
PD and LGD Modeling in the Current Environment



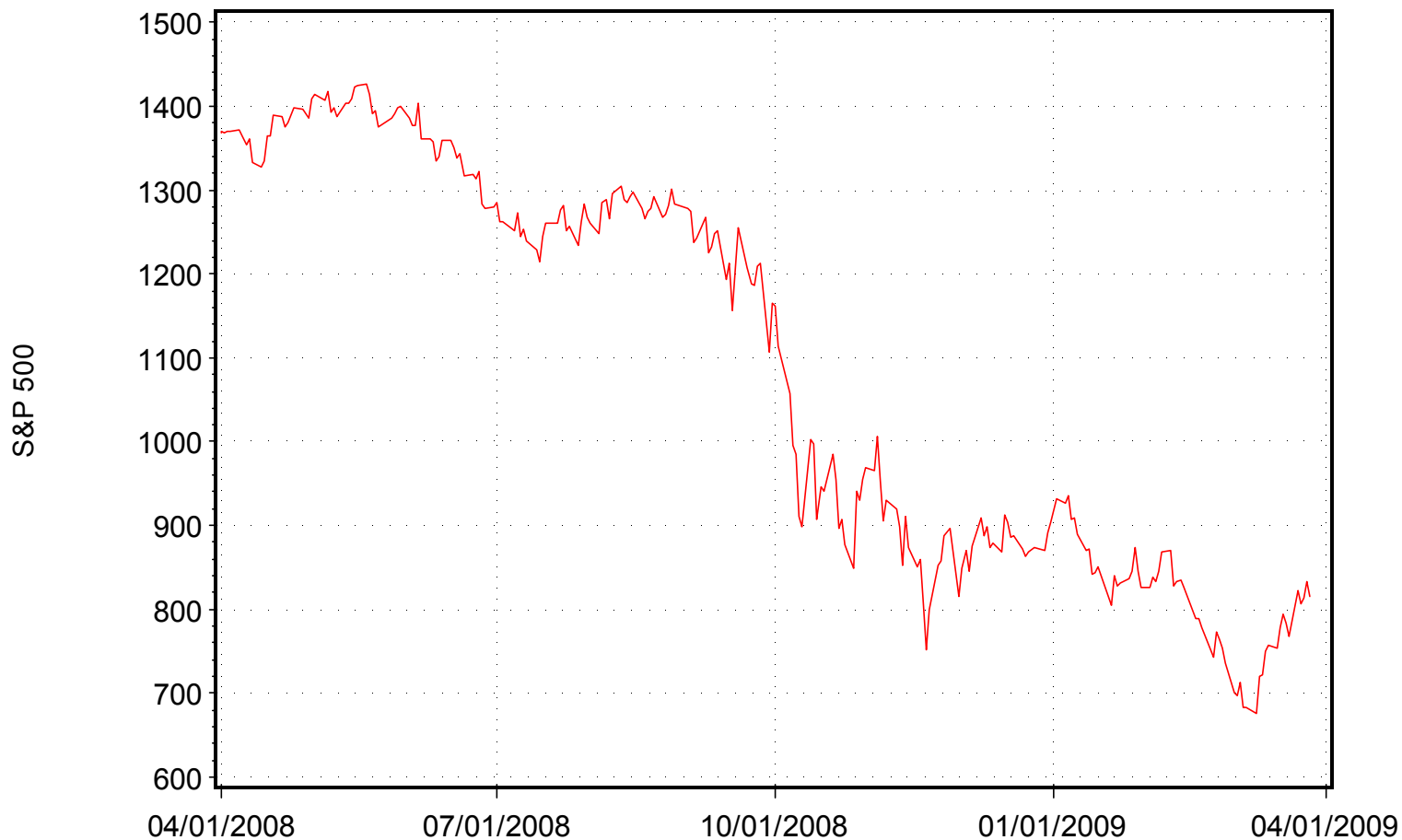
Presented by:
Douglas Dwyer

April 2, 2009



Moody's Analytics

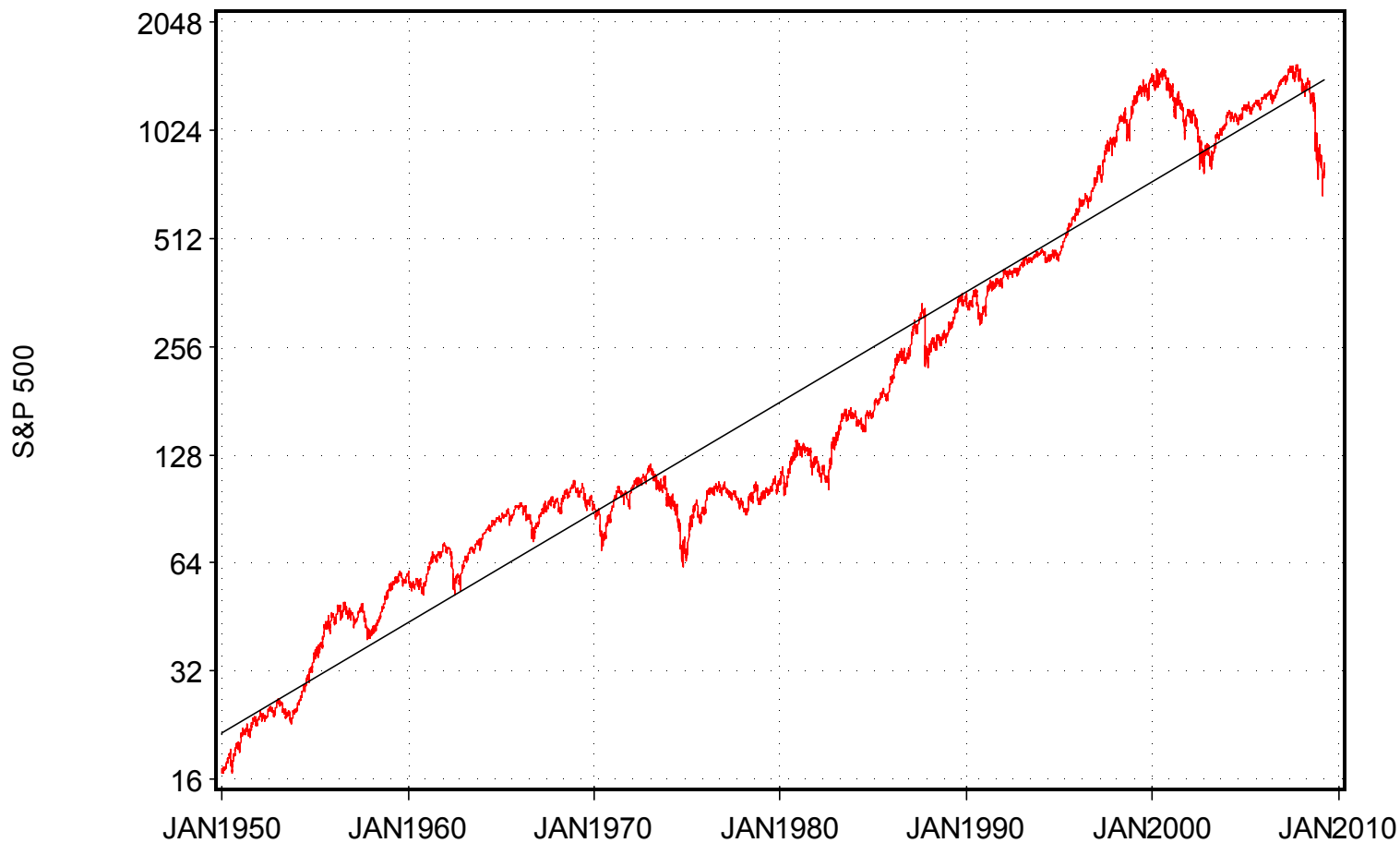
Recently we saw a large decline in the stock market



One-year return on the S&P 500 was -49% for the year ending March 5, 2009.



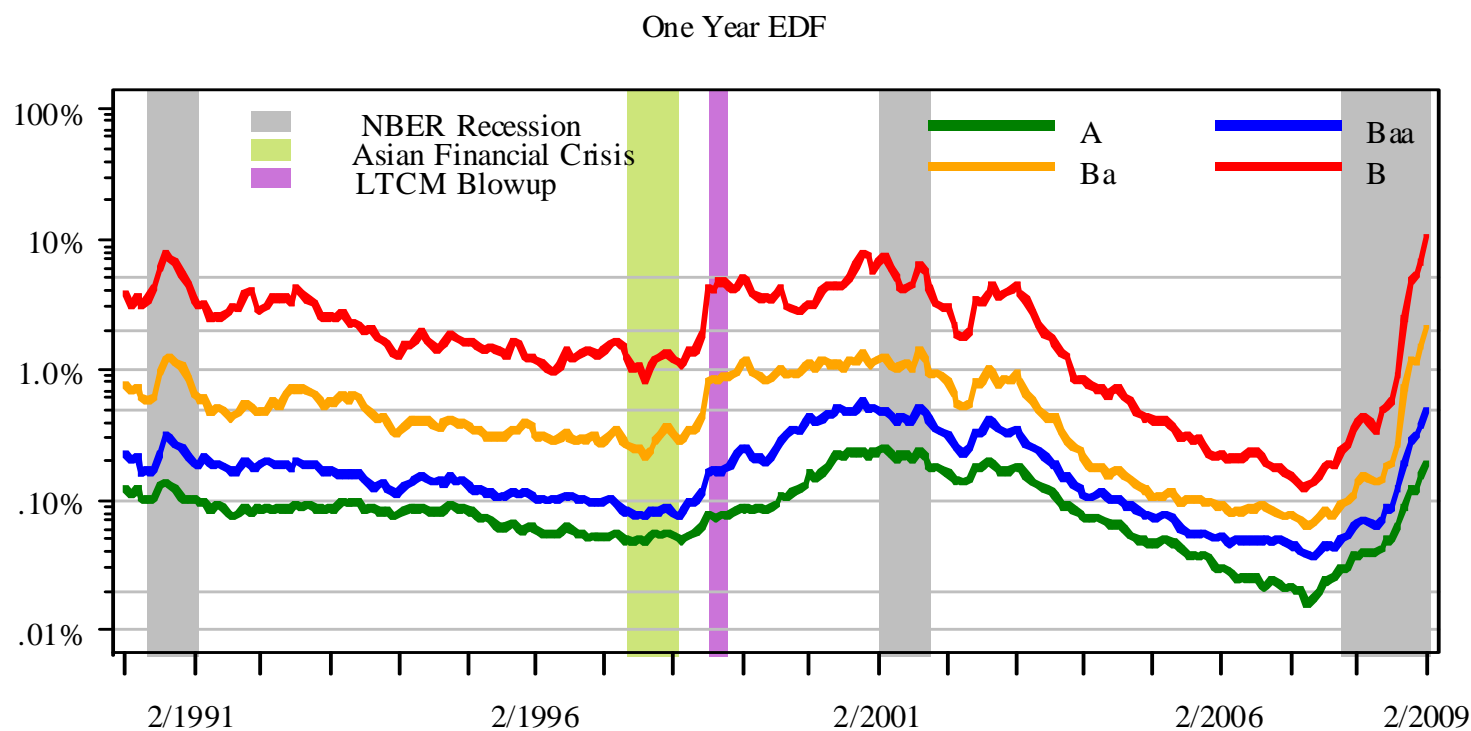
On a historical basis, this was a severe and rapid drop



The last comparable one-year drop in the S&P 500 was for the year ending October 3, 1974 (-43%), followed by the year ending July 23, 2002 (-33%).



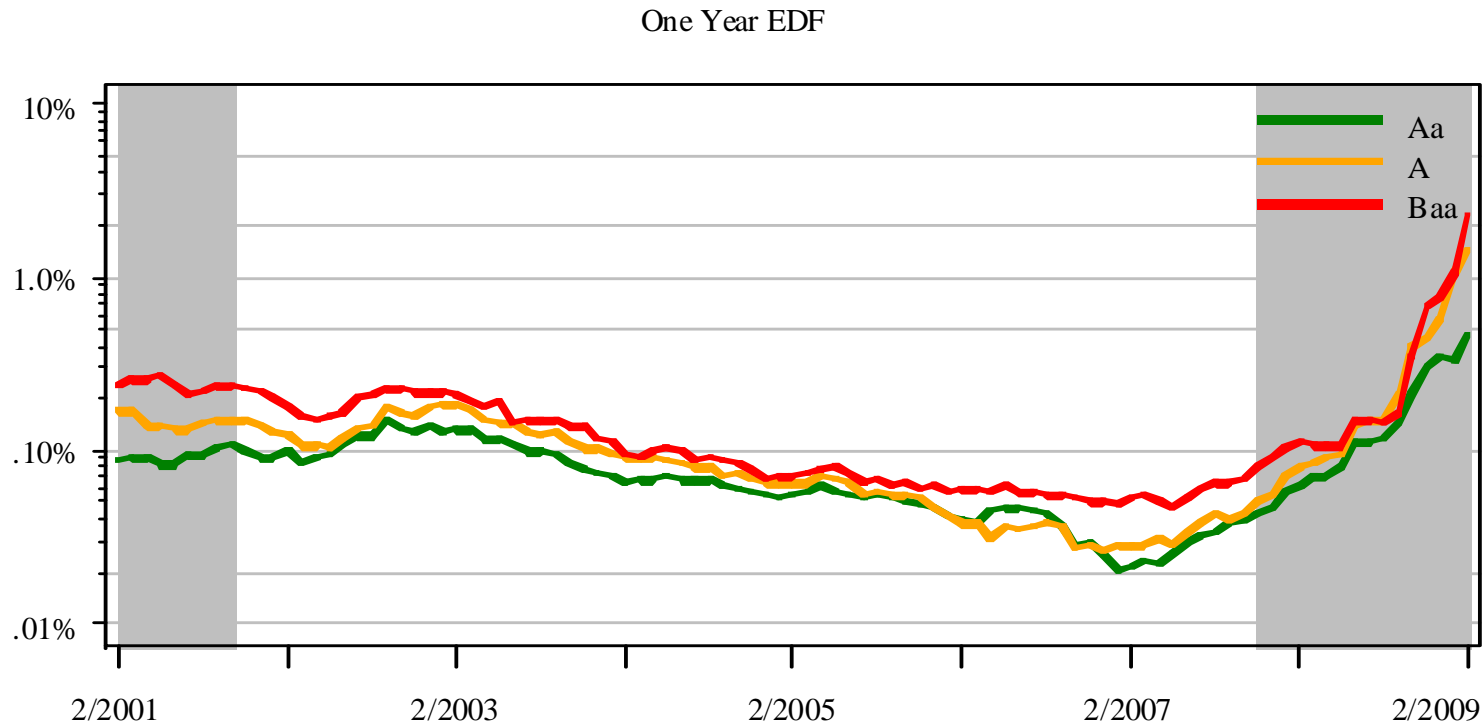
Default risk increased at the same time



Median values of one-year Expected Default Frequencies (EDFs) for the respective rating categories, based on North American Non-Financial Firms.
 Source: Moody's KVM EDF Report, as of February 28, 2009



Financial firms were hit particularly hard



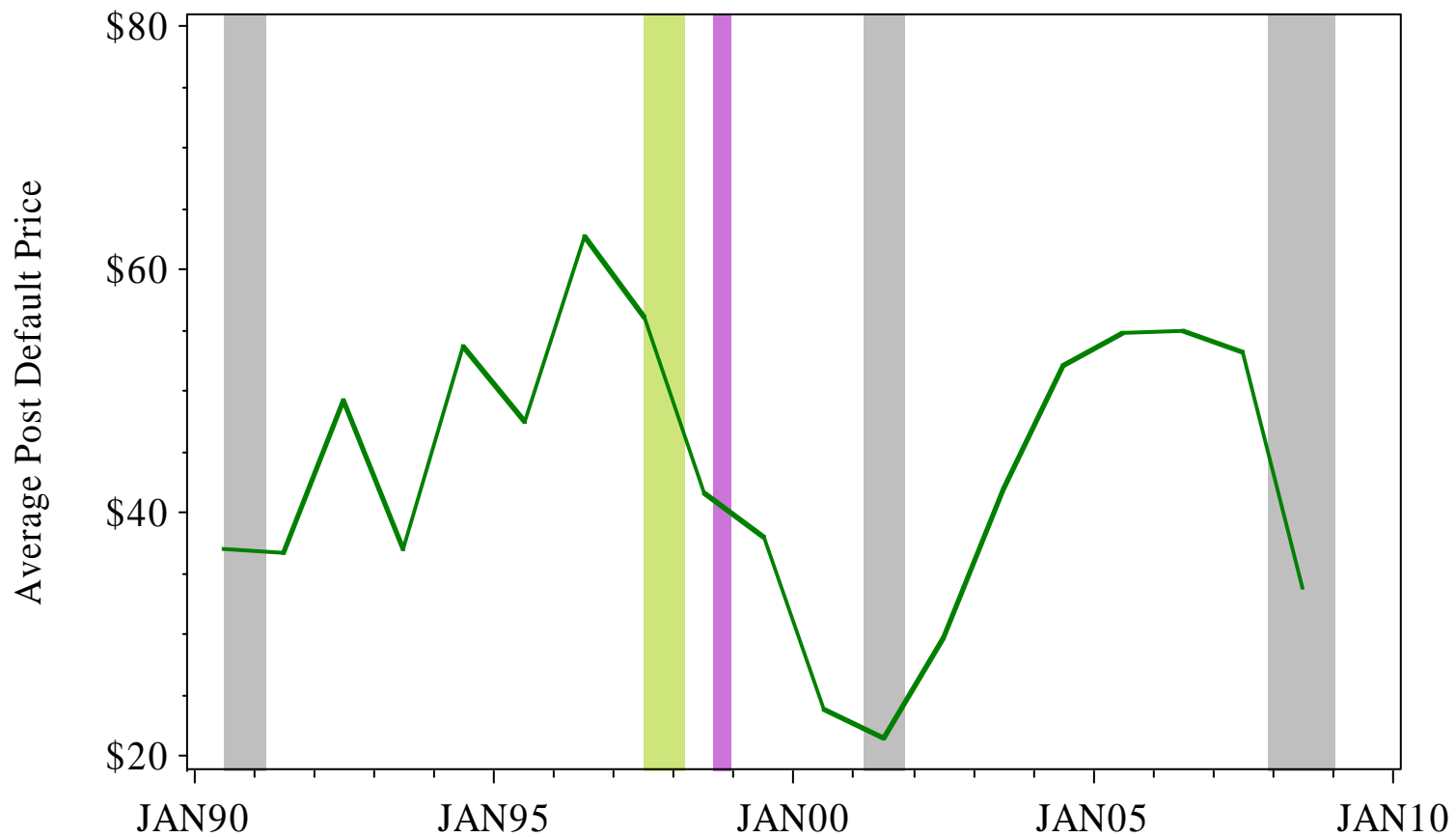
Median values for the respective rating categories, based on Global Financial Firms.

Source: Moody's KMV EDF Report, as of February 28, 2009



Realized recovery varies over the cycle as well

Realized Recovery Over Time



Presents the average post-default price of a senior unsecured bond for each year. Based on Exhibit 9 of the Moody's Investors Service 2008 Annual Default Study.



Credit risk varies over time

- During recessions, both default rates and LGD are likely to be very elevated
- Elevated periods of credit risk can be forecasted
- Important for risk management
- We now have many more tools and data to measure this phenomenon
 - Measure changes in default risk over the cycle
 - Measure changes in recovery risk over the cycle
 - Use stress testing to test model risk

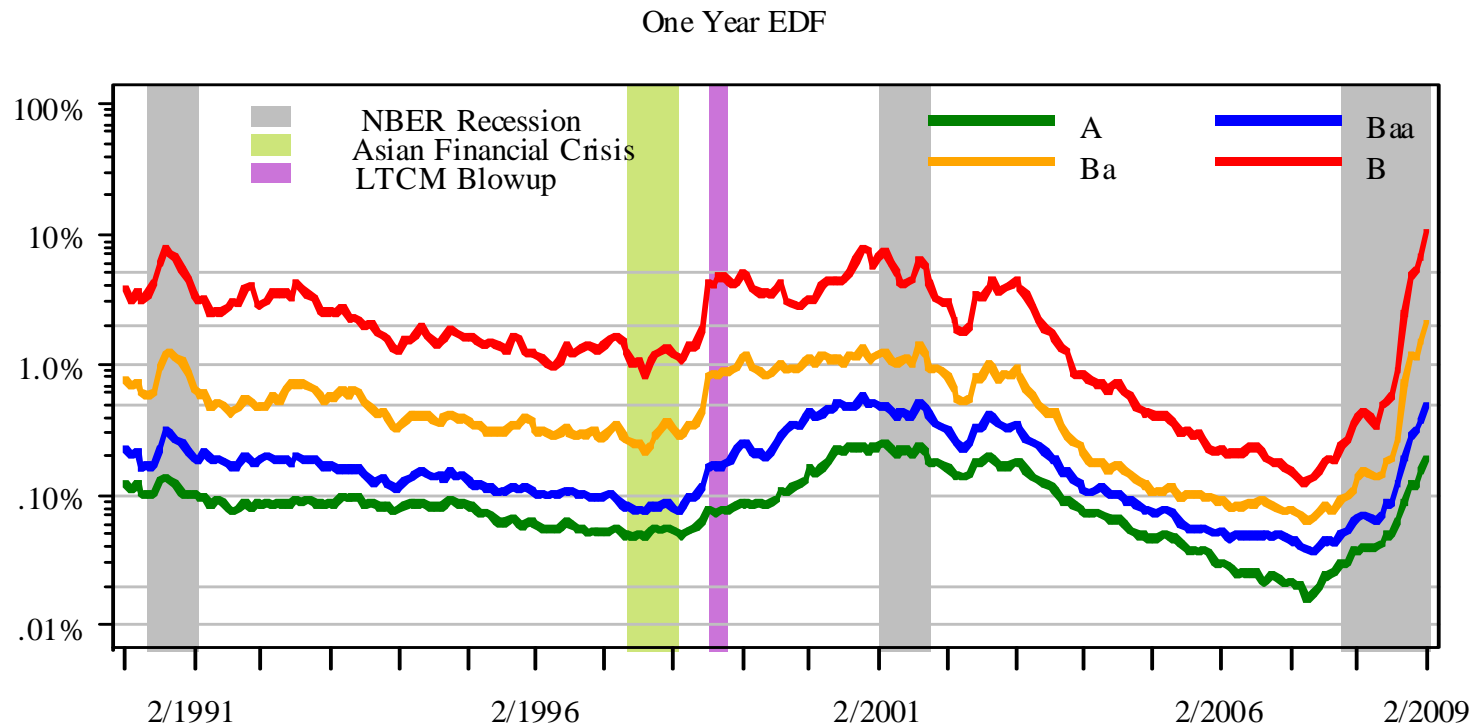


PD Modeling



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EDF levels are very elevated

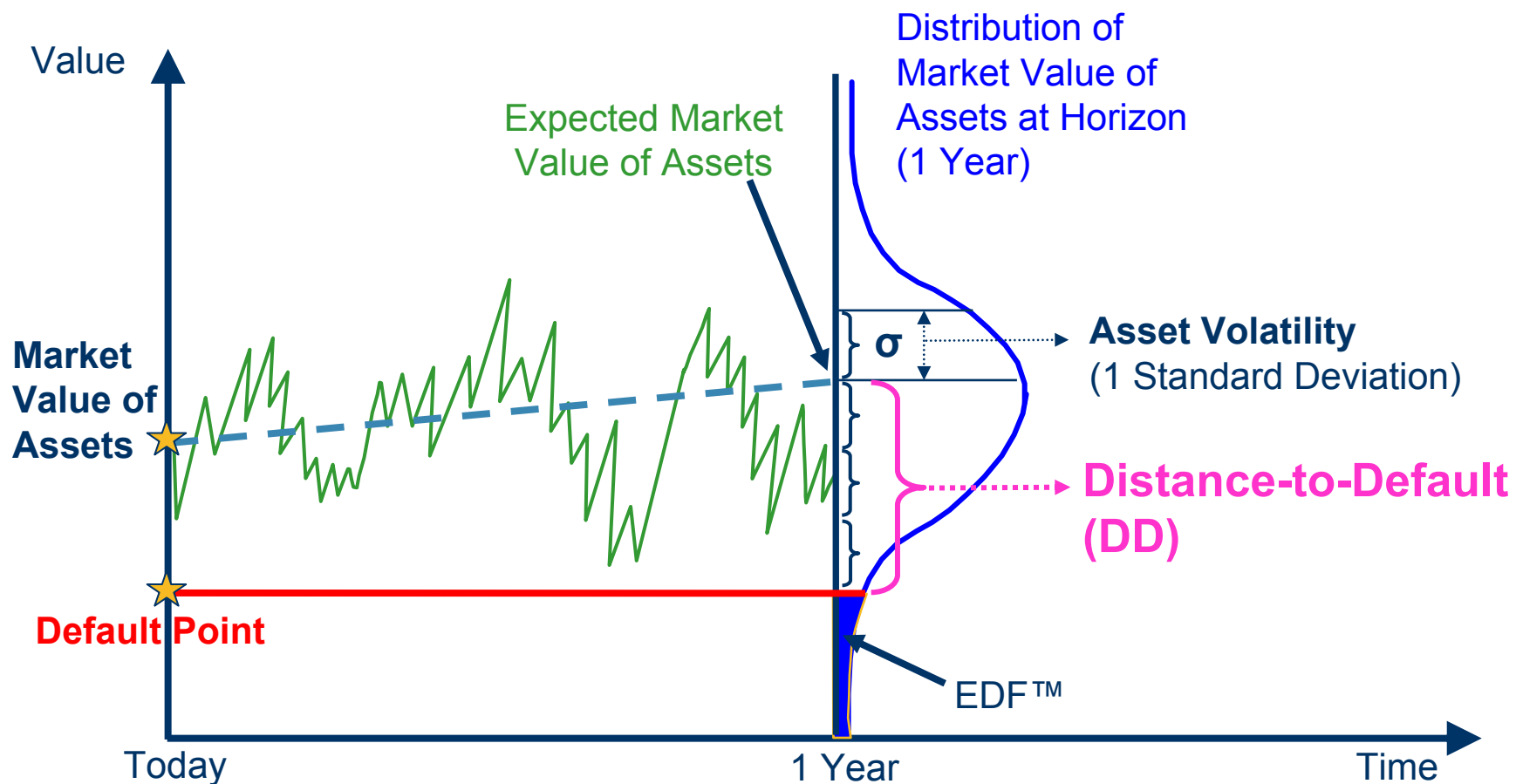


Median values for the respective rating categories, based on North American Non-Financial Firms.

Source: Moody's KMV EDF Report, as of February 28, 2009



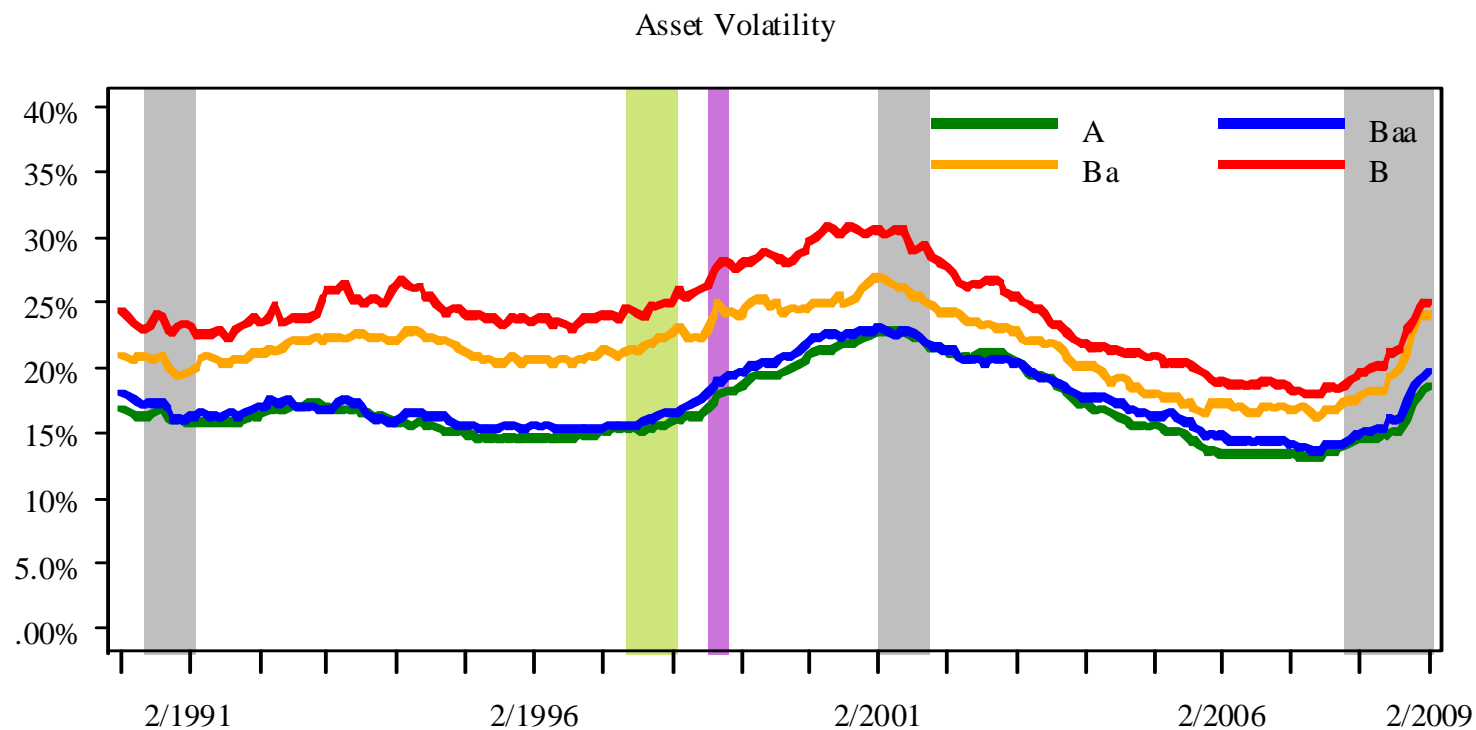
EDF model in a nutshell



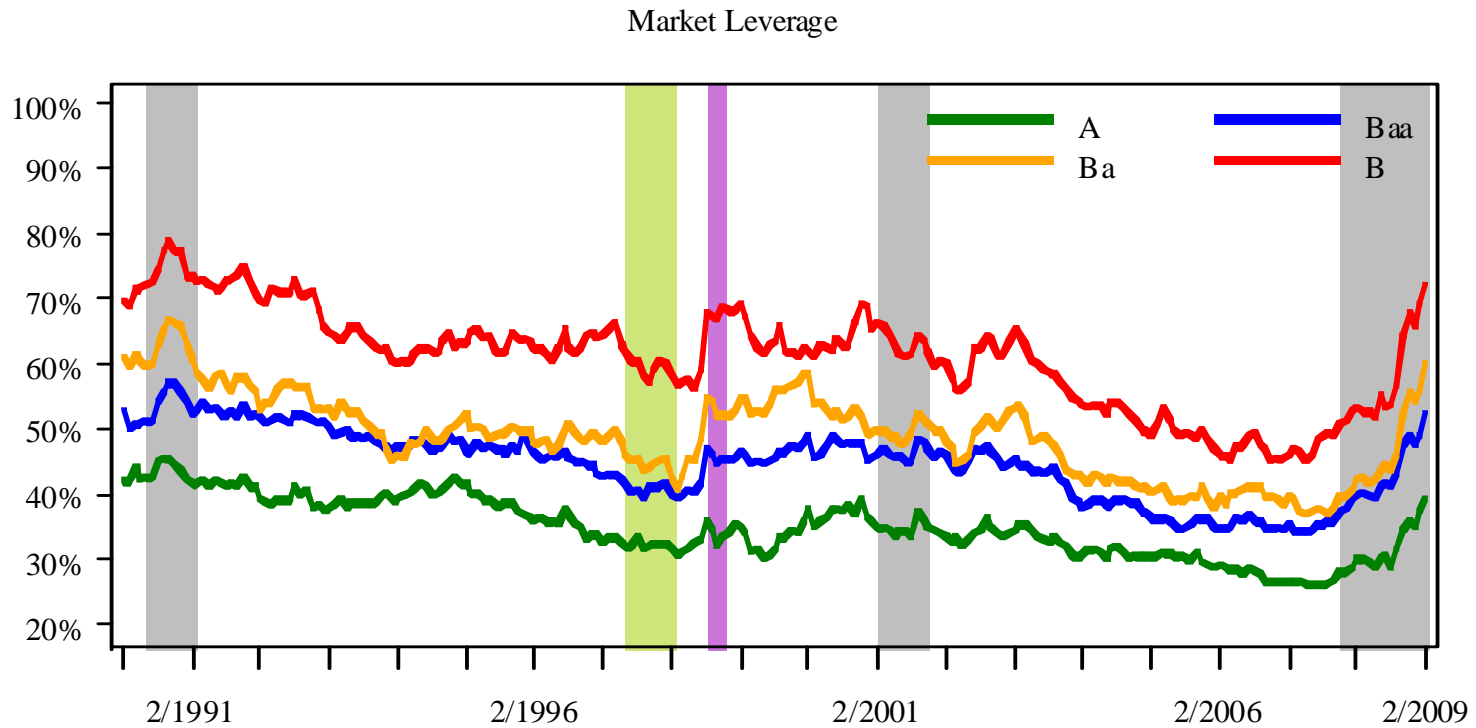
Distance-to-Default (DD) \approx The number of Standard Deviations the Market Value of Assets is away from the Default Point



The increase in EDF levels is driven by increasing volatility...

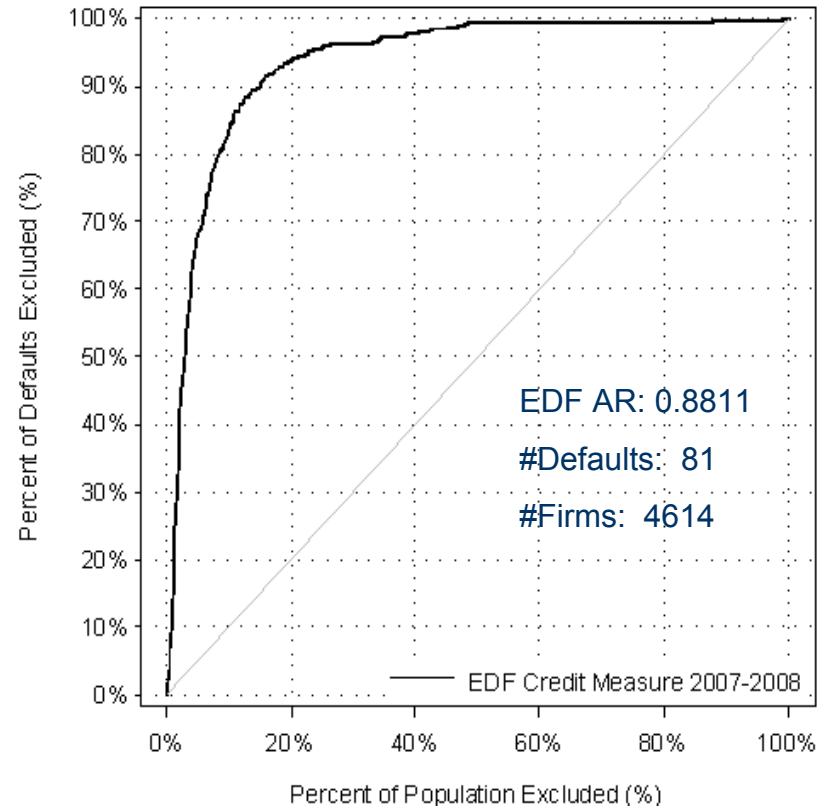
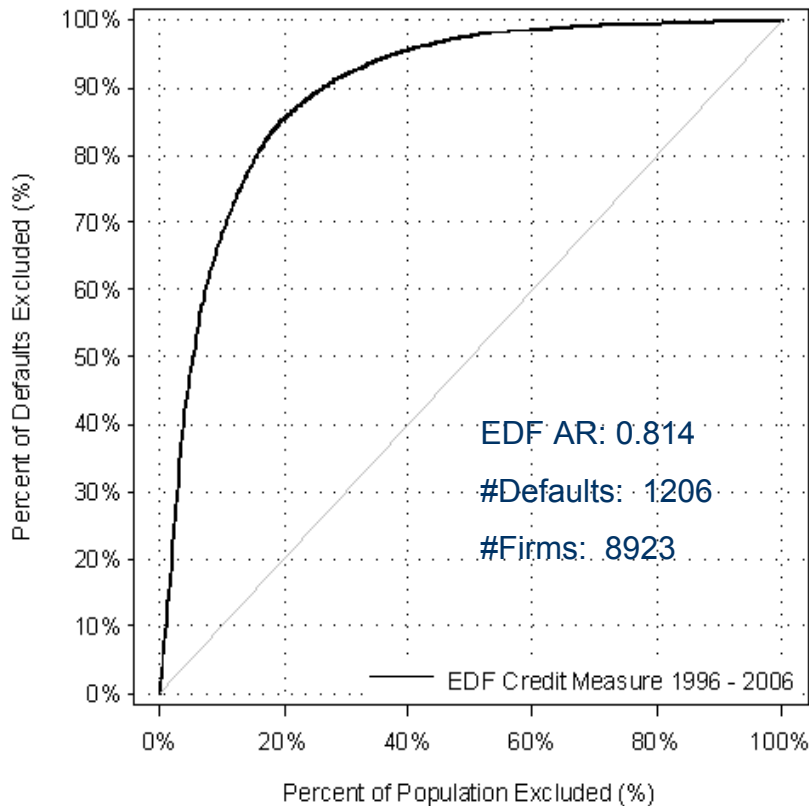


And increasing leverage



North American Corporate Sector

In the last two years, the accuracy ratio of the EDF model is higher than during the previous 10 years



Notes:

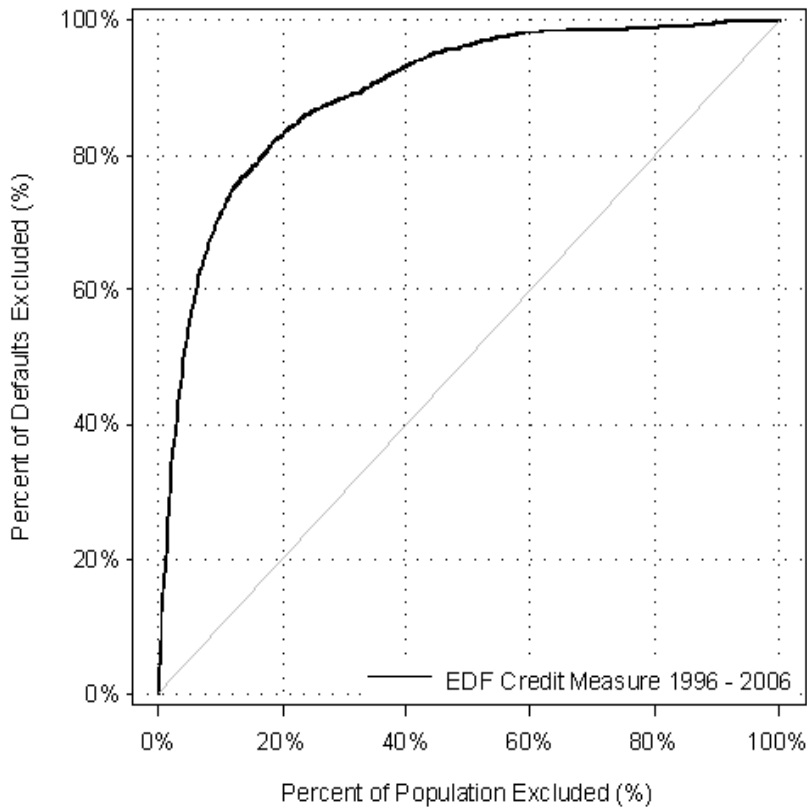
1. We exclude firms with annual sales less than \$30 million to control for hidden defaults.
2. We included the only one corporate bailout, General Motors (12/19/08). The results are more robust if we remove it.



Global Financial Firms including Bailouts

With the ambiguity in defaults related to government intervention during the recent credit crisis, the EDF model did not perform as well as in the previous ten years...

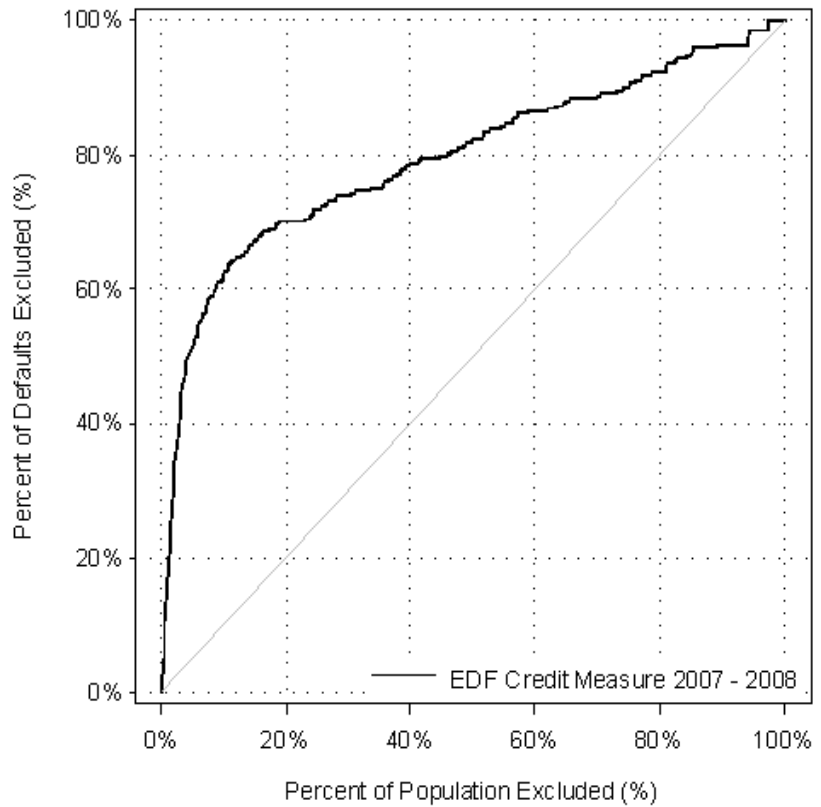
Global Financial Firms, Bailouts included, Book Assets greater than US\$30 Million



EDF AR: 0.7912

Defaults#: 280

Total Obs#: 6779



EDF AR: 0.592

Defaults#: 59

Total Obs#: 4692

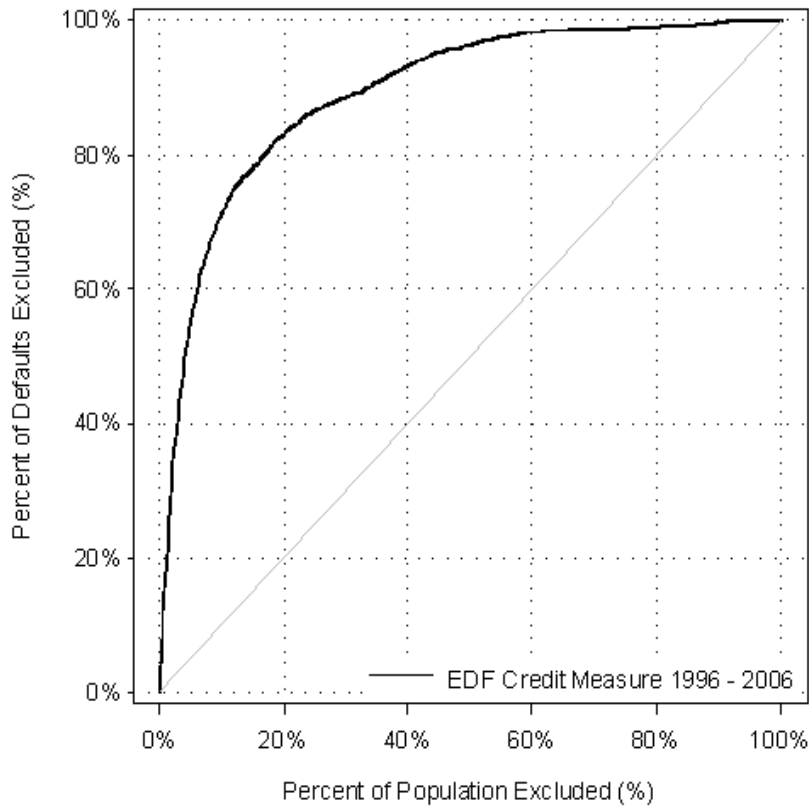


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Global Financial Firms excluding Bailouts

... but on the sample without government intervention, the EDF model performs as well during the credit crisis as during the previous ten years.

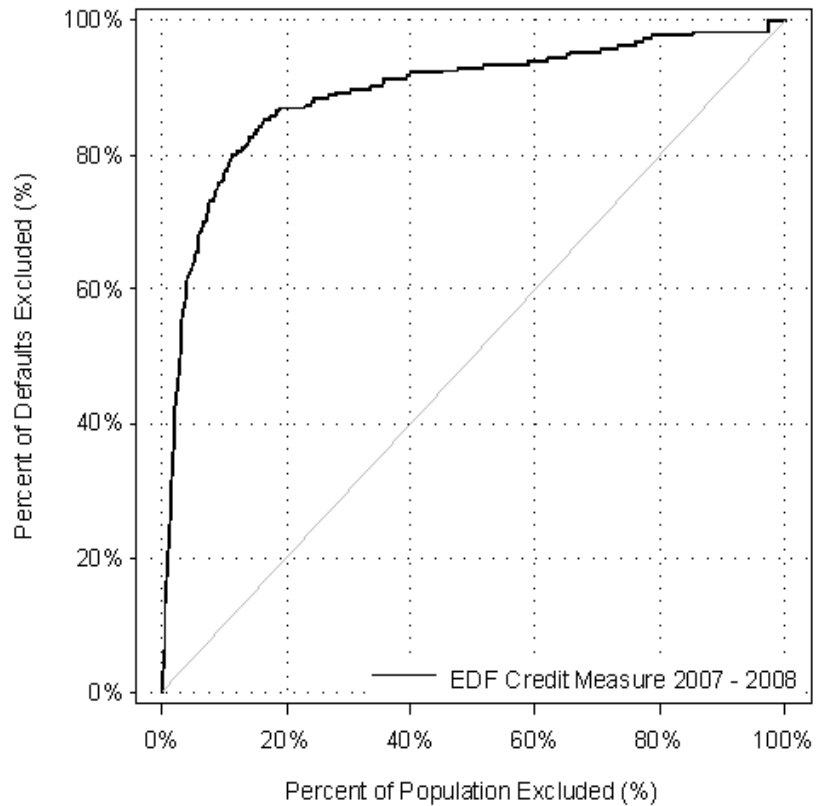
Global Financial Firms, Bailouts Excluded, Book Assets greater than US\$30 Million



EDF AR: 0.7912

Defaults#: 280

Total Obs#: 6779



EDF AR: 0.7857

Defaults#: 47

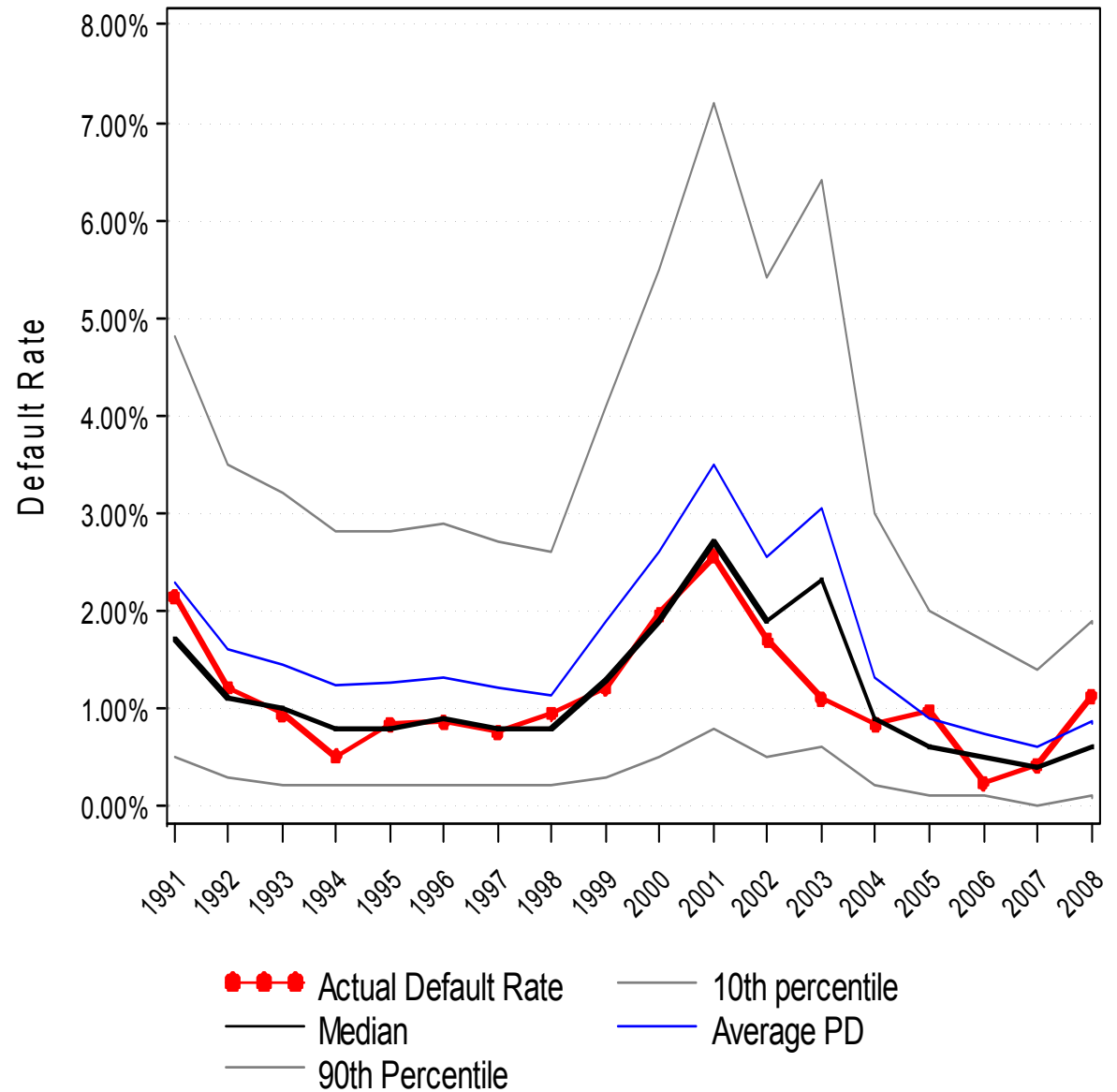
Total Obs#: 4692



EDF levels are statistically validated

North American Non-Financials, EDF < 35% and Sales > \$300 Million

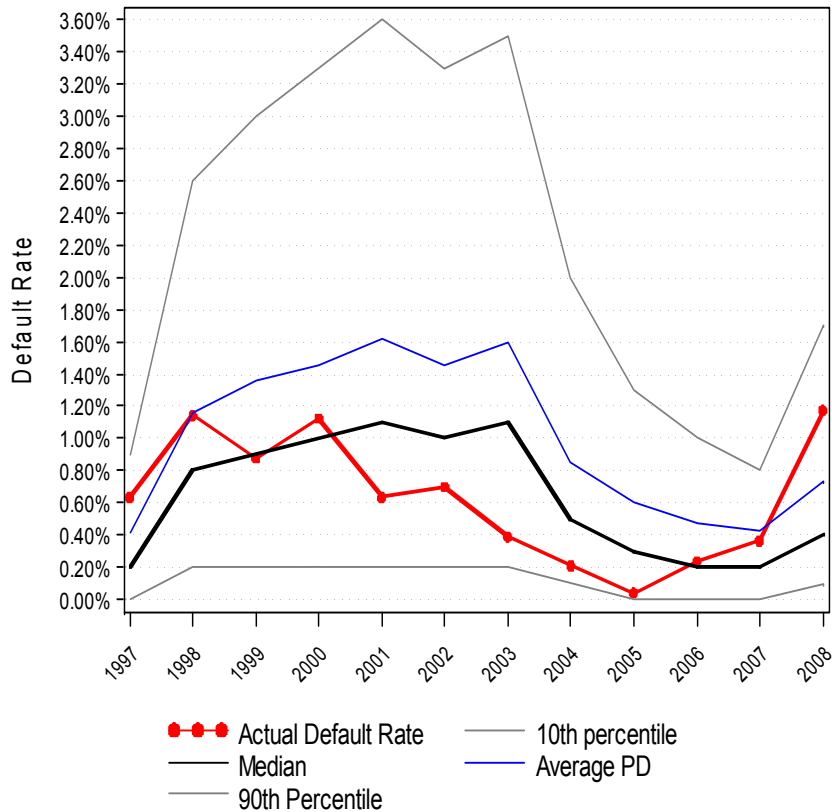
- Even given “true” default probabilities, because default risk is correlated, realized default rate can be higher or lower than the average PD
- Given the EDF sample, we simulate default rates assuming EDFs are “true” default probabilities and used an asset correlation of 0.19 to simulate defaults in each year. We present the distribution of default rates for each year
- Statistically speaking, the hypothesis that “the EDF is the true PD measure” cannot be rejected



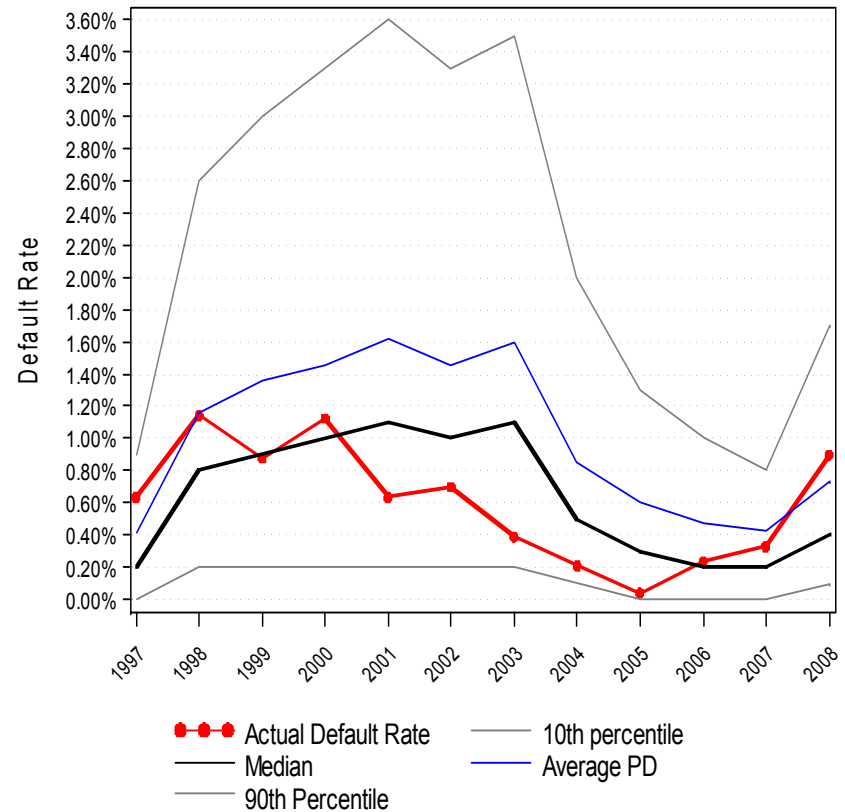
EDF levels are statistically validated

Global financial firms, EDF < 35% and Book Assets > \$300mm

Including Bailouts



Excluding Bailouts



- The EDF levels for financial firms are consistent with realized default rates with and without bailouts.



Modeling LGD/Recovery



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Drivers of recovery include

- Factors external to the issuer
 - stage of the cycle
 - geographic region
 - industry
- Issuer-specific factors
 - probability of default
- Issue-specific factors
 - standing in the capital structure
 - debt above and below



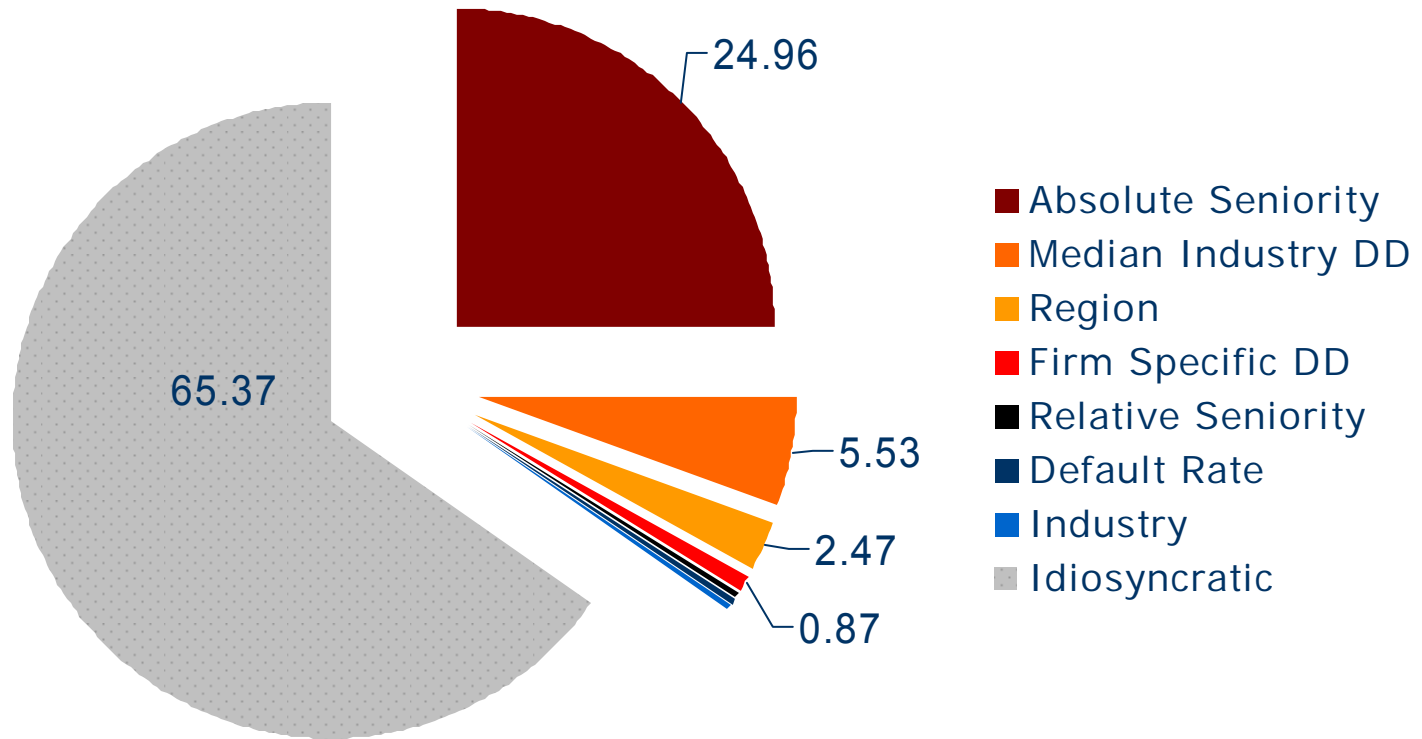
Modeling Recovery is more challenging than PD

Recovery is also impacted by:

- Companies taking on debt and selling assets prior to default
- The form of default
 - bankruptcy
 - missed payment
 - distressed exchange
 - receivership
- The post-default actions of the lender



A model can explain a substantial portion of the variation in recovery



Presents the incremental R² from adding Absolute Seniority, Median Industry DD, Region, Firm Specific DD, Relative Seniority, the Aggregate Default Rate and an industry control sequentially into a regression-based model (LossCalc 3.0)

The R² of a regression measures the percent of variation in the independent variable that is explained by the dependent variables.



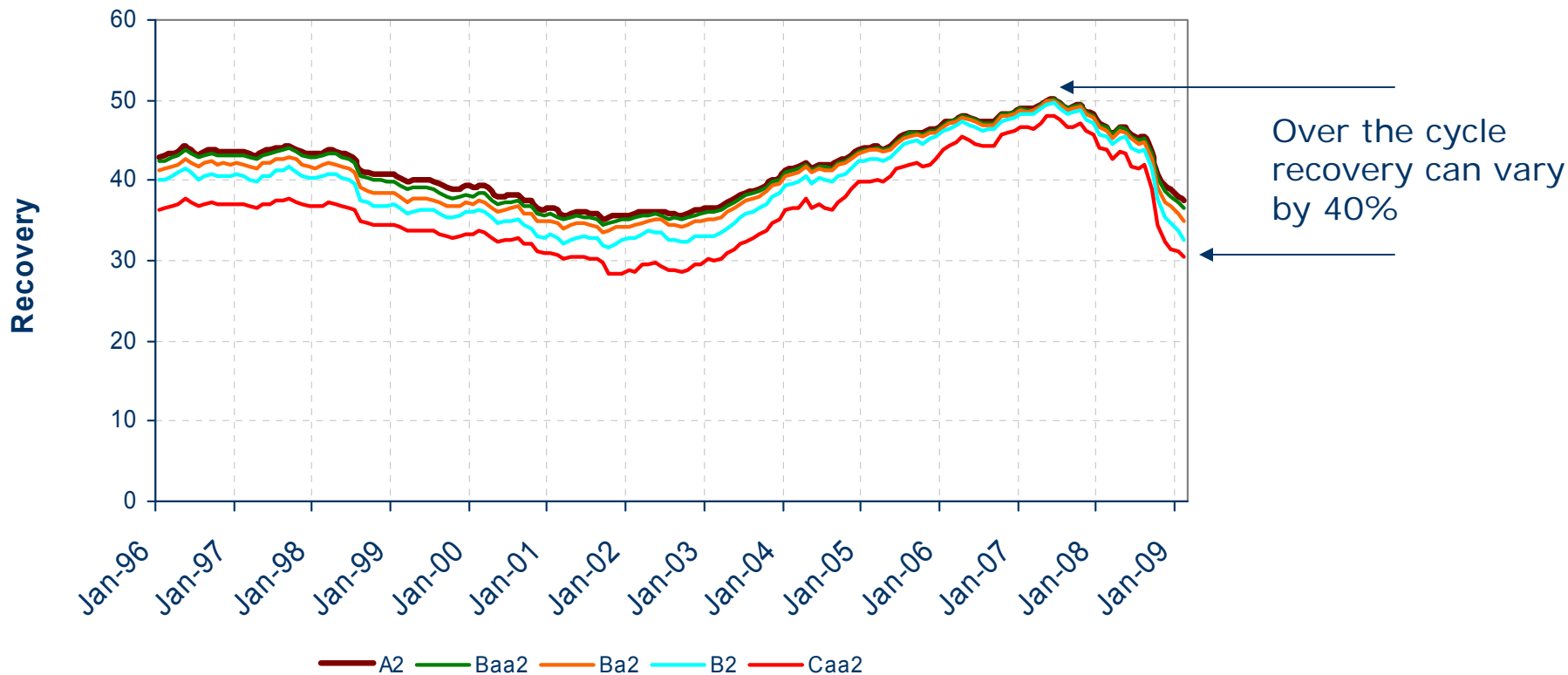
Selected Recent Recoveries

Company	Date	Recovery	LossCalc 3.0 Estimate
Movie Gallery (first lien loan)	9/10/2007	\$83	\$73.6
Washington Mutual (senior unsecured bonds)	9/27/2008	\$57	\$55.4
Nortel Networks Corporation (senior unsecured bonds)	2/10/2009	\$12	\$24.5



Variations in recovery over the cycle can be forecasted

1-Year Recovery for EDF Implied Rating Categories,
January 1996 - Present



Estimates of recovery using LossCalc v3.0, which is a model that controls for geography, industry, stage of the credit cycle, debt type, standing in the capital structure, collateral type, and the firm's credit quality. This example estimates the recovery for a senior unsecured bond in the Business Services industry with an PD equal to the median EDF of firms with the respective agency rating at that time.



Stress Testing



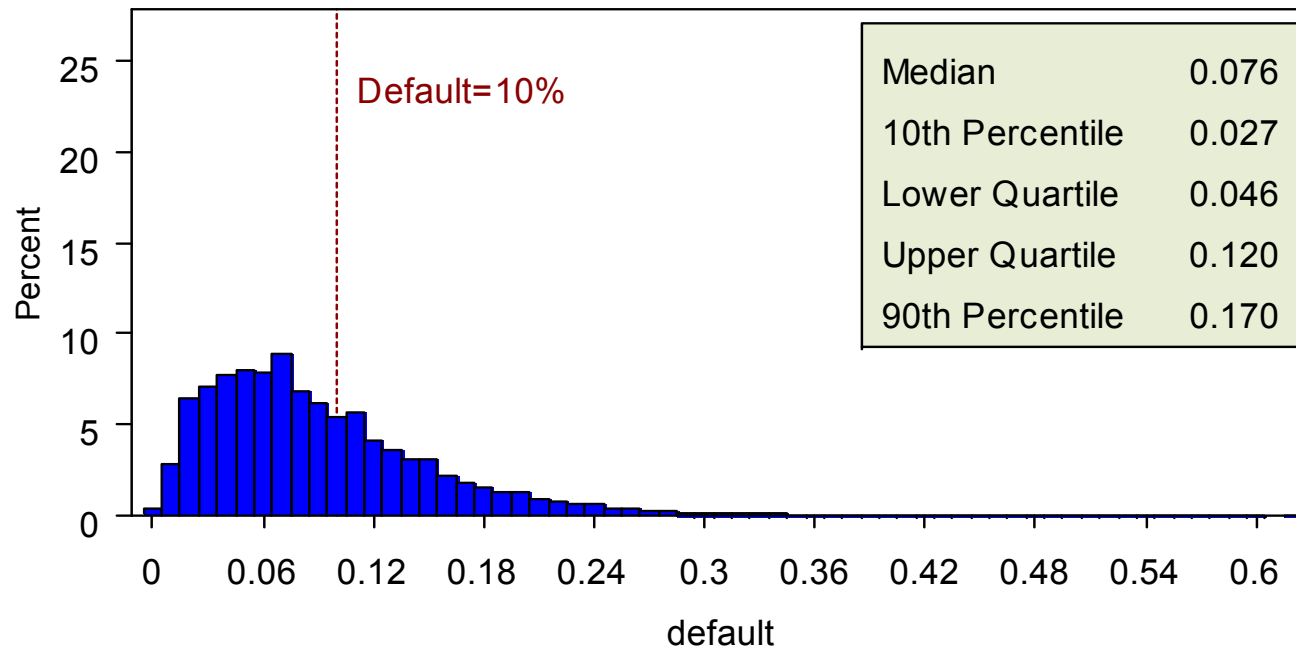
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In Early September 2008, we did some stress testing

- An EDF level of 2.8% in September of 2006 is intended to have the same interpretation of an EDF level of 2.8% in September of 2008 – a 1 in 36 chance of default in one year
- By end of August 2008, EDF Levels had increased significantly, but were still at relatively low levels compared to the levels observed in the last recession
- Volatility – as measured by the modeled – was responding relatively slowly to the changing environment
- Other measures of risk were very elevated – spreads and option implied volatility
- In the last recession, the speculative grade default rates peaked between June of 2001 and May of 2002 at a little more than 10% in the US
 - We asked what would have to happen for the default rate to reach the levels observed during the last recession?



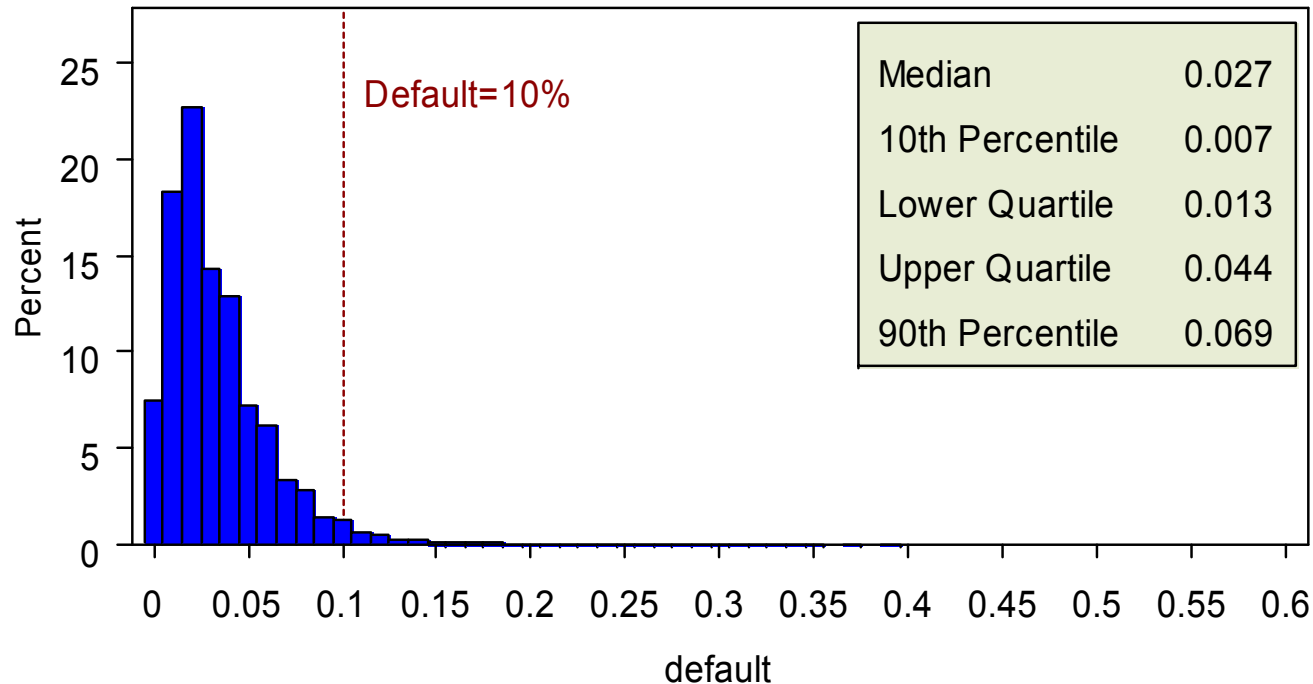
In May of 2001, the model predicted a distribution of possible default rates for US Speculative Grade Firms



- Presents the distribution of possible default rates between June 2001- May 2002, given the EDF levels as of the end of May 2001 and a one-factor Gaussian model with an asset correlation of 0.2.
- The realized default rate was in the 3rd quartile – between the Median and the 75th percentile. According to the framework, a default rate could have been lower than 2.7% and it could have been higher than 17.0%



Using the EDFs at the end of August 2008, credit risk did not look as bad as May of 2001



- Presents the distribution of possible default rates between September 2008 and August 2009 given EDF levels at the end of August 2008 and a Gaussian one-factor model with an asset correlation of 0.2.
- According to the model, the median possible default rate is 2.7%. There is a 10% chance that default rates could exceed 6.9%



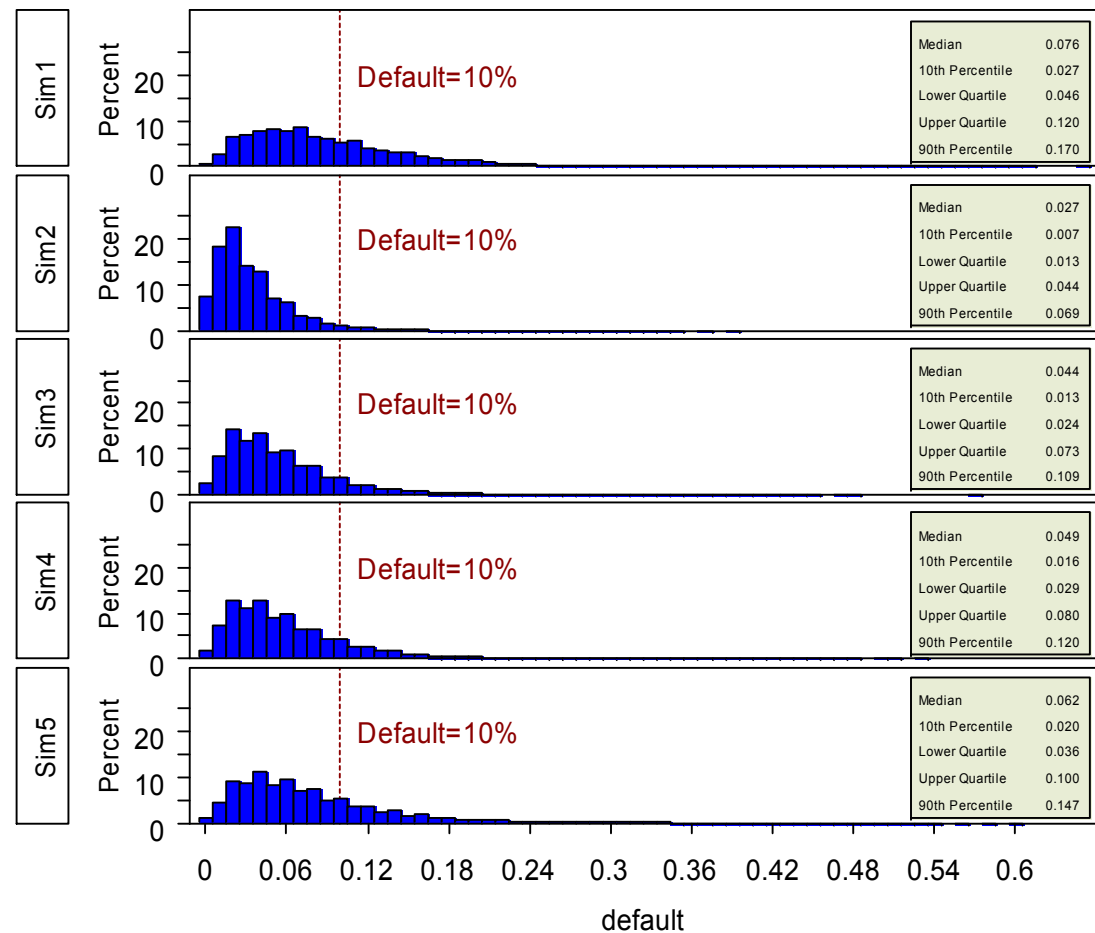
What would have had to change for default risk to become comparable to the last recession?

- What if we stress volatility back to the levels observed in 2001?
 - Multiply volatility of each firm today by the ratio of the median volatility observed in 2001 to the median volatility observed at the end of Aug 2008 by broad rating group and recompute the EDF of each firm using EDFcalc
- What if we further stress the portfolio by reducing the equity value of every firm by first 10% and then 30%?
 - Historically, there is a 1% chance of the S&P 500 declining by 10% within a month
 - The largest one-month decline in the S&P 500 since 1950 is 22% (October of 1987)



In September, it looked possible for the Speculative Grade Default Rate to reach levels seen in 2001

Simulation	P-value Default Rate > 10%
May 2001	34.6%
August 2008	2.3%
Stressed Volatility	12.8%
10% fall in equity value	16.1%
30% fall in equity value	25.4%

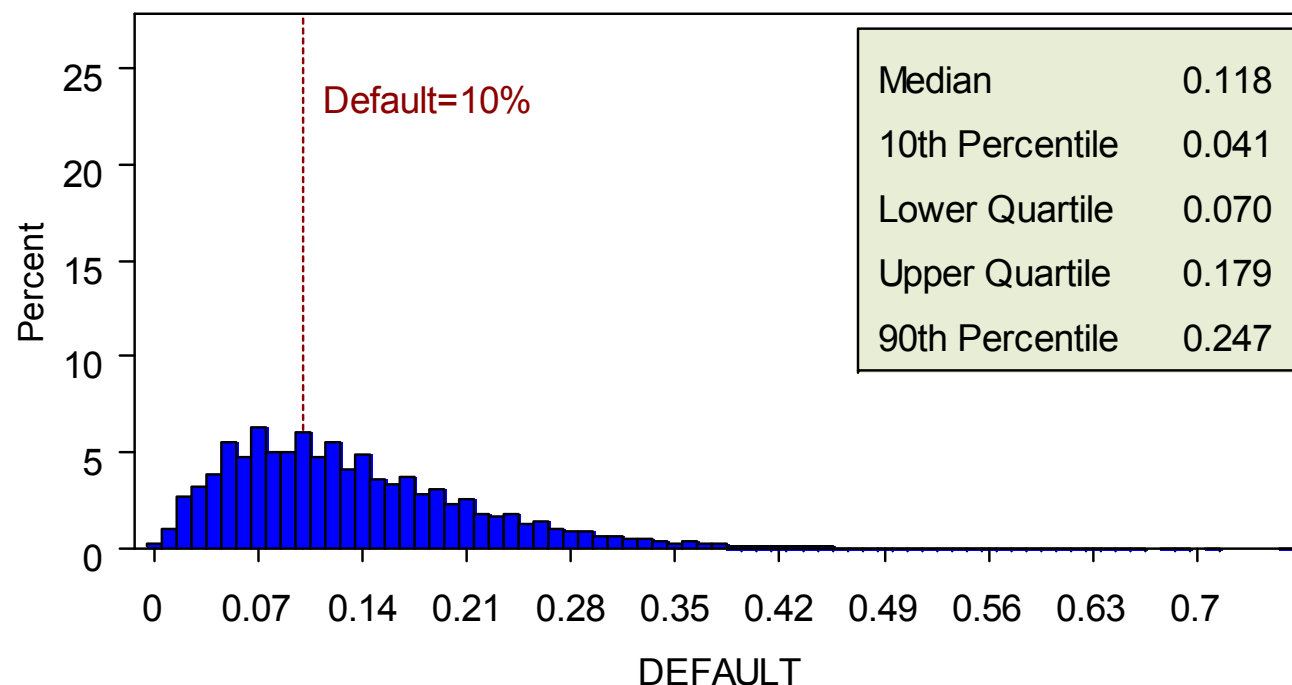


Over the next year, high default rates are likely

- Stock market has fallen by about 40% since the end of August 2008
- Volatility has increased as well
- The model predicts more defaults than at the peak of the prior recession



Using the EDFs at the end of February 2009, default risk looks higher than in May of 2001

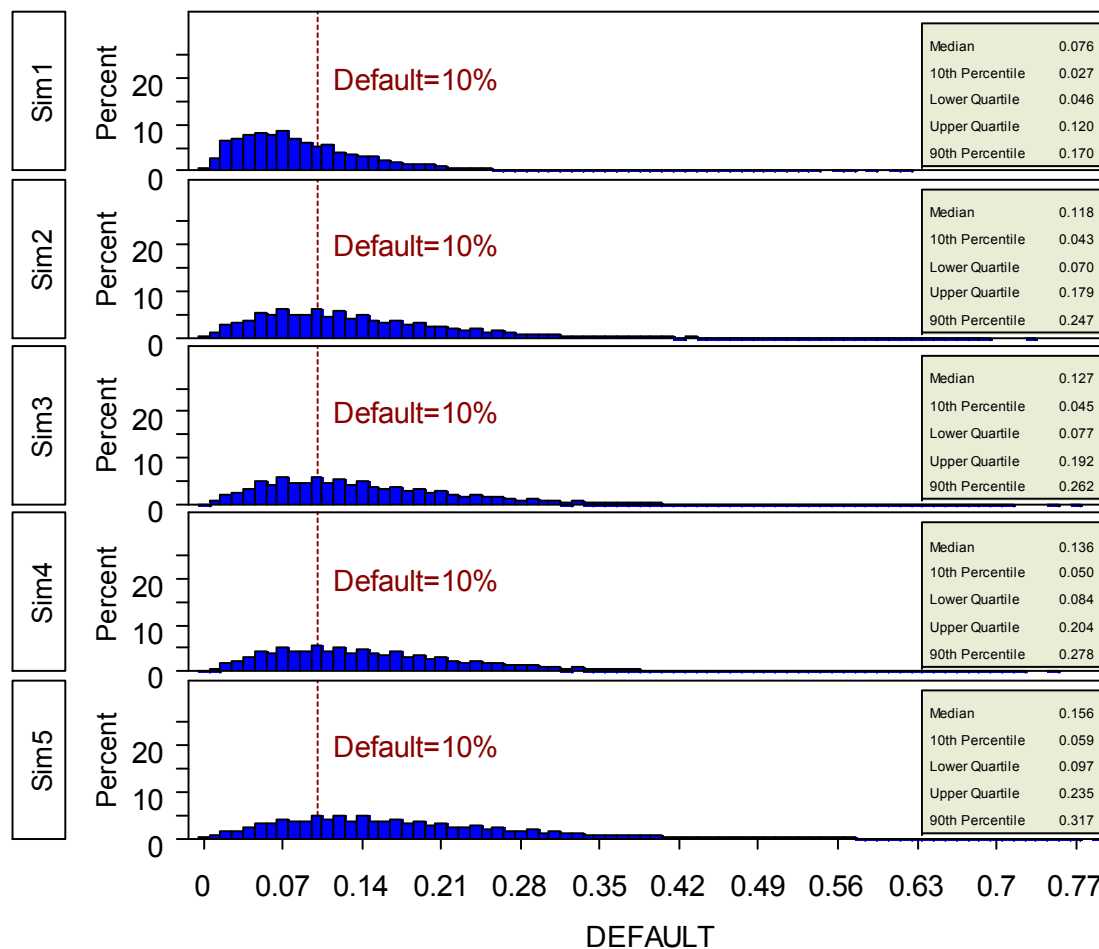


- Presents the distribution of possible default rates between March 2009 and February 2010, given EDF levels at the end of February 2009 and a Gaussian one-factor model with an asset correlation of 0.2.
- According to the model, the median possible default rate is 11.8%. There is a 10% chance that default rates could exceed 24.7%



Now, high default rates appear likely

Simulation	P-value Default Rate > 10%
May 2001	34.6%
February 2009	58.6%
Stressed Volatility	62.8%
10% fall in equity value	66.3%
30% fall in equity value	73.5%



Conclusion: credit risk is very elevated

- Credit risk changes over the cycle
 - Both default risk and loss given default go up during a recession
 - Changes in credit risk can be forecasted
- Tools are available to
 - Measure the change in default risk as the cycle changes
 - Measure the change in loss given default
 - Stress test model risk

