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

| | Data | Benchmark | No Shock |
|---|---|---|---|
| $SD\%(V_y)$ | 1.7 | 1.4 | 0.7 |
| $SD\%(V_c)$ | 1.4 | 1.1 | 0.02 |
| $corr(V_y, y)$ | 0.64 | 0.50 | 0.99 |
| $corr(V_c, y)$ | 0.45 | 0.005 | -0.82 |

- 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).
- $q_\ell \uparrow$ (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 $\uparrow$
- $P \uparrow$
- $q_h \downarrow$ 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., $corr(y, i) = -0.03$ 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.

# Comments: Calibration, Computation, and Model

- $\sigma_\theta$ 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, $\overline{\theta}$).
- Full-fledged incomplete market model!

# References

**Hodrick, Robert J., Narayana Kocherlakota, and Deborah Lucas**, "The Variability of Velocity in Cash-In-Advance Models," *Journal of Political Economy*, 1991, *99* (2), 358–384.