

Measuring and Forecasting Financial Stability

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„Distress in the Financial Sector and Economic Activity“

Distress in the Financial Sector and Economic Activity

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Board of Governors of the Federal Reserve

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Overview

- Financial intermediaries play an important role in transferring resources from investors to borrowers.
- As concern about the health of these institutions increases, their ability to intermediate the flow of credit may be reduced.
- As borrowers find it more difficult or more expensive to obtain credit, activities requiring credit will be scaled back.
- This lack of financial intermediation both creates and amplifies existing shocks to economic activity
- Also examine how this potential lack of intermediation influences monetary policy

Some Relevant Literature

Considerable empirical support for the notion that the health of the financial sector matters for real economic activity

- Hubbard, Kuttner, and Palia (2002): Less well capitalized banks tend to charge higher loan rates
- Guiso, Kashyap, Panetta, and Terlizzese (2002): measures of bank health are useful instruments for the interest rates banks charge on loans
- Gibson (1995): Declines in health of Japanese banks resulted in lower investment by Japanese customers

This Work

This presentation is composed of work done in one paper and several memos:

- Examine how financial stress affects economic activity, via its effects on the investment channel.
 - From distributed paper and older memos
 - Shows direct effects of financial stress on investment and profits, as well as indirect effects via the amplification of non-financial shocks
- Examine how the health of the financial sector influences monetary policy
 - From most recent memo
 - “Taylor rule” with financial health
 - Attempt to think about the quantity of easing needed to offset large financial stresses

Basics of Financial Health Index

- Goal is to build a measure based on distance to default in the style of Merton (1974), similar to Moody's KMV
 - Use equity prices and volatilities, as well as liabilities to infer the health of the financial sector
- Firms:
 - 25 largest by assets (via COMPUSTAT) in each quarter 1973 to present
 - Depository institutions, non-depository credit institutions, securities and commodities broker/dealers, and their holding companies
 - No insurance companies or GSEs
 - Totals about 70 firms
 - Commercial banks roughly 2/3 of sample

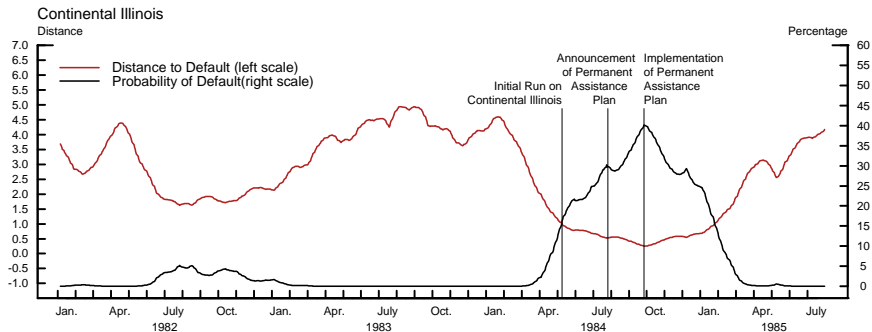
Individual Firm Calculations

- Daily Information: Equity prices, exponentially-weighted realized volatilities of equity price, liabilities (linearly interpolated)
- Using strategies from Merton (1974):
 - Label equity as a call option on market value of the assets of the firm (V_t), where liabilities (D_t , the book value of firm's debt) is the strike price of the option.
 - Allows us look at the market-implied solvency of the firm using options pricing
 - Think about a Z-score distance to default that comes from the level of V_t relative to D_t , given the volatility of V_t :

$$\text{Distance} = \frac{V_t - D_t}{\sigma_{V_t}}$$

- Daily values allow for easy real-time analysis

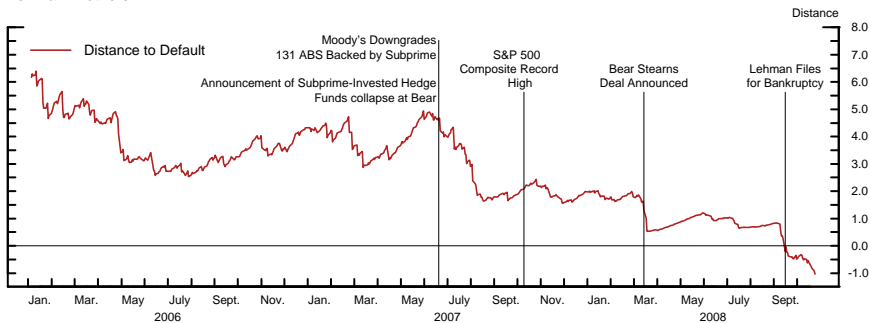
An Example: Continental Illinois



- Experienced difficulties associated with bad loans related to the oil boom of the late 1970's, suffered a bank run in May, 1984
- FDIC orchestrated an open-bank resolution plan which was implemented in September 1984

An Example: Lehman Brothers

Lehman Brothers



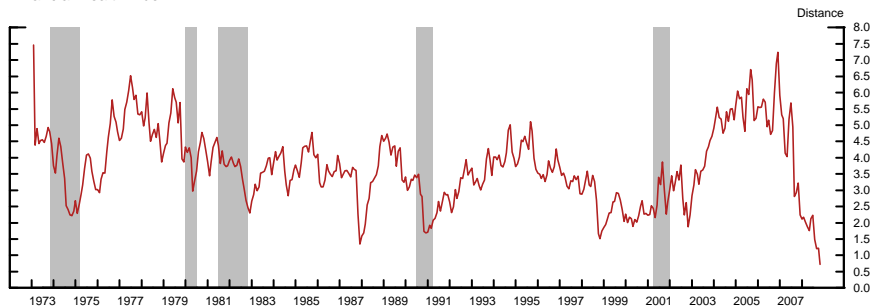
- Large struggles culminated over the busy 9/13-9/14 weekend, filed for bankruptcy Monday 9/15/2008
- Similar dips in distance to default for many firms for the events listed

Individual Firms to an Index

- Index is median distance to default of the top 25
- Changes in the constituency of the index tend to be small
 - Approximately 3 institutions turn over on average each year
- Index is not the probability of joint default, but an indicator of financial sector “health”
 - “Default” as a technical term should not be taken too seriously
 - As this “distance to default” shrinks for a given firm, it is clear that the firm will be more and more capital constrained; enough firms in this situation is a serious impediment to financial intermediation
 - Median vs. mean or weighted mean

Financial Health Index

Financial Health Index



- Reached a new low in September 2008, continues to move down
- Likely understates depth of current crisis
- Recession effects

Notes on Financial Health Measure

- Separating Commercial Banks and Non-Commercial-Bank Financial Institutions does not seem to matter
 - Recall 2/3 of firms commercial banks
 - Correlation on the two mutually exclusive indexes is 0.84
- By affecting the availability of credit, we expect that the measure of financial health affects investment

A Connection with Real Economy: Standards

- Granger Causality:

- Index appears to Granger cause tightening in both commercial and consumer lending standards

Direction	χ^2 statistics	Prob $> \chi^2$
Index on Standards	15.15	0.001
Standards on Index	1.33	0.514

VAR Study of Financial/Real Interaction

- Two VAR models:
 - Model from paper, looks at profits and investment in the presence of financial stress
 - Model from recent memo, looks at how monetary policy is affected by financial sector health
 - Used 4-variable, 2-lag VAR models in both cases
 - First model uses quarterly data, second model uses monthly data

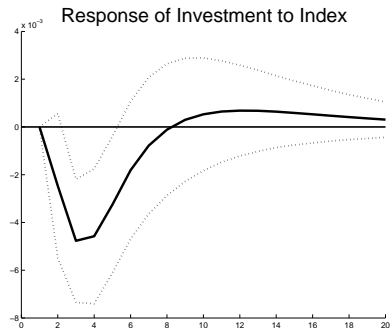
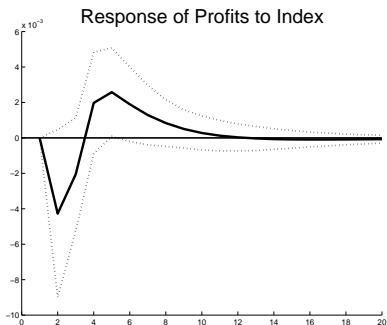
VAR Specification (A)

- Four variables, Two lags
 - Nonresidential Investment
 - Corporate Profits
 - First Principle Component of Corporate Bond Spreads
 - Our Financial Health Index
- Quarterly data
 - 1973:1 - 2008:2
 - Include intercept breaks in 1984
- Investment channel results robust to:
 - Inclusion of: interest rates, inflation, consumption, unemployment, GDP, productivity
 - Changes in lag length
 - Changes in sample length

Structural Assumptions

- Baseline ordering of shocks:
 - (1) Profits
 - (2) Investment
 - (3) Financial health index
 - (4) Spreads
- Index and spreads highly correlated
 - Ordering matters for their relative importance
 - But, results are qualitatively similar
 - The *joint* importance of the two variables is robust to their ordering

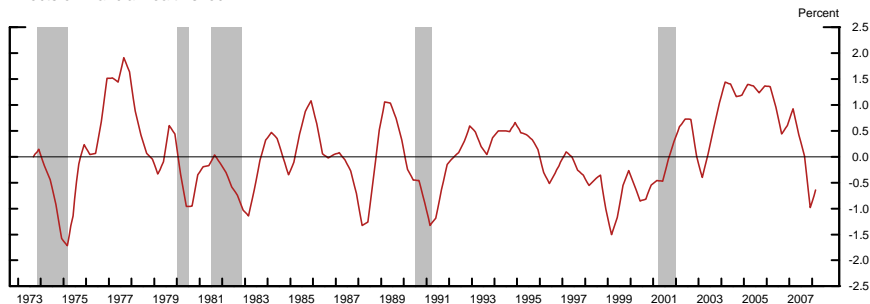
Impulse Response



- Investment is main transmission channel, though profits are affected directly as well
- Shocks to financial health index account for 12% of the variance of investment, 4% for profits

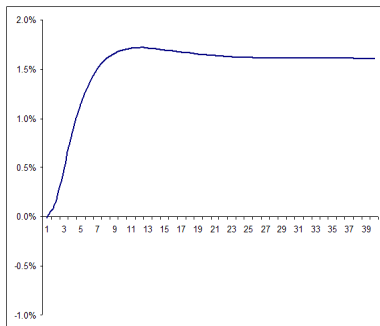
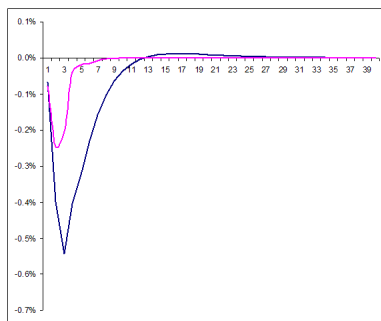
Direct: Financial Health and Investment Growth

Effects of financial health shock



- Effects of shocks to the financial sector on investment growth over the sample
- Swings of 1 to 2 percent (quarterly basis)
- Drags investment down during most recessions

Feedback & Amplification: Profit Shock



- Within 5 years, the effect is just over 2% cumulative loss to level of investment, or 70% of the total investment that was lost
 - One-standard deviation exogenous shock to profits
 - Compare the difference between the normal model, and a model where the financial variables have no effects on the real variables

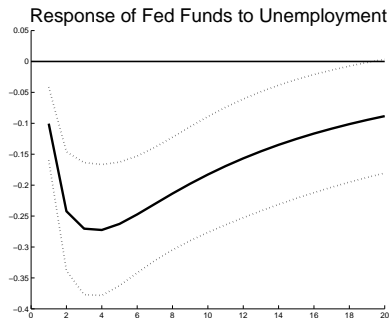
VAR Model (A) Summary

- Investment channel does seem to convey financial stress to “real side” economic activity
- Shocks to financial variables can move investment directly
 - Profits less so
- Shocks to a non-financial variable can be amplified through the financial health channel to have a much greater effect.
 - Financial stress can dramatically exacerbate transmission of non-financial shocks

VAR Specification (B)

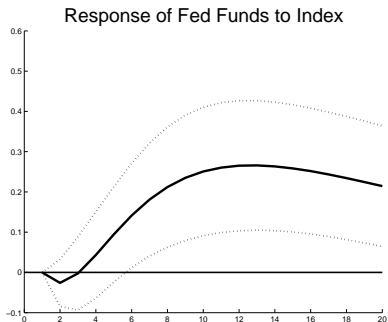
- Trying to extract the effect of financial stress (quantified by the index) in a “Taylor Rule” model
- Four variables, Two lags
 - Civilian Unemployment
 - Effective Fed Funds Rate
 - Inflation
 - Our Financial Health Index
- Filtered to remove trends via very low frequency HP filter
- Monthly data
 - 1979:10 - 2008:10

A Shock to Financial Health



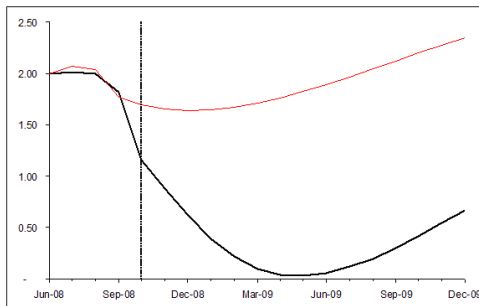
- Financial health affects unemployment
- The Fed responds to unemployment
- Index $\uparrow \implies$ Unemp $\downarrow \implies$ Fed Funds \uparrow

Policy-Financial Health Connection



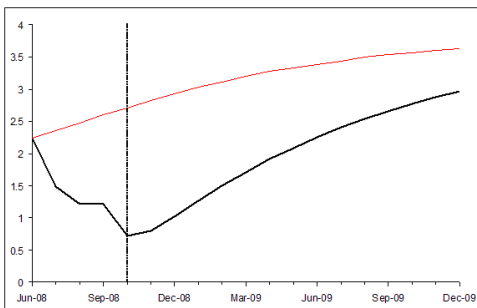
Net result is that the effective Fed funds is affected by the level of financial stress

Counterfactual: Fed Funds



- Black line is forecast for Fed Funds (Effective) moving forward
- Red line is counterfactual that shows what the projections would be had the unanticipated financial shocks of July-October not occurred.
- Financial shocks over last 4 months will result in a further 200 basis points of easing

Counterfactual: Index



- Same Counterfactual: financial shocks removed from July onward

Conclusions

- Model A suggests that:
 - Deterioration in the health of financial sector reduces, in a measurable way, its ability to intermediate credit
 - Constructed a measure of financial health and determined that this health has an effect on corporate investment
 - Assert that financial stress leads to tighter credit conditions, which causes the connection we observe regarding corporate investment
 - In addition to a direct effect on investment, financial stress demonstrated the ability to multiply the effect of non-financial shocks
- Model B suggests that:
 - Financial stress has strong implications for monetary policy through unemployment channel

Probability and Distance

- Distance is number of standard deviations between market value of assets (V) and book value of debt (D).
 - Suppose $Dist = 0.5$:
 - This means the distance between value of assets and debt is one half the size of a standard deviation of the value of assets over the time horizon of interest (one year in our case)
- “Probability of Default” is a non-linear transformation of the distance based on several assumptions:
 - Return on assets moving forward
 - Model assumptions about time frame

Can think of probability as a good non-linear transformation to emphasize the non-linear nature of the difficulty a financial institution is in when the market value of its assets approaches the value of its debt

Probability and Distance

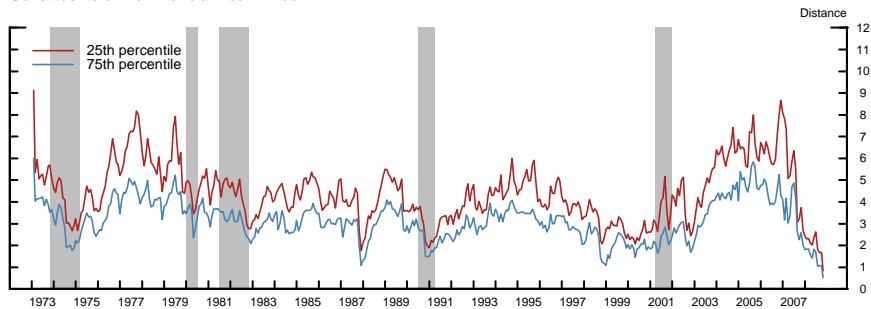
Actual formula from the Merton model:

$$p_t = Pr \left[- \frac{\ln \frac{V}{D} + \left(\mu - \frac{\sigma^2}{2} \right) t}{\sigma \sqrt{t}} \geq \varepsilon \right]$$

where: V is the value of assets, σ is the volatility of assets, D is the book value of debt (liabilities), and μ is the expected return on assets over the given time horizon.

Constituents of the Index

Constituents of the Financial Health Index

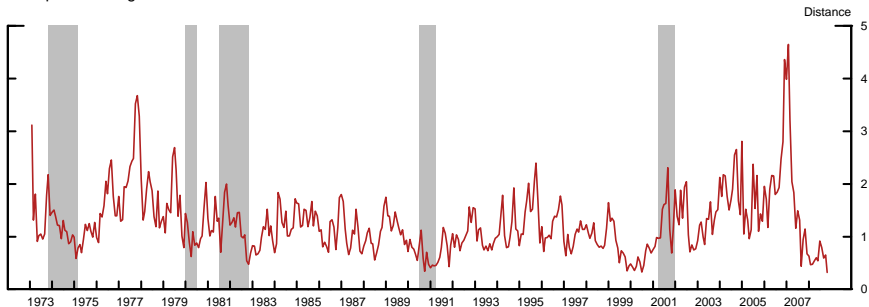


- Hope for independence between IQR and index:

- Indicates that some firms are taking advantage of the weakness of their rivals
- Alternative sources of funding for economic activity that requires borrowing

Inter-quartile Range

Interquartile Range of Financial Health Index



- IQR usually goes down during recessions as well
- Index and IQR tend to move together
 - Correlation ≈ 0.8

Weekly Index

