How did Monetary Policy Implementation Change with the Financial Crisis?

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Agenda

I. FRS Mandate and Pre- vs. Post- Crisis FOMC Statement Excerpts

II. Pre-Crisis Framework
   a. What are:
      a. Reserves
      b. Reserve Requirements
      c. Fed funds?
   b. Seeking Reserve Balance Equilibrium in a Pre-Crisis World
   c. Pre-Financial Crisis Balance Sheet
   d. How do TOMO’s change the level of reserves?
   e. Forecasting Reserve Supply - Autonomous Factors
   f. Forecasting Reserve Demand
   g. Putting it All Together in Pre-Crisis World

III. Financial Crisis Emerges
   a. 2H 2007
   b. 1H 2008
   c. 2H 2008
   d. Post-Crisis Balance Sheet
FRS Mandate

Federal Reserve Act:

The Board of Governors of the Federal Reserve System and the Federal Open Market Committee shall maintain long run growth of the monetary and credit aggregates commensurate with the economy's long run potential to increase production, so as to promote effectively the goals of...

- maximum employment,
- stable prices, and
- moderate long-term interest rates.

http://www.federalreserve.gov/aboutthefed/section2a.htm
Direction from the FOMC

Excerpt from Press Release following the June 28, 2007 FOMC meeting:

The Federal Open Market Committee decided today to keep its target for the federal funds rate at 5-1/4 percent.

Excerpt from Press Release following the September 17, 2015 FOMC meeting:

To support continued progress toward maximum employment and price stability, the Committee today reaffirmed its view that the current 0 to 1/4 percent target range for the federal funds rate remains appropriate. In determining how long to maintain this target range, the Committee will assess progress--both realized and expected--toward its objectives of maximum employment and 2 percent inflation.
Pre-Crisis Framework:
What are Reserve Balances?

- Reserve Balances are end-of-day balances in transaction accounts that banks keep at the Fed.
- The Fed’s payment system is known as Fed Wire. Banks make payments for their clients and for their own account over Fed Wire. Two daily close times: 6:00 pm for third party wires, final close at 6:30 pm.
- In addition to transaction needs, bank reserve balances are used to meet reserve requirements. Of note, the Fed started paying interest on reserve balances in the fourth quarter of 2008.
Pre-Crisis Framework:

How are Reserve Requirements Calculated?

• Banks are required to keep a “reserve” at the Fed equal to approximately 10% of their demand deposits less applied vault cash.

• Reserve requirements are “lagged”, in that the average daily requirements for this maintenance period are based on demand deposits and vault cash held over a previous computational period. This enables the Desk to know what reserve requirements are with certainty before each maintenance period starts.
Building a Foundation
Reserve Requirement Timeline

Computation Period
FR 2900 Report Week
FR 2900 Report Week
FR 2900 Report Week

Maintenance Period
FR 2900 Report Week
FR 2900 Report Week
FR 2900 Report Week
FR 2900 Report Week
FR 2900 Report Week
Pre-Crisis Framework

How Do Banks Meet Reserve Requirements?

• Banks’ reserve requirement is to hold a cumulative amount of reserves over a two-week reserve maintenance period, within which daily balances can vary, although they should not be overdrawn – i.e. negative end-of-day balance in their reserve account.

• The two week period help smooth inter-day rate volatility over the maintenance period.
Pre-Crisis Framework
The Fed Funds Market

• Banks can buy and sell reserves with each other, which are known as “fed funds” trades. “Buying” funds (borrowing) adds reserves to a bank’s account but does not create a future reserve requirement obligation (Fed funds borrowed is not a reserve-able liability).

• A bank’s motivation to borrow reserves is to increase reserve balances, either to meet reserve requirements or to make payments or cover a daylight overdraft.

• Fed funds trades are uncollateralized and can be arranged directly or through brokers.

• Typical duration is one business day (overnight).

• DMM collects daily fed funds trade information from several fed funds brokers in order to compile and subsequently publish the “daily effective rate”: a weighted average of overnight brokered fed funds transactions.
Seeking Reserve Balance Equilibrium in a Pre-Crisis World

Supply and Demand

Federal Funds Rate

Reserve Action

A. Too high
   target
   Too low
   NONE

B. Too high
   target
   ADD

C. Too high
   target
   DRAIN

Demand for Balances

Supply of Balances

A. Too high
   target
   Too low
   NONE

B. Too high
   target
   ADD

C. Too high
   target
   DRAIN
## Selected Balance Sheet Items
### August 01, 2007

**USD, billions**

### Assets

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Securities held outright</td>
<td>791</td>
</tr>
<tr>
<td><em>U.S. Treasury securities</em></td>
<td>791</td>
</tr>
<tr>
<td><em>Federal agency debt</em></td>
<td>0</td>
</tr>
<tr>
<td><em>Agency MBS</em></td>
<td>0</td>
</tr>
<tr>
<td>Repurchase agreements</td>
<td>25</td>
</tr>
<tr>
<td>Loans</td>
<td>*</td>
</tr>
<tr>
<td>Other assets</td>
<td>58</td>
</tr>
<tr>
<td><strong>Total assets</strong></td>
<td>874</td>
</tr>
</tbody>
</table>

### Liabilities

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal Reserve Notes</td>
<td>777</td>
</tr>
<tr>
<td>Deposits **</td>
<td></td>
</tr>
<tr>
<td><em>Depository Institutions</em></td>
<td>17</td>
</tr>
<tr>
<td><em>Treasury General Account</em></td>
<td>5</td>
</tr>
<tr>
<td>Reverse repurchase agreements</td>
<td>32</td>
</tr>
<tr>
<td><em>Foreign official/international accounts</em></td>
<td>32</td>
</tr>
<tr>
<td>Other liabilities</td>
<td>9</td>
</tr>
<tr>
<td><strong>Total liabilities</strong></td>
<td>840</td>
</tr>
</tbody>
</table>

**Capital**

<table>
<thead>
<tr>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
</tr>
</tbody>
</table>

**Total liabilities and capital**

<table>
<thead>
<tr>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>874</td>
</tr>
</tbody>
</table>

*Less than $1 billion*

**(Reserve requirements less applied vault cash) = $7.7 billion.**

Sources: H.4.1, H.4.3 Federal Reserve Statistical Releases
How do Temporary Open Market Operations change reserve levels?

1. Fed conducts a one-week RP (adding) operation.
2. All awards go to “Dealer A”. Dealer A places securities with its clearing bank to pledge to FRBNY. FRBNY places electronic money (“reserves”) in its account at the clearing bank.
3. Clearing bank settles the RP by giving placing the reserves in Dealer A’s account and placing the collateral in the Fed’s account.
4. Viola! Dealer A’s clearing bank now has an increase in their reserve holdings.
5. Upon maturity, the collateral / reserve swap is reversed and reserves “disappear”
Seeking Reserve Balance Equilibrium in a Pre-Crisis World

Supply and Demand

<table>
<thead>
<tr>
<th>Demand for Balances</th>
<th>Supply of Balances</th>
</tr>
</thead>
</table>

Federal Funds Rate

- Too high
- Too low

Reserve Action

A. NONE
B. ADD
C. DRAIN

A. Demand for Balances is equal to Supply of Balances. Federal Funds Rate is at target. Reserve Action is NONE.

B. Demand for Balances is less than Supply of Balances. Federal Funds Rate is too high. Reserve Action is ADD.

C. Demand for Balances is greater than Supply of Balances. Federal Funds Rate is too low. Reserve Action is DRAIN.

Demand for Balances
Supply of Balances
Seeking Reserve Balance Equilibrium in a Pre-Crisis World
Autonomous factors result from various business activities conducted by the Federal Reserve banks. Such activities affect the assets and liabilities on the Fed’s balance sheet, i.e. the size of the Supply of Reserve Balances box in the see-saw.

These factors are called “autonomous” because they are beyond the Trading Desk’s control. Focus was on forecasting:
- currency in circulation
- Treasury accounts at the FRS
- foreign reverse repo accounts
Currency-in-circulation includes all paper currency (Federal Reserve notes) and coin.

Currency enters circulation through transactions between commercial banks and the Federal Reserve. When banks remove currency from the Fed, reserve balances decrease. When banks deposit currency into the Fed, reserve balances increase.

Currency demand is impacted by several factors, including:
  – Transaction needs
  – Opportunity cost of holding currency vs. reserves
The Federal Reserve acts as fiscal agent for the U.S. Treasury:
- Treasury Auctions
- Cash and Debt Management

The Treasury General Account (TGA) at the Federal Reserve facilitates receipt and payment of government funds. Funds held by Treasury at the Fed are funds that are not held by the banking system, thus TGA balances reduce reserve levels. The Desk forecasts balances of nearly 100 different Treasury accounts.

Pre-financial crisis, the Treasury maintained investment accounts at depository institutions in order to invest temporary excess cash and achieve its target TGA level.

In addition to the TGA, a Supplementary Financing Account (SFA) was created in September 2008. At its peak, the SFA totaled $560 billion but is currently zero.
The Federal Reserve provides payment, investment and custodial services to foreign central banks and international organizations.

Foreign central banks invest funds overnight in repurchase agreements with the System Open Market Account. An increase in the foreign RP pool reduces Fed balances.

Over 350 accounts for some 250 customers are eligible to participate in the foreign RP pool.
Forecasting Reserve Demand

Since “excess” reserves were not compensated, banks had a strong economic motivation to closely manage reserves.

Each morning, the DMM Desk received a report showing the prior business day’s reserve balance holdings broken out by the type of bank (e.g. Large vs. Small). The report also details large bank reserve balance holdings broken out by maintenance period-to-date as well presenting remaining reserve balance needs by bank for the maintenance period.

The DMM Desk gathered intelligence from extensive market contacts and relied on historical information to gauge demand on various “special days” such as:

- High Payment Flow (HPF) Days
- Friday effects (typically had a soft bias because reserve balances count for three calendar days)
- FOMC Rate Change Anticipation Effects

After forecasting Reserve Supply and Demand, DMM would then conduct a Temporary Open Market Operation to set the level of reserves each day.
Putting it All Together in a Pre-Crisis World

- DMM routinely conducted repo operations to control the level of reserves in the banking system. The provision of reserves was skewed so that relatively more reserves were provided on High Payment Flow days when demand was typically high.
• DMM needed to consider the size of repo operations to avoid operations that were too small (e.g. bid-to-cover > 30 to 1) or were too large (increased risk of an unsubscribed auction).

• To facilitate this, DMM met regularly with its “sister” staff, Treasury Market Practices, to discuss and plan outright purchases of Treasury securities, “POMO’s”, such that the system had an appropriate “short” position and planned RP operations were the “right” size.
Financial Crisis Emerges

Total Reserve Balances

$ Billions

*Indexed to 1/2/2009
Source: Federal Reserve H.4.1, FRBNY
BNP Paribas suspends funds because of subprime problems

Published: Thursday, August 9, 2007

PARIS — French bank BNP Paribas has suspended three of its funds on Thursday as problems in the U.S. subprime mortgage sector are preventing it from calculating their value.

BNP Paribas Investment Partners said in a statement that the decision affected its Parvest Dynamic ABS, BNP Paribas ABS Euribor and BNP Paribas ABS Eonia funds.

It said the valuation of the funds would resume as soon as liquidity returned to the market and added that in the continued absence of liquidity, additional information on the envisaged measures would be communicated to investors within a month.

A spokeswoman for BNP could not immediately comment on the latest net asset value of the three funds.

BNP shares were indicated down 2.6 percent.

"The complete evaporation of liquidity in certain market segments of the U.S. securitisation market has made it impossible to value certain assets fairly regardless of their quality or credit rating," it said.
FRS Crisis Emerges –2H 2007

August 17, 2007
FRS reduces the rate of DW loans from target + 100 bps to target + 50 bps. Tenors of loans are also extended to one month from overnight.

December 12, 2007
TAF auctions of DW credit are announced
Fed authorizes FX swap loans to the Bank of Canada, Bank of England, the ECB and the Swiss National Bank
FRS Crisis Emerges – 1H 2008

March 7, 2008
Single-tranche term RPs announced with stated intention to increase outstanding amounts to $100 billion
First SOMA Treasury bill sale announced along with intention to redeem future T bill maturities

March 11, 2008
Term Securities Lending Facility (TSLF) is announced
Increase in the size of TAF and FX swap facilities
<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 14, 2008</td>
<td>Fed lends $29 billion to JPMC to facilitate JPMC’s acquisition of Bear Stearns. Loan is non-recourse to JPMC and is backed by lower quality assets of Bear Stearns. <em>(Bear shareholders initially receive $2.00 per share which is later increased to $10.00 per share).</em></td>
</tr>
<tr>
<td>March 16, 2008</td>
<td>Primary Dealer Credit Facility (PDCF) is established</td>
</tr>
</tbody>
</table>
### Selected Balance Sheet Items
#### June 18, 2008
USD, billions

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Securities held outright</td>
<td>Federal Reserve Notes 787</td>
</tr>
<tr>
<td>U.S. Treasury securities 479</td>
<td>Deposits * *</td>
</tr>
<tr>
<td>Federal agency debt 0</td>
<td>Depository Institutions 24</td>
</tr>
<tr>
<td>Agency MBS 0</td>
<td>Treasury General Account 4</td>
</tr>
<tr>
<td>Repurchase agreements 134</td>
<td>Treasury Supplemental Financing Account 0</td>
</tr>
<tr>
<td>Loans</td>
<td>Reverse repurchase agreements 42</td>
</tr>
<tr>
<td>Primary Credit 13</td>
<td>Foreign official/international accounts 42</td>
</tr>
<tr>
<td>Primary Dealer Credit Facility 9</td>
<td>Other liabilities 6</td>
</tr>
<tr>
<td>Term Auction Facility 150</td>
<td>Total liabilities 863</td>
</tr>
<tr>
<td>Other assets * 118</td>
<td>Total liabilities and capital 903</td>
</tr>
<tr>
<td>Total assets 903</td>
<td></td>
</tr>
</tbody>
</table>

* Includes loan for Bear Stearns Loan and lending to other Central Banks under Swap Facilities
** (Reserve requirements less applied vault cash) = $6 billion.

Memo Item: Securities lent to dealers under term facility: $112 billion

Sources: H.4.1, H.4.3 Federal Reserve Statistical Releases
FRS Crisis Emerges – 2H 2008

September 7, 2008: FHFA places both FNMA and Freddie Mac in conservatorship

September 14, 2008: Lehman bankruptcy
Fed announces TSLF Schedule 2 operations

September 16, 2008: Fed lends AIG $85 billion under Section 13 (3) of the Federal Reserve Act

The Reserve Fund loses money invested with Lehman and “breaks the buck” sparking massive redemption requests for 2a-7 money funds
## FRS Crisis Emerges – 2H 2008

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>September 19, 2008</td>
<td>ABCP lending facility is announced</td>
</tr>
<tr>
<td>September 21, 2008</td>
<td>Goldman Sachs and Morgan Stanley become bank holding companies</td>
</tr>
<tr>
<td>September 24, 2008</td>
<td>FX Swap facility expanded to Australia, Denmark, Norway and Sweden. Brazil, Mexico, Singapore and South Korea will be added later</td>
</tr>
<tr>
<td>October 7, 2008</td>
<td>Commercial Paper Funding Facility (CPFF) is created</td>
</tr>
<tr>
<td>October 8, 2008</td>
<td>Additional $38 billion lent to AIG</td>
</tr>
</tbody>
</table>
## Selected Balance Sheet Items
**January 28, 2009**

USD, billions

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Securities held outright</td>
<td>Federal Reserve Notes 849</td>
</tr>
<tr>
<td>U.S. Treasury securities</td>
<td>Deposits *</td>
</tr>
<tr>
<td>Federal agency debt</td>
<td>Depository Institutions 740</td>
</tr>
<tr>
<td>Agency MBS</td>
<td>Treasury General Account 39</td>
</tr>
<tr>
<td>Repurchase agreements</td>
<td>Treasury Supplemental Financing Account 175</td>
</tr>
<tr>
<td>Loans</td>
<td>Reverse repurchase agreements 72</td>
</tr>
<tr>
<td>Primary Credit</td>
<td>Foreign official/international accounts 72</td>
</tr>
<tr>
<td>Primary Dealer Credit Facility</td>
<td></td>
</tr>
<tr>
<td>Term Auction Facility</td>
<td>Other liabilities 13</td>
</tr>
<tr>
<td>A M L F Facility</td>
<td>Total liabilities 1,888</td>
</tr>
<tr>
<td>C P F F Facility</td>
<td>Capital 41</td>
</tr>
<tr>
<td>Maiden Lane LLC (Bear Stearns) 26</td>
<td>Total liabilities and capital 1,929</td>
</tr>
<tr>
<td>AIG Loans</td>
<td></td>
</tr>
<tr>
<td>Maiden Lane II LLC 19</td>
<td></td>
</tr>
<tr>
<td>Maiden Lane III LLC 27</td>
<td></td>
</tr>
<tr>
<td>Other AIG Loans 38</td>
<td></td>
</tr>
<tr>
<td>Central bank liquidity swaps 466</td>
<td></td>
</tr>
<tr>
<td>Other assets 63</td>
<td></td>
</tr>
<tr>
<td><strong>Total assets</strong> 1,929</td>
<td></td>
</tr>
</tbody>
</table>

* (Reserve requirements less applied vault cash) = $26 billion.

**Memo Item:** Securities lent to dealers under term facility: $125 billion
Financial Crisis Emerges

Total Reserve Balances

$ Billions

*Indexed to 1/2/2009
Source: Federal Reserve H.4.1, FRBNY