MONETARY REGIMES, MONEY SUPPLY AND THE US BUSINESS CYCLE SINCE 1959: IMPLICATIONS FOR MONETARY POLICY TODAY

MERCATUS WORKING PAPER

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Three pillars of the monetary exchange economy

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Motivation

- Interest rate policy can be ‘decoupled’ from the CB balance sheet (e.g., Woodford (2000), Keister et al. (2008), Borio and Disyatat (2010) and Kashyap and Stein (2012))
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- An old policy debate: Thornton (1802), Pigou (1917), Tinbergen (1939, 1951), and Poole (1970).

- Confusion over the effect of the choice by the monetary authority between reserves and interest rate manipulation. (Hetzel, 1986; McCallum, 1986; Carlstrom and Fuerst, 2001)
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E.g., Burns-Miller era:

- U.S. “built-in” inflation bias, Fed must accommodate (FGR, 2010)

- Overestimated the costs of disinflation, sceptical of MP, dismissed the relation between the stock of money and the price level
Objective

Offer a clear alternative characterization of monetary policy often missing (or dismissed) from the contemporary narrative. (see, e.g., Sims (2013); Thornton (2014); Belongia and Ireland (2017))

(1) Type of monetary policy regime \(\Rightarrow\) the role of monetary aggregates and interest rate policy on the U.S. business cycle.

\(\Rightarrow\) transmission mechanism;

\(\Rightarrow\) determination of the money stock, and hence the price level.
Objective

Offer a clear alternative characterization of monetary policy often missing (or dismissed) from the contemporary narrative. (see, e.g., Sims (2013); Thornton (2014); Belongia and Ireland (2017))

(2) Show that the U.S. economy need not succumb to the low-inflation, low-interest-rate state observed since the 2008 global financial crisis.

⇒ a strict versus flexible interest rate targeting regime (*de facto* or *de jure*)
Revisiting three pillars of the monetary exchange economy

A traditional model of money stock determination based on

1. The Fisher relation
2. Money stock and price-level determination
3. The behaviour of money demand
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A traditional model of money stock determination based on

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⇒ form the core of the general equilibrium framework which we extend to a New-Keynesian (NK) DSGE model.

⇒ an interest rate targeting regime: simply a special case in a continuum of endogenous monetary policy regimes.

⇒ Estimated: 1959Q1–2007Q3; 1984Q1–2007Q3 (GM)
Main results

Monetary aggregates are important, not only for MP, but for capturing the *actual* behaviour of a monetary economy.

1. The interaction $\equiv M^s & M^d$ and the type of monetary regime in our model does well to capture the dynamics of the U.S. business cycle.

2. The evolution toward a stricter interest rate targeting regime renders central bank balance sheet expansions ineffective.

3. 2007–09 global financial crisis: a more flexible interest rate targeting regime would have led to a significant monetary expansion and more rapid economic recovery in the U.S.
Figure: The recovery period 2009Q3–2012Q3. Forecast conditional on actual Fed interest rate path near the ZLB (solid line). Unconditional forecast (dashed line). Actual data (cross marker).
Figure: The recovery period 2009Q3–2012Q3. Forecast conditional on maintaining 2% inflation target (solid line). Unconditional forecast (dashed line). Actual data (cross marker).
## Variance decomposition of business cycle under two monetary regimes (in percent)

<table>
<thead>
<tr>
<th>Shock</th>
<th>$\epsilon_z$</th>
<th>$\epsilon_i$</th>
<th>$\epsilon_{ms}$</th>
<th>$\epsilon_{md}$</th>
<th>$\epsilon_z$</th>
<th>$\epsilon_i$</th>
<th>$\epsilon_{ms}$</th>
<th>$\epsilon_{md}$</th>
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<td>0.09</td>
<td>98.23</td>
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<td>velocity ($v$)</td>
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<td>0.52</td>
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<td>10.84</td>
<td>87.19</td>
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<tr>
<td>output ($y$)</td>
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<td>30.41</td>
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<td>3.83</td>
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<td>87.5</td>
<td>8.5</td>
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<td>real rate ($r$)</td>
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<td>37.62</td>
<td>50.03</td>
<td>9.63</td>
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<td>0.17</td>
<td>95.06</td>
<td>4.31</td>
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<td>99.92</td>
<td>0.02</td>
<td>0.05</td>
<td>0.01</td>
<td>99.73</td>
<td>0.18</td>
<td>0.08</td>
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<td>inflation ($\pi$)</td>
<td>11.79</td>
<td>55.26</td>
<td>12.64</td>
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<td>4.33</td>
<td>0.25</td>
<td>73.95</td>
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<td>output gap ($\bar{y}$)</td>
<td>31.66</td>
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<td>6.19</td>
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<td>93.78</td>
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<td>0.14</td>
<td>45.84</td>
<td>52.53</td>
<td>1.49</td>
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<td>Free Reserves ($fr$)</td>
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<td>93.23</td>
<td>6.23</td>
<td>0.46</td>
<td>0.14</td>
<td>42.37</td>
<td>55.97</td>
<td>1.52</td>
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### Flexible prices

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<th>Shock</th>
<th>$\epsilon_z$</th>
<th>$\epsilon_i$</th>
<th>$\epsilon_{ms}$</th>
<th>$\epsilon_{md}$</th>
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<td>96.85</td>
<td>0</td>
</tr>
<tr>
<td>velocity ($v$)</td>
<td>49.85</td>
<td>0.05</td>
<td>49.99</td>
<td>0.12</td>
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<td>prices ($p$)</td>
<td>3.6</td>
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<td>35.03</td>
<td>60.37</td>
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<tr>
<td>output ($y$)</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>real rate ($r$)</td>
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<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>nominal rate ($i$)</td>
<td>35.73</td>
<td>0.06</td>
<td>64.05</td>
<td>0.16</td>
</tr>
<tr>
<td>nominal target rate ($i^T$)</td>
<td>0.01</td>
<td>99.97</td>
<td>0.01</td>
<td>0.02</td>
</tr>
<tr>
<td>inflation ($\pi$)</td>
<td>11.35</td>
<td>0.16</td>
<td>83.12</td>
<td>5.37</td>
</tr>
<tr>
<td>output gap ($\bar{y}$)</td>
<td>0.14</td>
<td>45.84</td>
<td>52.53</td>
<td>1.49</td>
</tr>
<tr>
<td>natural output ($y^n$)</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>natural rate ($r^n$)</td>
<td>100</td>
<td>0</td>
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<td>0</td>
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<td>Non-Borrowed Reserves ($h$)</td>
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<td>81.99</td>
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<td>Free Reserves ($fr$)</td>
<td>6.77</td>
<td>80.08</td>
<td>13.07</td>
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</table>
Impulse response functions

Figure: Impulse responses for the Great Moderation period.
Figure: Historical decomposition (1959Q1 – 2007Q3): Money: MZM. Cross marker line: actual data for the log of money-to-output ratio.

Solid line: percentage deviation of the latent variable from its long-run trend (steady-state). Note: the growth rate of money is the observable variable for estimation.
Figure: Historical decomposition (1959Q1 – 2007Q3): Velocity.
Figure: Historical decomposition (1959Q1–2007Q3): Inflation.
Figure: Historical decomposition (1959Q1 – 2007Q3): Nominal interest rate. Solid red line: deterministic Taylor rule (DTR) fit. Dotted red line: DTR fit without interest rate smoothing.
Figure: Historical decomposition (1959Q1–2007Q3): Real interest rate. Dashed red line: zero real interest rate level.
Optimal policy

Setting $\pi_t = \tilde{y}_t = 0$ will eliminate price distortions from the Phillips curve. The central bank seeks to minimize the following quadratic loss function ($\pi_t = \tilde{y}_t = 0$):

$$
\min_{\pi_t, \tilde{y}_t} \frac{1}{2} E_0 \left( \sum_{t=0}^{\infty} \beta^t (\pi_t^2 + \omega \tilde{y}_t^2) \right)
$$

s.t.

$$
\pi_t = \beta E_t [\pi_{t+1}] + \tilde{\kappa} \tilde{y}_t ,
$$

where $\omega = \tilde{\kappa}/\epsilon$ and $\epsilon$ is the price elasticity of demand. The optimal policy rules under discretion and commitment follow as:

$$
\tilde{y}_t = -\frac{\tilde{\kappa}}{\omega} \pi_t , \quad \tilde{y}_t = -\frac{\tilde{\kappa}}{\omega} p_t .
$$

The following modified optimal Taylor rule (OMTR) represents the efficient benchmark:

$$
i_t = r_t^n + \kappa_\pi \pi_t + \kappa_y \tilde{y}_t .
$$
Optimal policy

Figure: Impulse response to a negative money demand shock.
Empirical findings for the U.S. business cycle

Optimal policy

Figure: Impulse response to a positive technology shock.
The principle contribution

- Demonstrate that neither an interest rate targeting regime nor a money growth rule is desirable. (Poole, 1970)

- The ‘decoupling principle’ overlooks money’s essential role in economic activity and the determination of the general level of prices.

- Rather, monetary authorities should stabilize nominal income in a market economy environment using both its monopoly over the monetary base and interest rate policy. (Svensson, 1999)
  - The reason being that under certain states of the world, at either the ZLB or highly elastic reserve demand, either interest rate policy or money base creation can be ineffective.
Thank you
Future work

   ▶ time-varying parameters (drift) vs. Markov switching
   ▶ stochastic volatility

Open economy
   ▶ international Fisher effect

Regulatory changes
   ▶ “effective” reserve ratio; LCR & cap. req. (Dodd-Frank)
A Model of Price-level Determination, Money Demand and Endogenous Monetary Regimes

Fisher relation: \[ i_t = E_t[\pi_{t+1}] + [r^n_t + \eta_c(E_t[\tilde{y}_{t+1}] - \tilde{y}_t)] \] (4)

Money demand: \[ m^d_t - p_t = y_t - (\phi_i i_t + (1 - \phi_y)y_t) + \xi_{m^d,t} \] (5)

Monetary policy: \[ h_t = \rho_h h_{t-1} - \nu_h (i_t - i^T_t) \] (6)

Money supply: \[ m^s_t = h_t + \phi_{rr}(h_t - f_r) + \xi_{m^s,t} \] (7)

where \( i^T_t = f(i^T_{t-1}, \tilde{y}_t, \pi_t, \varepsilon_i,t) \), \( f_r = f(i|i^{dr}, i^{er}) \)

\( i_t \): nominal rate. \( \pi_t \): inflation rate. \( r_t \): real rate.

\( p_t \): price level. \( y_t \): output. \( h_t \): bank reserves. \( m_t \): nominal money stock.

\( \phi_y \) and \( \phi_i \): real income and the interest rate semi-elasticities of the demand for money

\( \rho_h \): persistence. \( \nu_h \): degree of interest rate smoothing by monetary authority.

\( \phi_{rr} = \frac{FR}{rrM} = \frac{FR}{RR} \).

New-Keynesian Phillips curve: \[ \pi_t = \beta E_t[\pi_{t+1}] + \tilde{\kappa}\tilde{y}_t \]
References

Ireland, P.N., 2014. The macroeconomic effects of interest on reserves. Macroeconomic Dynamics 18, 1271–1312.