) is drawn.

- Agents choose the amount of money which exactly covers expenditure associated with $\theta_h$.

- Agents with $\theta_h$ (constrained) spend all and consume $q_h$.

- Agents with $\theta_\ell$ (unconstrained) consume $q_\ell < q_h$, leave some money.

- Total cash-good consumption is less than the total money holding (precautionary demand for money).
Key Mechanism: Shock to TFP

In response to a positive TFP shock \((z \uparrow)\)
- \(h \uparrow, k' \uparrow, c \uparrow, y \uparrow\) (standard RBC).
- \(q_l \uparrow\) (standard RBC, notice they are unconstrained).
- \(P \downarrow\) as money demand \(\uparrow\).
- \(q_h \uparrow\).

How about velocity?
- \(V_y \uparrow\) because \(y \uparrow, P \downarrow\), but drop in \(P\) (associated with consumption \(\uparrow\)) is less than increase in \(y\) (consumption smoothing).
- \(V_c \downarrow\).
Key Mechanism: Shock to $i$

In response to a positive shock to nominal interest rate ($i \uparrow$)

- Cost of holding money ↑
- $P \uparrow$
- $q_h \downarrow$ as CIA constraint gets tighter.
- $q_\ell$ does not change as CIA constraint is not binding.

How about velocity?

- $V_y \uparrow$ as $P \uparrow$.
- $V_c \uparrow$ as $P \uparrow$. 
Key Mechanism: Comments

- Need a right combination of $z$–shock and $i$–shock to get the cyclical properties of $V_y$ and $V_c$ right.

- $z$–shock and $i$–shock are jointly estimated, independently of the model. Implicit assumption is that the model replicates the dynamics of the endogenous variables in the regression. However... e.g., $\text{corr}(y, i) = -0.03$ in the model and $0.54$ in the data.

- Comparing impulse responses of the model and the data helps evaluating the fit (shut down interaction of the shocks?).

- Since monetary policy significantly affects the cyclical properties of velocity, compare (i) U.S. in different periods or (ii) across countries.

- Cyclical properties of cash-goods and credit-goods.
• $\sigma_\theta$ is carefully calibrated to match the $SD(q)$ (computed using CEX). But could be the upperbound if $SD(q)$ contains *predicted* and *unpredicted* variations.

• Preference shock $\theta$ is discretized with 5 points. The properties of the model might be sensitive to this number (in particular, $\bar{\theta}$).

• Full-fledged incomplete market model!