Measuring and Forecasting Financial Stability

Workshop by Deutsche Bundesbank and Technische Universität Dresden
Dresden, 15-16 January 2009

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„Estimating the Market Value of the Implicit Guarantee to Fannie Mae and Freddie Mac Using Contingent Claims“

Estimating the Market Value of the Implicit Guarantee to Fannie Mae and Freddie Mac Using Contingent Claims

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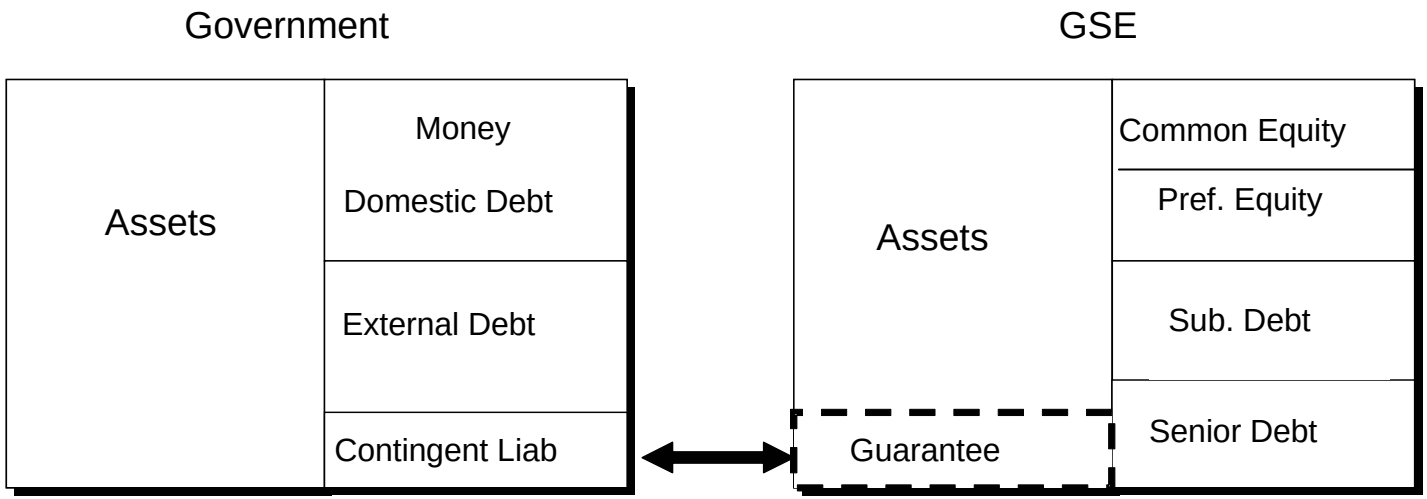
The Merton Model, and MKMV

- Derives an “expected default frequency” (EDF)
- Uses market information, not judgmental ratings or historical transition frequencies
- EDF is a function of
  - Firm’s capital structure
  - Current implied asset value
  - Uncertainty, or volatility, of asset return
- Three-step approach
  - Estimate value and volatility of firm assets
  - Calculation of “distance to default”
  - Scale “distance to default” into probability of default

Purpose: Extend the Merton Model beyond EDF. Create a market value estimate of any implicit guarantee.



- Estimating expected market loss given default
- Equivalent to value of any guarantee
- Stability is dependent on understanding risk transfer
- Fannie and Freddie provide a good example

Contingent Claims Analysis

- Equity as a call option on firm assets

$$V_E = V_A N\left(d_1\left(DB_3\right)\right) - DB_3 e^{-r_f \tau} N\left(d_2\left(DB_3\right)\right)$$

  - DB_3 is the distress barrier on senior, subordinated, and preferred equity

- Also use the following relationship

$$\sigma_E V_E = \sigma_A V_A N\left(d_1\right)$$

- Solve the two equations for V_A and σ_A

Contingent Claims Analysis

- Distance to Minimum Capital

$$D2MC = d_2\left(DB_3\right) = \frac{\ln\left(V_A * \exp\left(\left(r_f - \frac{1}{2}\sigma_A^2\right)\tau\right)\right) - \left(\ln DB_3\right)}{\sigma_A\sqrt{\tau}}$$

- Distance to Default on Senior Debt

$$D2D = d_2\left(DB_1\right) = \frac{\ln\left(V_A * \exp\left(\left(r_f - \frac{1}{2}\sigma_A^2\right)\tau\right)\right) - \left(\ln DB_1\right)}{\sigma_A\sqrt{\tau}}$$

Beyond EDF:
Valuing the Guarantee

Value of senior debt has two components

1. Pure default-free value

2. Default risk
   - Shareholders put assets to the debt holders in the event of default
   - Expected loss = promised payments – market value of assets
   - Amount of expected loss is an *implicit put option* on firm assets with debt as the strike price

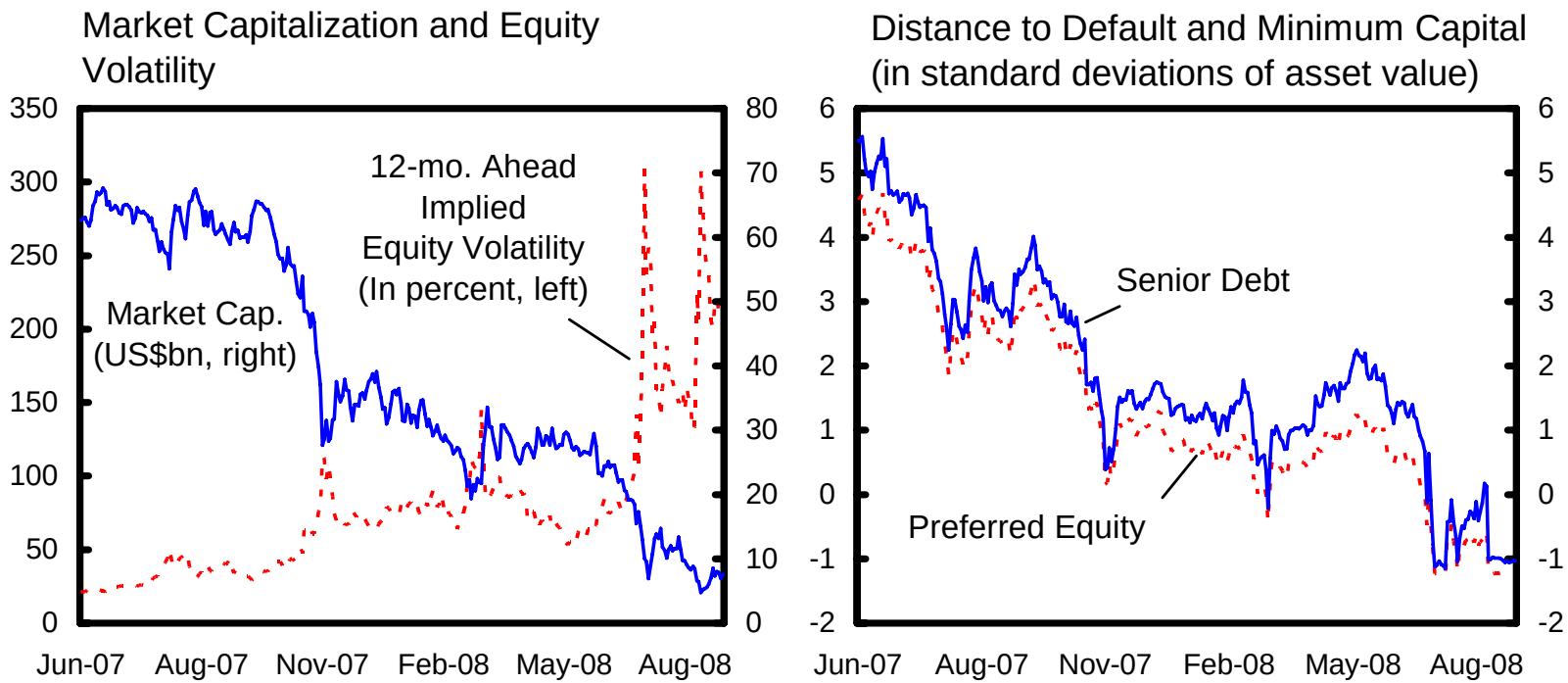
Valuing the Implicit Guarantee

- Any guarantee against default would need to offset expected loss on senior liabilities
  - Risky debt = default free value – expected loss
  - *Risky debt = default-free debt – implicit guarantee*

$$V_{SL} = DB_1 e^{-r_f \tau} - \left[DB_1 e^{-r_f \tau} N\left(-d_2\left(DB_1\right)\right) - V_A N\left(-d_1\left(DB_1\right)\right) \right]$$

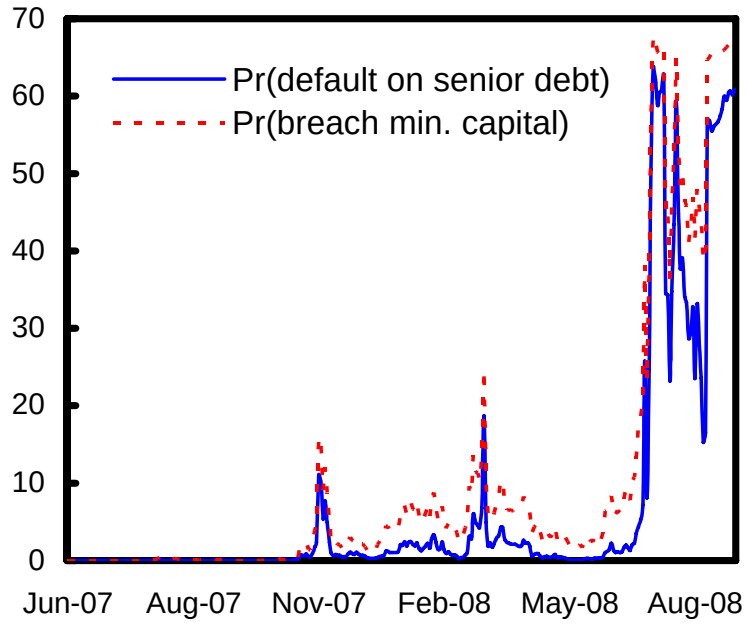
- Paper also develop measures for expected capital losses (preferred equity and sub debt)

Case Study: Fannie Mae

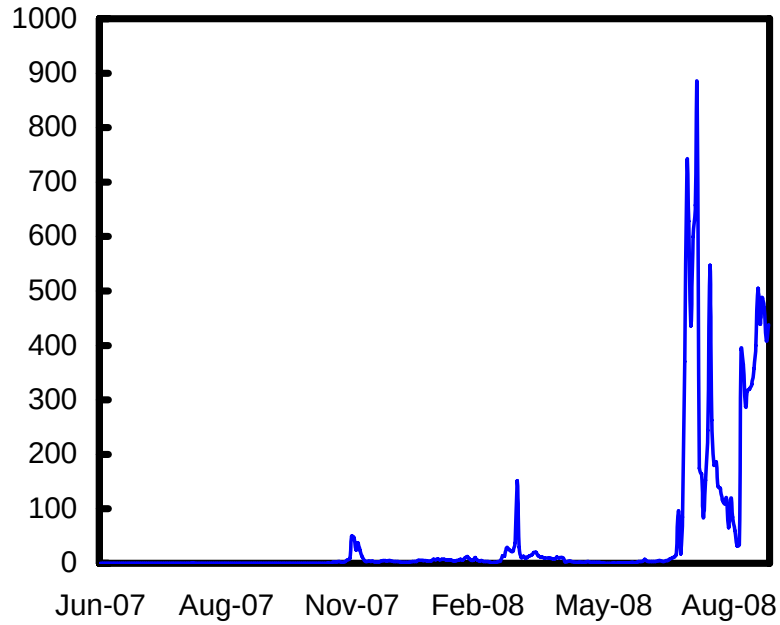


Case Study: Fannie Mae

Estimated Actual Probabilities
(in percent)

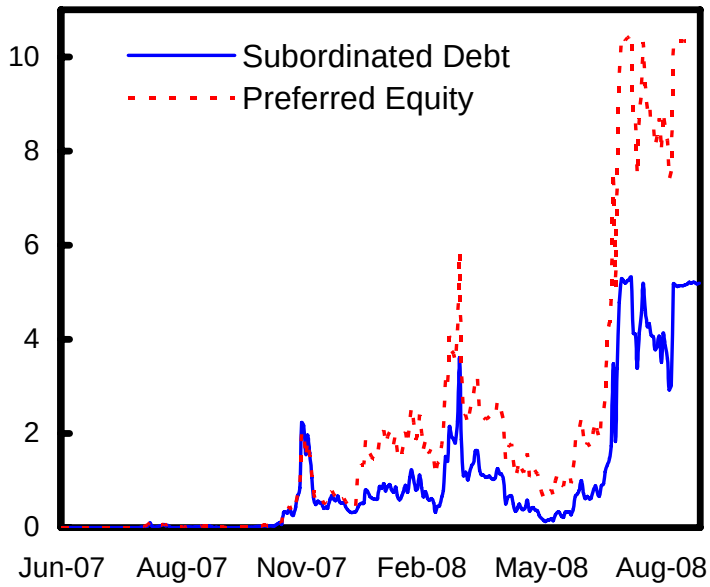


Estimated Implied CDS spreads:
Senior Debt (in basis points)

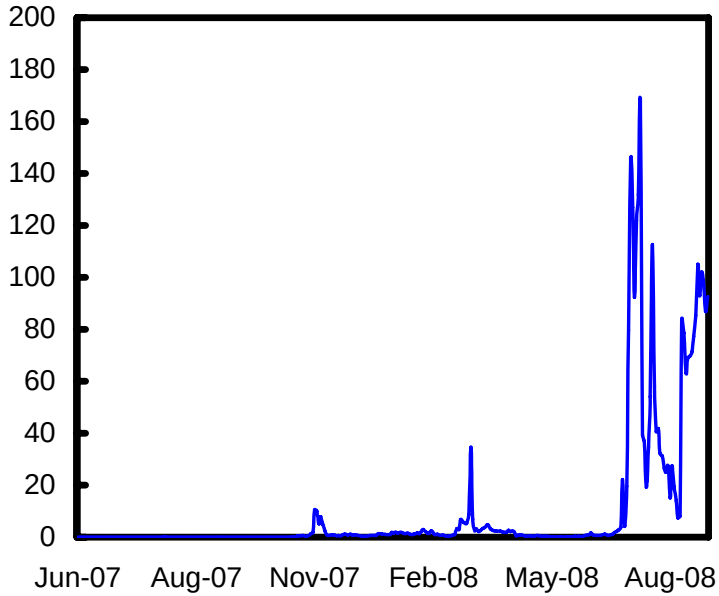


Case Study: Fannie Mae

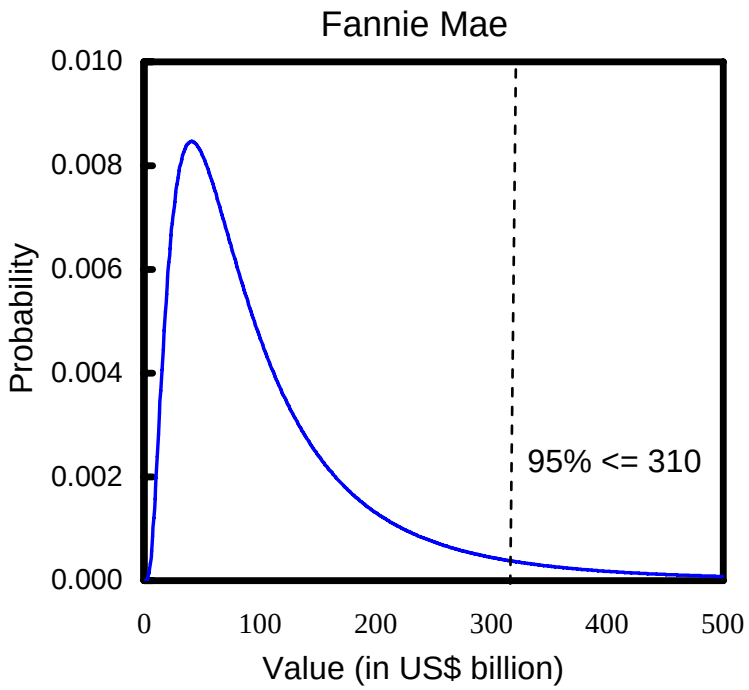
Expected Loss: Subordinated Debt and Preferred Equity (in US$ billions)

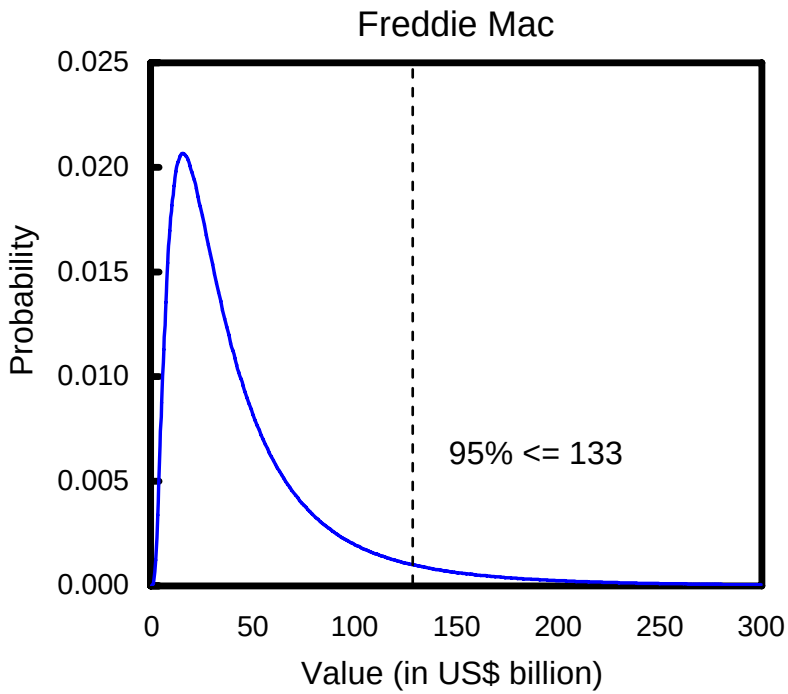


Expected Loss: Senior Debt (in US$ billions)



Case Study: Fannie Mae and Freddie Mac





Contingent Claims Analysis: Final Thoughts

- Based on market data, structural approach
- Requires less data input
- Incorporates nonlinearities
- From Risk-neutral to implied actual

  Yet this route isn't needed for valuing expected losses
- Useful for risk analysis and implicit guarantees
- Understanding risk transfer, which underlies financial stability

Contingent Claims Analysis: Banks

Figure 2 Volatile Assets Relative to Debt Distress Barrier and "Minimum Capital Barrier"