Public Affairs 854
Spring 2009
University of Wisconsin-Madison

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Social Sciences 7418

The Financial and Economic Crisis Interpreted in a CC-LM Model

1. Background: Typical Financial Crisis

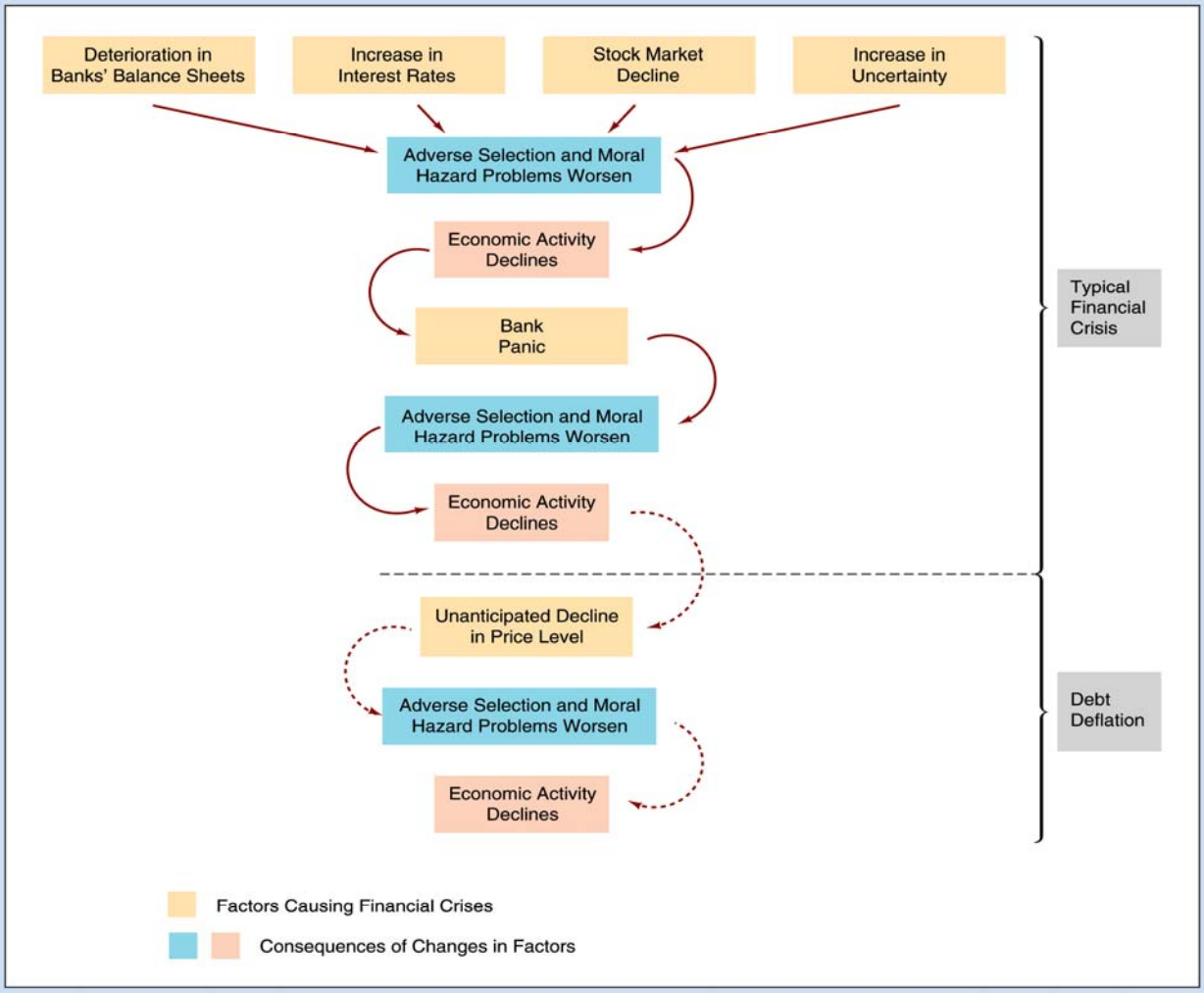


FIGURE 2 **Sequence of Events in U.S. Financial Crises**

Source: Mishkin

2. Theory: Interaction between Financial Sector and Real Sector (CC-LM)

Consider an economy where bank credit is imperfectly substitutable for bond finance, as in Bernanke and Blinder (1988), augmented by allowing the credit supply to depend on a shift variable, the "riskiness" of the marginal investment project. Banks hold liabilities of deposits. On

the asset side, the banks hold loans, reserves and either domestic government debt.

Loan demand is given by:

$$L^d = \underset{-++}{L(\rho, i, y)} \tag{1}$$

Loan supply is given by:

$$L^s = \underset{+--}{\lambda(p, i, Z)D(1-\tau)} \tag{2}$$

where Z is a measure of riskiness of the marginal investment project, and τ is the reserve ratio. The data generating process of Z is not modelled explicitly. The credit market equilibrium is given by equating loan supply and demand.

The money market equilibrium is given by equating the demand for deposits with the supply; hence the LM schedule is:

$$\underset{-+}{D(i, y)} = mR \tag{3}$$

where m is the money multiplier, and R is the stock of reserves. (Excess reserves are ignored in this analysis.) The money multiplier is assumed constant. Allowing it to depend positively on the interest rate does not change the qualitative conclusions.

The CC curve is a conventional IS curve, except that it depends upon the bank lending rate as well as the interest rate:

$$y = \underset{--}{Y(i, \rho)} \tag{1}$$

Substituting money market equilibrium into the loan market equilibrium yields:

$$L(\rho, i, y) = \lambda(\rho, i, Z)mR(1-\tau) \tag{2}$$

Solving for the equilibrium loan rate, ρ, one obtains:

$$\rho = \underset{++-+}{\varphi(i, y, R, Z)} \tag{3}$$

In this formulation, the spread between the bank loan rate and the risk free rate, ρ-i, is a positive function of Z, the riskiness of the marginal project. The CC schedule is obtained by substituting (6) into (4).

To solve out the model analytically, work with the semi reduced form equation representing the CC equation is:

$$y = Y(i, \rho) \tag{6'}$$

Taking the total differential yields:

$$dY = Y_i di + Y_\rho (\rho_i di + \rho_Y dY + \rho_R dR + \rho_Z dZ) \tag{7}$$

Rearranging:

$$dY(1 - Y_\rho \rho_Y) = (Y_\rho \rho_i + Y_i) di + Y_\rho \rho_R dR + Y_\rho \rho_Z dZ \tag{8}$$

The LM curve is obtained by differentiating (5):

$$\begin{gathered} dD = m(dR) = D_i di + D_Y dY \\ m \equiv D_R \end{gathered} \tag{9}$$

Solving for the deposit interest rate:

$$di = \frac{m(dR) - D_Y dY}{D_i} \tag{10}$$

Substituting (10) into (8):

$$dY\left[1 - Y_\rho \rho_Y + \frac{(Y_\rho \rho_i + Y_i) D_Y}{D_i}\right] = \left[\frac{(Y_\rho \rho_i + Y_i) m}{D_i} + Y_{\tilde{n}} \rho_R\right] dR + Y_\rho \rho_Z dZ \tag{11}$$

Solving for income:

$$\boxed{dY = \frac{1}{\Delta}\left\langle\left[\left(\frac{(Y_\rho \rho_i + Y_i) m}{D_i}\right) + Y_\rho \rho_R\right] dR + Y_\rho \rho_Z dZ\right\rangle} \tag{12.1}$$

where

$$\Delta \equiv \left[1 - Y_\rho \rho_Y + \frac{(Y_\rho \rho_i + Y_i) D_Y}{D_i}\right] \tag{12.2}$$

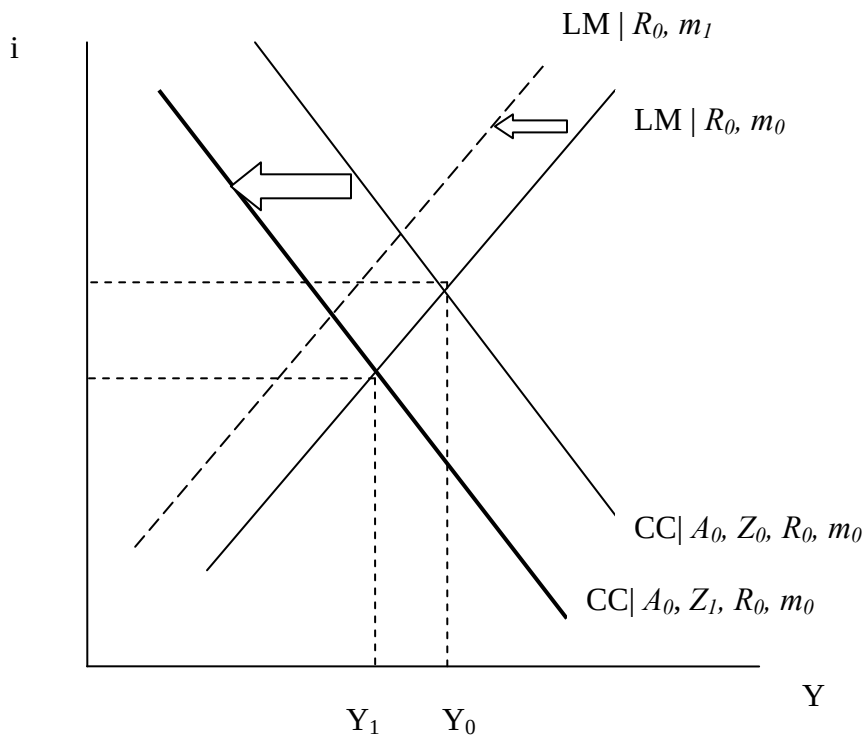
The comparative statics are summarized in the table below.

Table 1

Effects of Shocks on Observable Variables

	(1) Income	(2) Money	(3) Credit	(4) Interest Rate (on bonds)
1. Rise in bank reserves	+	+	+	-
2. Rise in money demand	-	+	-	+
3. Rise in credit supply	+	+	+	+
4. Rise in credit demand	-	-	+	-
5. Rise in commodity demand	+	+	+	+

Source: Bernanke and Blinder (1988)

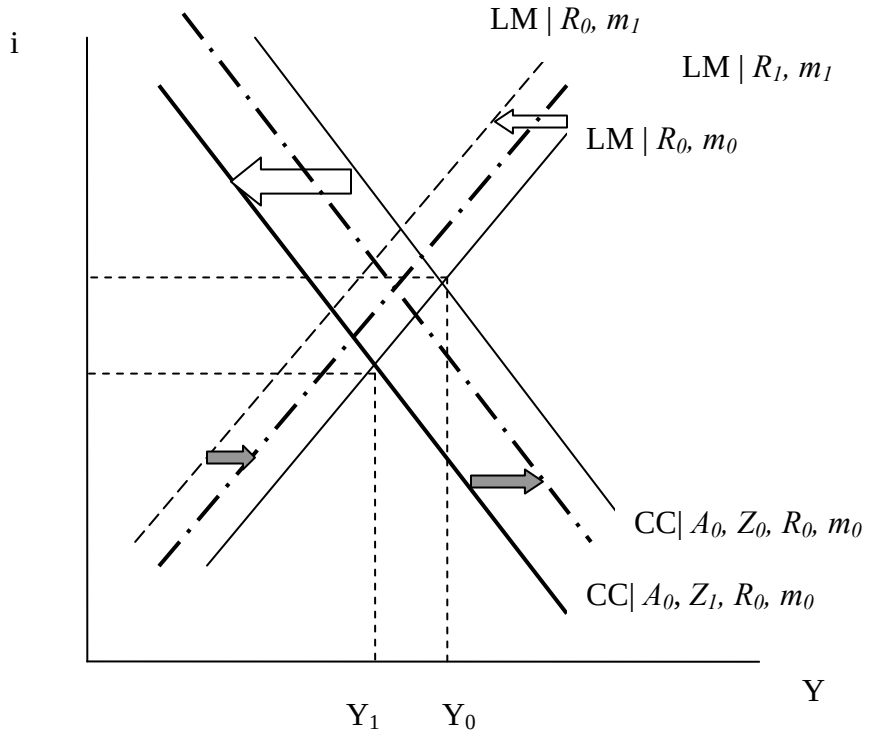


- If riskiness of the marginal investment project rises (Z), the CC curve shifts in.
- If the money multiplier (*m*) falls, both the CC *and* LM curves shift in.
- If some financial institutions fail, both the CC *and* LM curves shift in.

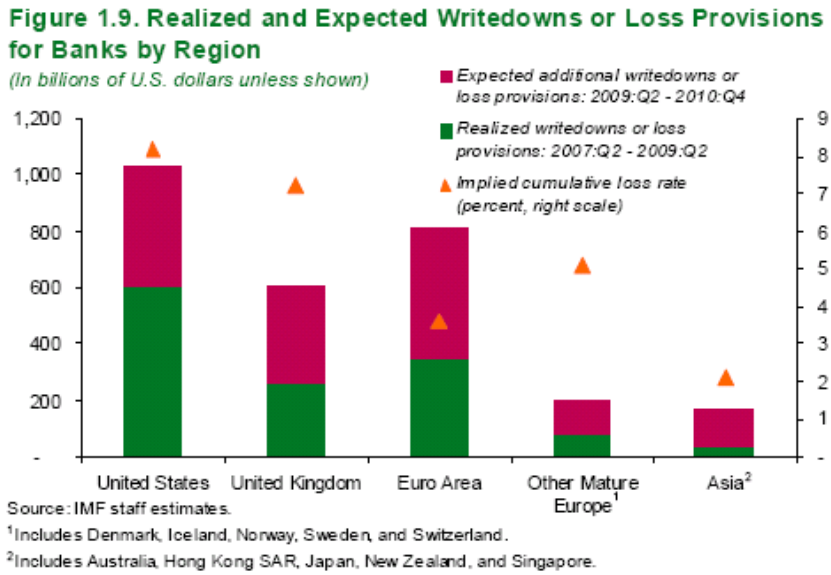
Here, we take Z as exogenous. But if Z depends upon the level of economic activity, then one

could have an adverse feedback loop, wherein the initial shift inward of CC results in an additional increase in Z and hence further inward shift of CC.

If either financial institutions fail, or the monetary multiplier falls, then the monetary authorities can either increase Reserves, or directly lend to the financial institutions. This is shown below as a shift outward of the LM curve, and of the CC curve (gray arrows).



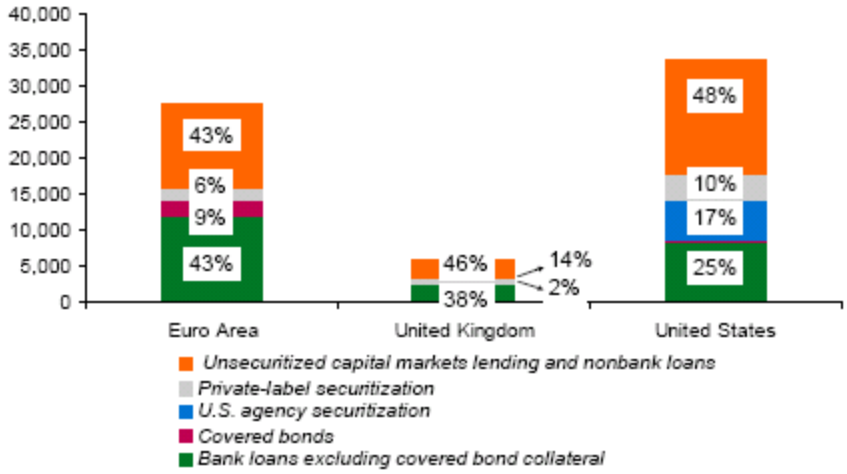
3. Actual Data *3.1 Writedowns*



Source: IMF, 2009, *GSFR* (October 2009).

The Credit Crunch of Lending in the Euro Area, United Kingdom, and United States, as of 2009:Q1

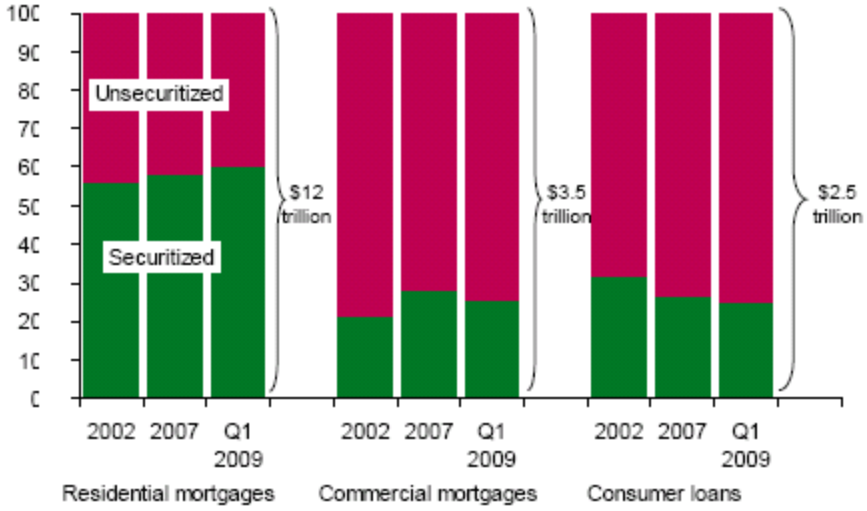
(In billions of U.S. dollars)



Sources: National authorities; and IMF staff estimates.

Share of Securitization in Select U.S. Credit Classes

(In percent)



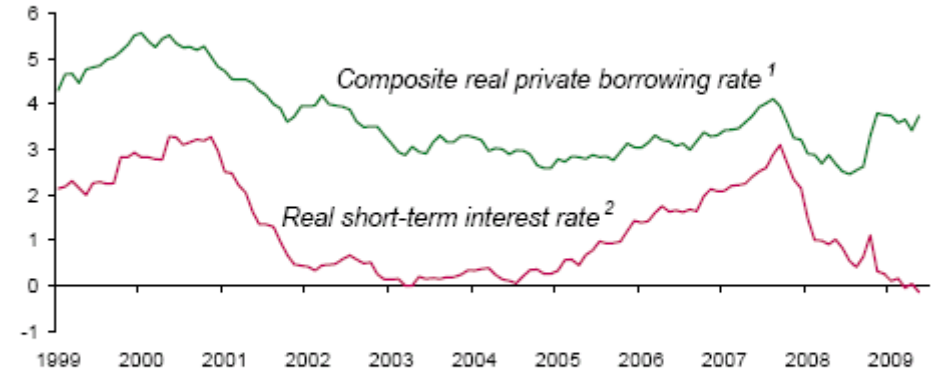
Sources: U.S. Federal Reserve, *Flow of Funds;* and IMF staff estimates.

IMF, 2009, *GFSR* (Box 1.2).

3.2 Lending Rates

Figure 1.6. Composite Real Private Borrowing Rate and Short-Term Interest Rates

(In percent)



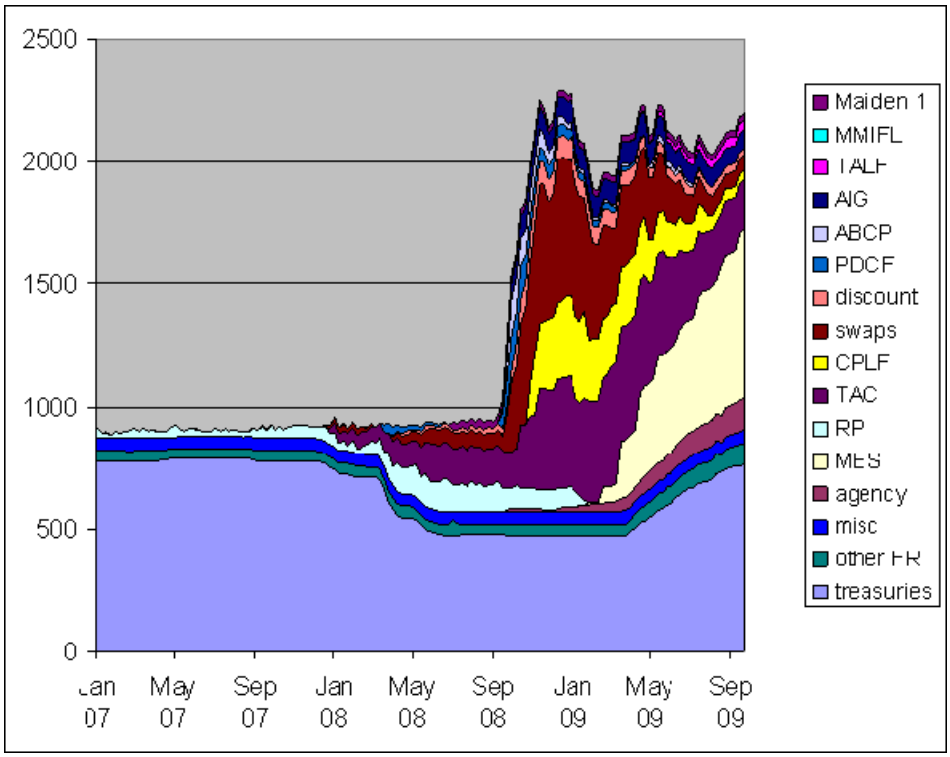
Sources: Bloomberg L.P., European Central Bank; European Securitisation Forum; U.S. Federal Reserve; Haver Analytics; and IMF staff estimates.

[1]The composite real private borrowing rate (RPBR) is a GDP-weighted average of the U.S., Japan, euro area and U.K. RPBRs. The component RPBRs are calculated as the average of nominal bank mortgage, consumer, and corporate lending rates, and corporate bond and mortgage- and asset-backed security yields, weighted by amounts of credit outstanding, minus year-on-year consumper price index.

[2]GDP-weighted average of G-7 short-term interest rates, one-month rolling.

IMF, 2009, *GFSR*, p.4.

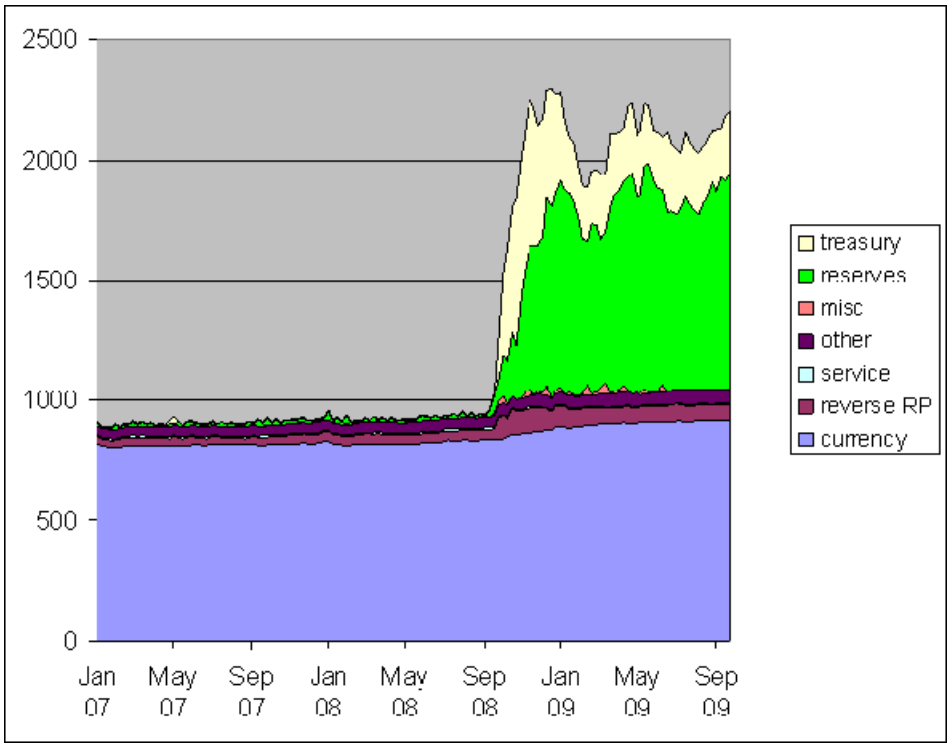
3.3 Monetary Response



Factors supplying reserve funds, in billions of dollars, seasonally unadjusted, from Jan 1, 2007 to September 23, 2009. Wednesday values, from Federal Reserve H41 release. Agency: federal agency debt securities held outright; swaps: central bank liquidity swaps; Maiden 1: net portfolio holdings of Maiden Lane LLC; MMIFL: net portfolio holdings of LLCs funded through the Money Market Investor Funding Facility; MBS:

mortgage-backed securities held outright; CPLF: net portfolio holdings of LLCs funded through the Commercial Paper Funding Facility; TALF: loans extended through Term Asset-Backed Securities Loan Facility; AIG: sum of credit extended to American International Group, Inc. plus net portfolio holdings of Maiden Lane II and III; ABCP: loans extended to Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility; PDCF: loans extended to primary dealer and other broker-dealer credit; discount: sum of primary credit, secondary credit, and seasonal credit; TAC: term auction credit; RP: repurchase agreements; misc: sum of float, gold stock, special drawing rights certificate account, and Treasury currency outstanding; other FR: Other Federal Reserve assets; treasuries: U.S. Treasury securities held outright.

Source: J. Hamilton, Econbrowser, Sept. 27, 2009.



Factors absorbing reserve funds, in billions of dollars, seasonally unadjusted, from Jan 1, 2007 to September 23, 2009. Wednesday values, from Federal Reserve H41 release. Treasury: sum of U.S. Treasury general and supplementary funding accounts; reserves: reserve balances with Federal Reserve Banks; misc: sum of Treasury cash holdings, foreign official accounts, and other deposits; other: other liabilities and capital; service: sum of required clearing balance and adjustments to compensate for float; reverse RP: reverse repurchase agreements; Currency: currency in circulation.

Source: J. Hamilton, Econbrowser, Sept. 27, 2009.

References

Bernanke, B. and A. Blinder, 1988, "Credit, money, and aggregate demand," *American Economic Review* 78 (May): 435-39.

D. Greenlaw, J. Hatzius, A.K. Kashyap, H.S. Shin, 2008, “Leveraged Losses: Lessons from the Mortgage Market Meltdown,” mimeo (February).

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