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

1. Background: Typical Financial Crisis

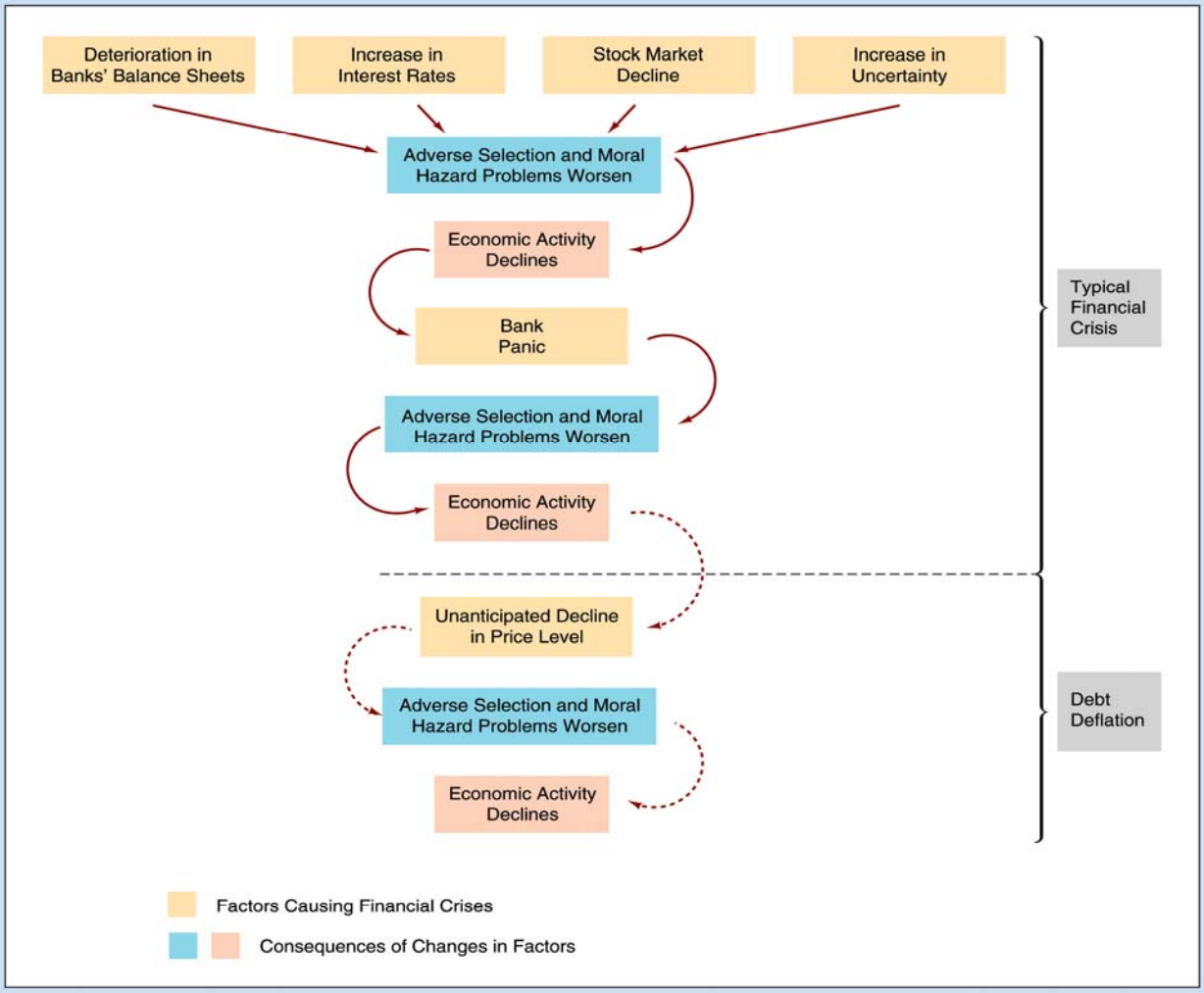


FIGURE 2 **Sequence of Events in U.S. Financial Crises**

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:

$$L^d = L(\rho, i, y) \qquad (1)$$
$$- + +$$

Loan supply is given by:

$$L^s = \lambda(p, i, Z)D(1-\tau) \qquad (2)$$
$$+ - -$$

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:

$$D(i, y) = mR \qquad (3)$$
$$- +$$

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:

$$y = Y(i, \rho) \qquad (1)$$
$$- -$$

Substituting money market equilibrium into the loan market equilibrium yields:

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

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

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

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

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

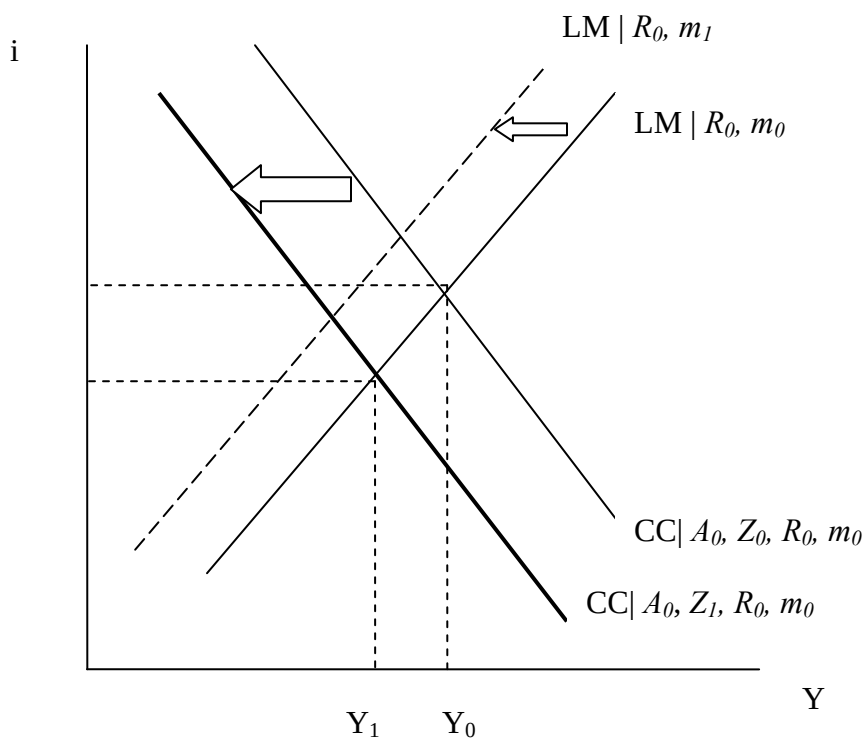
The comparative statics are summarized in the table below.

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	+	+	+	+

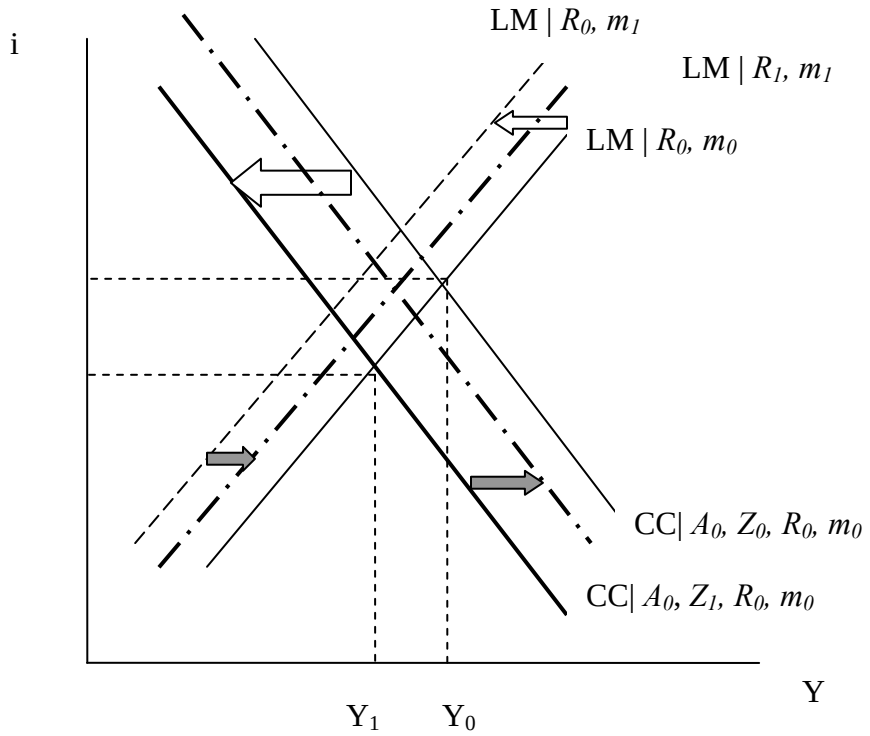
Source: Bernanke and Blinder (1988)



- 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 and Thinking about Balance Sheets

A little more detail on the balance sheet of the United States pre-crisis.

3.1 Reading Balance Sheets of a typical bank before and after a negative shock to assets

Commercial Bank (Before)			
Assets		Liabilities	
Reserves	$10M	Deposits	$90M
Loans (Mortgages, CRE) T-Bills Other bonds (GSEs)	$90M	Bank Capital (or "equity"	$10M

Commercial Bank (After)			
Assets		Liabilities	
Reserves	$10M	Deposits	$90M
Loans (Mortgages, CRE) T-Bills Other bonds (GSEs)	$80M	Bank Capital (or "equity")	$00M

3.2 Balance sheets of the financial sector before the collapse of Lehman

Exhibit 4.5 Leverage of Various Financial Institutions

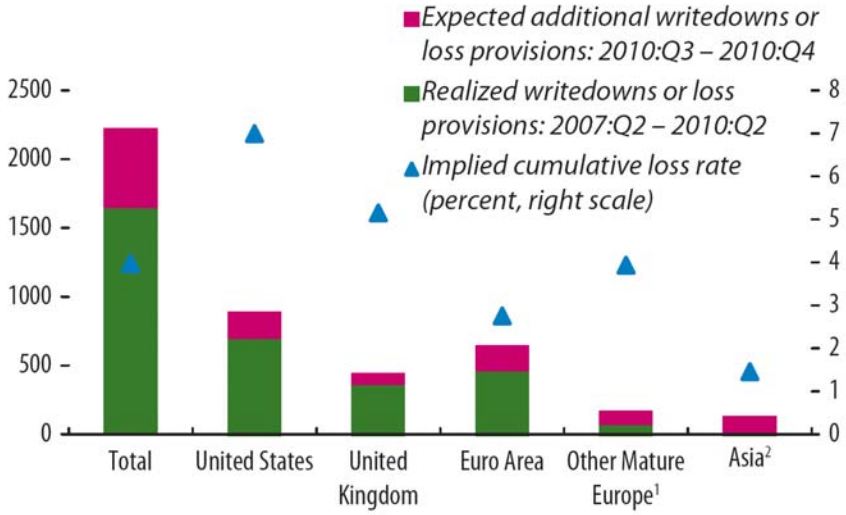
	Assets ($bn)	Liabilities ($bn)	Capital ($bn)	Leverage
Commercial banks	10793	9693	1100	9.8
Savings Inst	1914	1687	227	8.4
Credit Unions	748	659	89	8.4
Brokers/hedge funds	5397	5226	171	31.6
GSEs	1633	1567	66	24.7
Leveraged Sector	**20485**	**18804**	**1681**	**12.2**

Source: Authors' calculations based on Flow of Funds, FDIC Statistics on Banking, Adrian and Shin (2007), and balance sheet data for Fannie Mae, Freddie Mac, and broker-dealers under Goldman Sachs equity analysts' coverage.

Source: Greenlaw et al. (2008)

3.3 Loan loss magnitudes

Figure 1.12. Bank Writedowns or Loss Provisions by Region
(In billions of U.S. dollars unless indicated)



Source: IMF staff estimates.
[1]Includes Denmark, Iceland, Norway, Sweden, and Switzerland.
[2]Includes Australia, Hong Kong SAR, Japan, New Zealand, and Singapore.

Source: IMF, 2010, *Global Financial Stability Report* (Washington, DC: October).

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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