On the stability of money demand

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discussion by Francesco Lippi (EIEF)

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Fact: the relation between $M1/GDP$ and $r$ changes after the 80s breakdown mostly due to deposit (not currency). Reserves and M1 central to policy yet absent in standard macro models.
Money: difficult to analyze both in theory and in data

- what assets serve as money in practice?
  regulation and technical change matter

- in particular: NOW and MMDA (interest paying deposits) in early 1980s
  - MMDA allowed for limited checking but no limits on ATM withdrawals
  - MMDA close substitute to deposit but included in M2 (not in M1)

- relevance: e.g. $M, P, Y, r$ relationship (and welfare)
Empirical contribution: new measure of M1

Essentially $M1_{new} = M1 + MMDA$
Related empirical analysis in Teles and Zhou (2005)

\[ MZM = M1 + MMMF + MMDA \]
Model competing means of payments / deposits

\[
\max_{n, \gamma, \delta, x, c, d, a} \sum_{t=0}^{\infty} \beta^t U(x_t) \quad \text{subject to} \quad m \geq c\theta^c + d\theta^d + a\theta^a
\]

\[
nc \geq px\Omega(\gamma),
\]

\[
nd \geq px [\Omega(\delta) - \Omega(\gamma)],
\]

\[
na \geq px [1 - \Omega(\delta)].
\]

The law of motion for money balances is

\[
m' = \frac{m + T + py(1 - \phi n) - px (k^d (F(\delta) - F(\gamma)) + k^a (1 - F(\delta)) + 1) - (\theta^c - 1)c}{1 + \pi}
\]

– Key choices: 0 < \gamma < \delta, and # transactions \( n \) (\( m \) unit elasticity w.r.t. \( y \))
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- Key choices: \(0 < \gamma < \delta\), and \# transactions \(n\) (\(m\) unit elasticity w.r.t. \(y\))
- Costs: \(\phi n\), Fixed cost: \(k^d < k^a\), “reserve requirements” \(\theta^c, \theta^d, \theta^a\)
- “Opportunity cost” of \(m = c + d + a\) is \(\lambda_m = V'(m) \frac{r}{1+r}\) with \(\lambda'_m(r) > 0\)
Tradeoffs

A unit of consumption $x$ made of purchases of different size $z$:

$$1 = \int_0^\infty f(z) \frac{z}{\nu} \, dz$$

- checks have fixed cost per-purchase $\rightarrow$ convenient for large purchase

- pin down $\gamma$ (cash-good threshold), $n$ # transactions

$$\gamma \frac{1}{\nu} \left[ \frac{(\theta^c - 1) + r(\theta^c - \theta^d)}{n} \right] = k^d$$

$$\frac{n^2 \phi}{(1 - \phi n)} = \frac{r\theta^a + \left[ (\theta^c - 1) + r(\theta^c - \theta^d) \right] \Omega(\gamma) + r(\theta^d - \theta^a)\Omega(h(r)\gamma)}{1 + k^d (F(h(r)\gamma) - F(\gamma)) + k^a (1 - F(h(r)\gamma))}$$

resources spent on “trips” to the bank: $\phi n$

resources spent on banking services $k^d (F(\delta) - F(\gamma))$, $k^d (1 - F(\delta))$
Novelty is the multiplicity of bank liabilities

\[ \frac{c}{(c + d + a)} = \Omega(\gamma) \]

\[ \frac{d}{(d + a)} \]

- both cash and deposits are used even at \( r = 0 \) if \( \theta^c > 1 \)
- No demand for MMDA at \( r = 0 \)
Main results from calibration (match 1984 values)

\[
c/(c + d + a) \quad \text{and} \quad d/(d + a)
\]

Figure 5b: Currency / Demand Deposits - trend component, 1984 - 2012

Figure 5d: Demand Deposits / (Demand Deposits+MMDAs) - trend component, 1984 - 2012
Main results from calibration (match 1984 values)

\[ \frac{c}{c + d + a} \]

\[ \frac{d}{d + a} \]

Figure 5a: Currency / Demand Deposits, 1984 - 2012

0
0.2
0.4
0.6
0.8
1
RATIO
DATA
MODEL

Figure 5b: Currency / Demand Deposits - trend component, 1984 - 2012

0
0.2
0.4
0.6
0.8
1
RATIO
DATA
MODEL

Figure 5c: Demand Deposits / (Demand Deposits+MMDAs), 1984 - 2012

0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
RATIO
DATA
MODEL

Figure 5d: Demand Deposits / (Demand Deposits+MMDAs) - trend component, 1984 - 2012

0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
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0.9
1
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Figure 6: M1/GDP vs. Interest Rate (3-Month T-Bill), 1915 - 1935 & 1983 - 2012

\[ \frac{M}{GDP} = A\frac{1+(\theta^c-1)\Omega(\gamma)}{n(r)} \]

\[ \approx \frac{A}{n(r)} \]
Comments

1. some details (on interest elasticity, multipliers & transaction-costs specification)

2. on modeling M1: beyond households?

3. what did we learn?
Non-monotone $M(r)$ when both $\gamma$ and $n$ endogenous

$n(r)$ has a $1/2$ elasticity w.r.t. $r$ for given $\gamma$ and $\theta^c = 1$, like BT model.
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and for $\theta^c > 1$ model has satiation at $r = 0$
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$\theta_c = 1.01$

$\theta_c = 1.005$
Interest elasticity of M1 at low interest \( r < 0.01 \)

Satiation of money balances

Interest elasticity is small
M1 and Multipliers

Let \( M = a + b + c \) and remember \( m = c(r, ...)\theta^c + d(r, ...)\theta^d + a(r, ...)\theta^a \)

- model features a money multiplier:
  \[ M = \mu(\theta^i, k^i, r) \ m \]

- look at the empirical performance of the multiplier!
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  \frac{M}{p x} \\
  eq. 13
  \end{array} \right. \frac{x}{p \ y(1 - \phi n)}
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- Money $M$ to GDP in model is
  \[ \frac{M}{p y(1 - \phi_n)} = \frac{M}{p x} \]
  \[ \frac{x}{p y(1 - \phi_n)} = \frac{M}{p x} \]
  (1 \ - \ transaction \ service)
Dissociated transaction costs: $\phi_i \rightarrow n_i$?

model assumes once $\phi$ is “paid” $c, d, a$ are rebalanced

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In data (Italy, 2002) transaction frequency varies across assets:

<table>
<thead>
<tr>
<th></th>
<th>mean</th>
<th>median</th>
</tr>
</thead>
<tbody>
<tr>
<td># currency transactions (from $d$ to $c$)</td>
<td>22 (60 w. ATM)</td>
<td>12 (48 w. ATM)</td>
</tr>
<tr>
<td># deposits transactions (from Wealth to $d$)</td>
<td>14 (+12 Auto)</td>
<td>2 (+12 Auto)</td>
</tr>
</tbody>
</table>

Source Italian households survey data (Bank of Italy)
Sectoral breakdown of $M1$: HH and (non-fin) Firms

M1 and cash plus checking of firms and households
(1982 Dollars)

Notes: M1 is from the Federal Reserve Board of Governors Release H.6 at the end of the period. Firm cash+checking is from the Flow of Funds L.102(A): Nonfinancial business; checkable deposits and currency; asset. Household cash+checking is from the Flow of Funds L.101(A): Households and nonprofit organizations; checkable deposits and currency; asset. All data is not seasonally adjusted and deflated using CPI (CPIAUCNS) from the BLS.

money demand by firms almost as important as money demand by households
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- Fine tuning control of reserves, $M, P, y, r$?

  - Great motivation but not fully developed.
Conclusions

Very useful measurement

Simple clean theoretical model to think through data

Several implications can be expanded and refined . . . . . I look forward to it!