The Great Escape?

A Quantitative Evaluation of the Fed’s Liquidity Facilities

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Disclaimer: The views expressed are mine and do not necessarily reflect those of the Federal Reserve Bank of New York or the Federal Reserve System
The Fed’s Response to a Black Swan

Source: Board of Governors of the Federal Reserve System, Release H.4.1

- Treasury Securities
- Long Term Treasury Purchases
- Liquidity Facilities
- Agency Debt and MBS

Trillions of $
Questions

• We incorporate the financial friction proposed by Kiyotaki and Moore (2008) – differences in liquidity across assets – into a DSGE model with standard real and nominal rigidities and ask:

1. Can a KM-type liquidity shock quantitatively generate the crisis?

   • Large response of *macro* and financial variables.
Questions

• We incorporate the financial friction proposed by Kiyotaki and Moore (2008) – differences in liquidity across assets – into a DSGE model with standard real and nominal rigidities and ask:

1 Can a KM-type liquidity shock quantitatively generate the crisis?
   • Large response of macro and financial variables.

2 What is the quantitative effect of unconventional monetary policy in such a setting?
   • In an environment where standard monetary policy no longer works (the “great escape” from the liquidity trap)
Main results

Output

Inflation

Quarters

percent

percent (annualized)

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The Great Escape?

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The model: Kiyotaki-Moore (Shi version)

1. Households = \{ entrepreneurs with probability \( \kappa \): \( j \in [0, \kappa) \),
entrepreneurs (investment opportunity) workers with probability \( 1 - \kappa \): \( j \in [\kappa, 1] \) \}

2. Government
The model: Kiyotaki-Moore (Shi version) + a few more actors and a few more rigidities

1 Households = \{ entrepreneurs (investment opportunity) workers \}
   \begin{align*}
   & \text{with probability } \kappa : \quad j \in [0, \kappa) \\
   & \text{with probability } 1 - \kappa : \quad j \in [\kappa, 1]
   \end{align*}

2 Government

3 Intermediate firms \Rightarrow sticky prices

4 Final good producing firms

5 Labor packers \Rightarrow sticky wages

6 Capital producing firms \Rightarrow investment adjustment cost
### Households’ Balance Sheet

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>nominal bonds</td>
<td>own equity issued</td>
</tr>
<tr>
<td>( B_{t+1}/P_t )</td>
<td>( q_t N_{t+1}^I )</td>
</tr>
<tr>
<td>equity of other households</td>
<td>net worth</td>
</tr>
<tr>
<td>( q_t N_{t+1}^O )</td>
<td>( q_t N_{t+1} ) + ( B_{t+1}/P_t )</td>
</tr>
<tr>
<td>capital stock</td>
<td></td>
</tr>
<tr>
<td>( q_t K_{t+1} )</td>
<td></td>
</tr>
</tbody>
</table>

where \( N_t \equiv N_{t}^O + (K_t - N_{t}^I) \).
Frictions

- $N_{t+1}(j) \geq (1 - \phi_t)(1 - \delta)N_t + (1 - \theta)L_t(j)$

- $B_{t+1}(j) \geq 0$
Frictions

\[ N_{t+1}(j) \geq (1 - \phi_t)(1 - \delta) N_t + (1 - \theta) l_t(j) \]

Borrowing Constraint
Frictions

\[ N_{t+1}(j) \geq (1 - \phi_t)(1 - \delta) N_t + (1 - \theta) l_t(j) \]

Resaleability Constraint
Frictions

\[ N_{t+1}(j) \geq (1 - \phi_t)(1 - \delta) N_t + (1 - \theta) I_t(j) \]

\[ B_{t+1}(j) \geq 0 \]
Entrepreneurs & Frictions

\[ C(j)_t + p_t^l I(j)_t + q_t(N(j)_{t+1} - I(j)_t) + \frac{B(j)_{t+1}}{P_t} = (r^K_t + \lambda)N_t \]
\[ + \frac{R_{t-1}B_t}{P_t} + \tau_t + D_t + D^l_t \]
Entrepreneurs & Frictions

\[ C(j)_t + p_t^l I(j)_t + q_t (N(j)_{t+1} - I(j)_t) + \frac{B(j)_{t+1}}{P_t} = (r^K_t + \lambda)N_t \]

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Entrepreneurs & Frictions

\[ C(j)_t + p_t I(j)_t + q_t (N(j)_{t+1} - l(j)_t) + \frac{B(j)_{t+1}}{P_t} = (r^K_t + \lambda)N_t \]
\[ + \frac{R_{t-1}B_t}{P_t} + \tau_t + D_t + D^l_t \]

- \( N_{t+1}(j) \geq (1 - \theta)l_t(j) + (1 - \phi_t)(1 - \delta)N_t \)
- \( B_{t+1}(j) \geq 0 \)
Entrepreneurs & Frictions

\[
C(j)_t + p_t^l l(j)_t + q_t(N(j)_{t+1} - I(j)_t) + \frac{B(j)_{t+1}}{P_t} = (r^K_t + \lambda)N_t
\]
\[
+ \frac{R_{t-1}B_t}{P_t} + \tau_t + D_t + D^l_t
\]

- \( N_{t+1}(j) \geq (1 - \theta)l_t(j) + (1 - \phi_t)(1 - \delta)N_t \)
- \( B_{t+1}(j) \geq 0 \)
- Solution:

\[
l(j)_t = \frac{(r^K_t + \lambda \phi_t q_t)N_t + \frac{R_{t-1}B_t}{P_t} + D_t + D^l_t}{p_t^l - \theta_t q_t}
\]
Households’ FOCs

- **Euler:**

\[
C_t^{-\sigma} = \beta \mathbb{E}_t \left\{ C_{t+1}^{-\sigma} \left[ \frac{R_t}{\pi_{t+1}} + \frac{\kappa(q_{t+1} - p_{t+1}^l)}{\pi_{t+1} - \theta q_{t+1}} \frac{R_t}{\pi_{t+1}} \right] \right\}
\]

- **Arbitrage:**

\[
E_t \left[ C_{t+1}^{-\sigma} \left\{ \frac{R_t}{\pi_{t+1}} (1 + \frac{\kappa(q_{t+1} - p_{t+1}^l)}{p_{t+1}^l - \theta_{t+1} q_{t+1}}) \frac{r_{t+1}^K + \lambda q_{t+1}}{q_t} \frac{1}{q_t} \frac{1 + \frac{\kappa(q_{t+1} - p_{t+1}^l)}{p_{t+1}^l - \theta_{t+1} q_{t+1}} \frac{r_{t+1}^K + \lambda \phi_{t+1} q_{t+1}}{r_{t+1}^K + \lambda q_{t+1}}} \right] \right\} = 0
\]
The Role of Nominal Rigidities

\[ y_t = i_t [1 + S\left(\frac{i_t}{i^*}\right)] + C_t \]
The Role of Nominal Rigidities

\[ y_t = i_t [1 + S\left( \frac{i_t}{i_*} \right)] + C_t \]
Government

• Taylor rule:

\[ R_t = \max\{ R_\star (\pi_t / \pi_\star)^{\psi_1}, 0 \} \]

• Unconventional monetary policy (liquidity provision):

\[ \frac{N_{t+1}^g}{K} = \psi_k \left( \frac{\phi_t}{\phi} - 1 \right) \]
Government

• Taylor rule:

\[ R_t = \max\{R_*(\pi_t/\pi_*)^{\psi_1}, 0\} \]

• Unconventional monetary policy (liquidity provision):

\[ \frac{N_{t+1}^g}{K} = \psi_k \left( \frac{\phi_t}{\phi} - 1 \right) \]

• **Chicken**: Gvmt intervenes on the open market (does not relax individual agents constraints) ... but does have the power to issue liquid assets.
Liquidity Share: \( \frac{L}{L+qK} \)
Steady State as a Function of $\phi_*$

(for $L_*/Y_* = .40$)
Calibration

- Impose $\phi = \theta = 18.5\%$ to obtain:
  1. steady state liquidity share of 13%
  2. real return on liquid assets of 2.2\% (1952Q1:2008Q4)

- Probability of receiving investment opportunity: $\kappa = 5\%$

Doms and Dunne (1998) and Cooper, Haltiwanger and Power (1999)

- Nominal rigidities: $\zeta_p = \zeta_w = .75$
- Discount factor: $\beta = 0.99$
- Intertemporal elasticity: $\sigma = 1$
- Inverse Frisch elasticity: $\nu = 1$
- Investment adjustment costs: $S''(1) = 1$
- Depreciation rate: $\delta = 0.025$ (Annual depreciation = 10\%), $\lambda_p = \lambda_w = 0.1$
- Capital share: $\gamma = 0.4$
- Taylor rule response to inflation: $\psi_1 = 1.5$, Transfer rule coef $\xi_\tau = 0.1$
Response of Key Macro Variables

Model (with intervention) and Data

- **Output**: Graph showing the response of output over time.
- **Inflation**: Graph showing the response of inflation over time.
- **Nominal Interest Rate**: Graph showing the response of nominal interest rate over time.

Each graph is labeled with the corresponding variable (Output, Inflation, Nominal Interest Rate) and includes a time series from 2006 to 2009, with specific data points highlighted for years 2008 and 2009.
Response of Financial Variables

Spread Illiquid–Liquid Assets

Value of Capital

annualized bps.

percent

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The Effect of Policy Intervention

![Graph showing the effect of policy intervention on Output and Inflation over quarters.](image-url)
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Inflation

Output

percent (annualized)

Quarters

percent

−50
−40
−30
−20
−10
0
The Role of the Nominal Rigidities

Output

Investment

Consumption

Real Interest Rate

Quarters

percent

percent

percent

percent (annualized)

%
The Role of the Zero Bound
Conclusions

1. Liquidity shocks as in Kiyotaki-Moore model can generate quantitatively large movements in real and financial variables → can explain some features of the crisis.

2. Swap of liquid for illiquid assets (unconventional policy) is effective in reducing impact on spreads and real variables
   - How much should the central bank intervene via unconventional policy?
   - “Great escape” or “Great moral hazard”?

• Caveat: This is not a model for normative analysis!!!