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# Workout Periods and Loss Given Default: Decomposing the Macroeconomic Effect on Recovery Rates

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# Overview

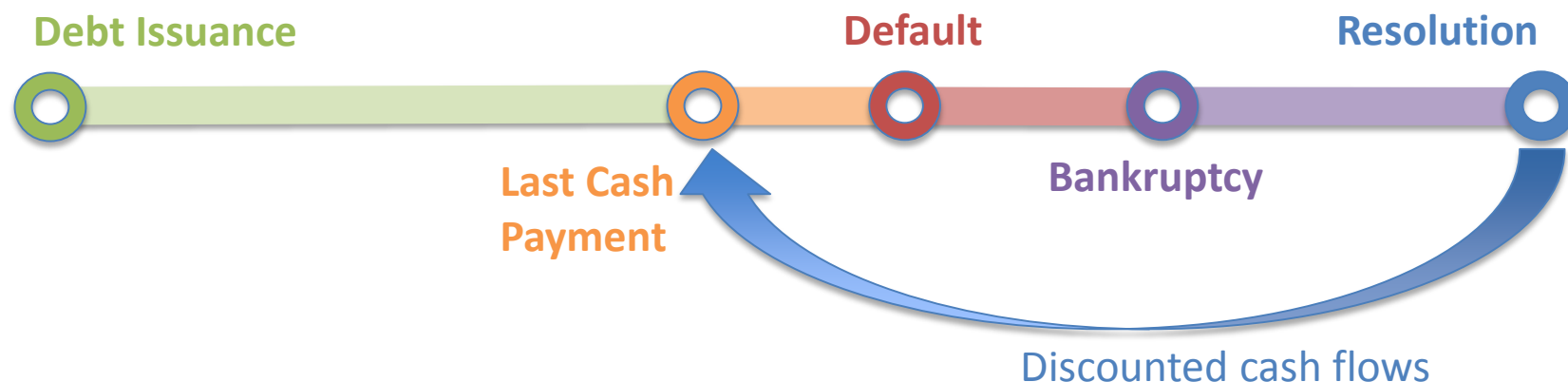
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- **Main questions to answer**
  - What is the impact of the workout period on corporate recoveries?
  - What determines how long the workout process lasts?
  - Given the lengthy workout period, how does the macroeconomic environment affect corporate recoveries?
- **Data**
  - Moody's Ultimate Recoveries
  - Available data from Q2 1987
  - Both loans and bonds are represented in the sample, though more than 60% are bonds
  - The defaulted obligors are North American non-financial corporates with over \$50,000,000 in total debt at the time of default
  - Costs and fees not included in the the discounting of the recoveries but reflected in the recovery amount

# Why modelling recovery rates is not straightforward?

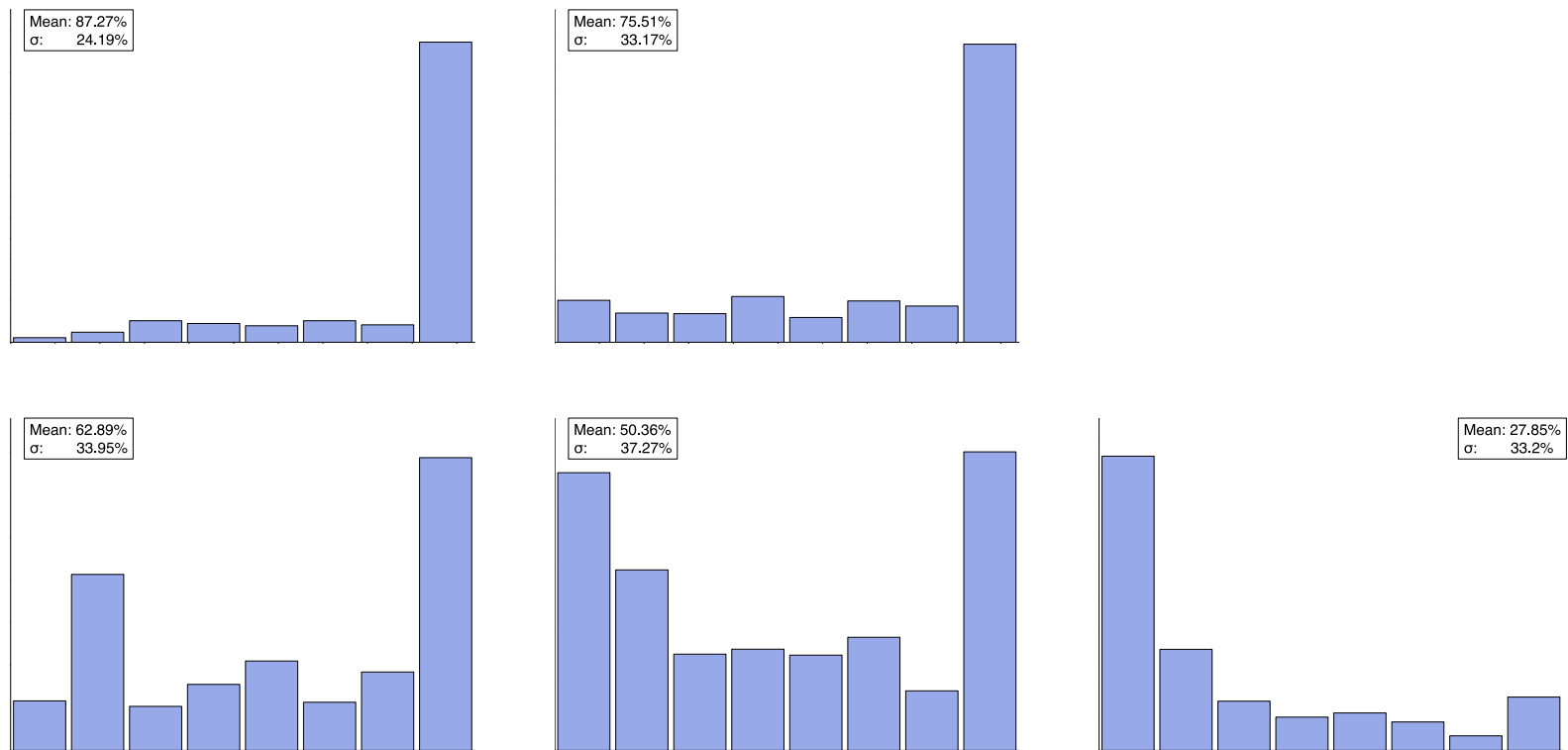
- **Few observations**
  - Collection historically has not been of the same standard as defaults
  - Recoveries refer to defaulted debt
  - Recoveries take time to materialize
- **Different definitions**
  - Traded prices 30 days post-default
  - Ultimate recoveries
- **Different ways to price ultimate recoveries**
  - Settlement: Value of settlement instruments is taken at or close to resolution
  - Liquidity: Value of the settlement instruments is taken at the time of a liquidity event (maturity of the instrument, the call of the instrument, or a subsequent default event)
  - Trading Price: Value based on the trading price of the defaulted instrument at or post-resolution
- **The effect of macroeconomic conditions**
  - Effect prior to default, at the time of default, throughout the workout period or at resolution?

# Default-workout period timeline for ultimate recoveries



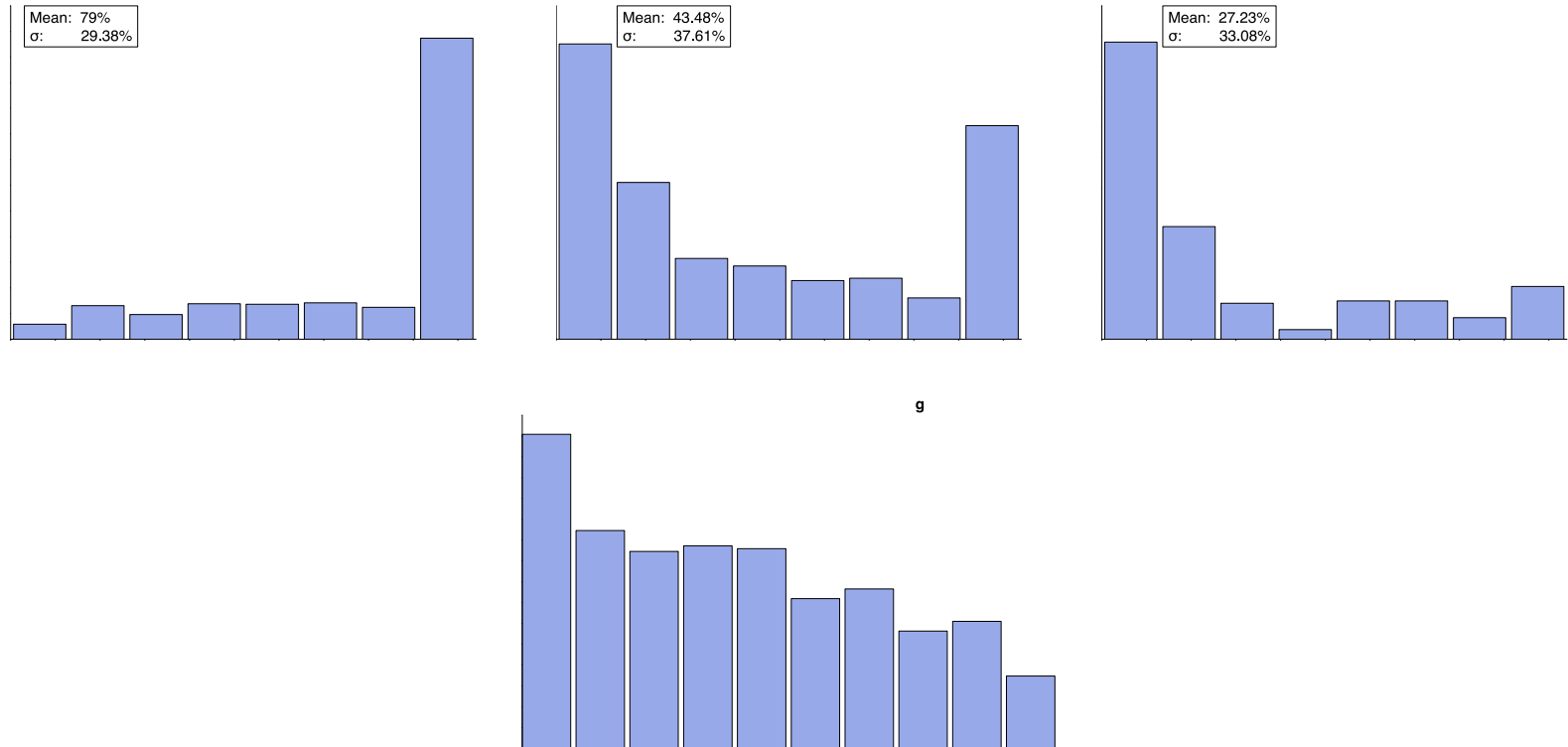
- Default typically takes place 6 months to 1 year after the last cash payment (depending on the coupon frequency). Bankruptcy can take place post-default
- The outcome of the default/bankruptcy process follows much later
  - Recovery cash flows can take place prior to the final settlement
  - Recoveries discounted back to the last time interest was paid
  - Instrument's pre-default coupon rate used for discounting
  - Moody's suggest the best method to price recoveries (in most cases the settlement method is used)

# How does instrument type affect recoveries?



- Loan recoveries are higher than bond recoveries
- Seniority level of bond instruments has a clear effect on recoveries
- Significant mass at 0% and 100% recovery rates

# How does debt and collateral ranking affect recoveries?



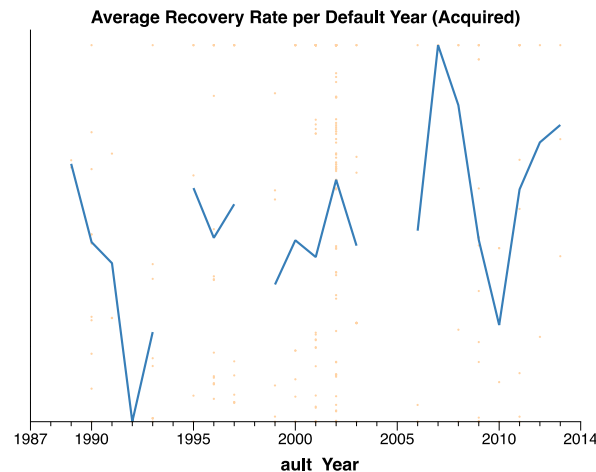
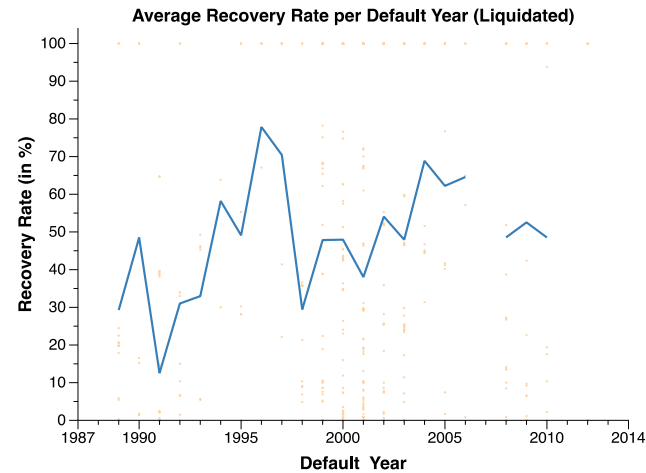
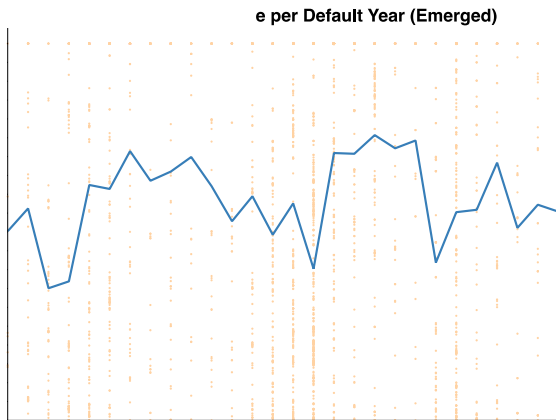
- Ranking of collateral is a major factor of recoveries
- Debt ranking differentiates recovery rates, especially in the extreme values

# How do default type recoveries?

Type	Issuers	Instruments	Mean workout period	[Min, Max] workout period	Mean recovery rate	[Min, Max] recovery rate
<b>Bankruptcy</b>	<b>755</b>	<b>3,771</b>	<b>439</b>	<b>[17, 4690]</b>	<b>55.5%</b>	<b>[0.0%, 169.8%]</b>
Acquisition	63	281	438	[38, 2043]	53.5%	[0.0%, 100.0%]
Emergence	550	2,955	395	[17, 4690]	57.4%	[0.0%, 169.8%]
Liquidation	142	535	606	[45, 2994]	45.7%	[0.0%, 108.3%]
<b>Default &amp; Cure</b>	<b>9</b>	<b>55</b>	<b>20</b>	<b>[0, 133]</b>	<b>96.1%</b>	<b>[27.1%, 100.0%]</b>
Emergence	9	55	20	[0, 133]	96.1%	[27.1%, 100.0%]
<b>Distressed Exchange</b>	<b>143</b>	<b>677</b>	<b>2</b>	<b>[0, 89]</b>	<b>80.5%</b>	<b>[0.0%, 115.7%]</b>
Acquisition	4	15	0	[0, 0]	78.9%	[12.9%, 100.0%]
Emergence	138	659	2	[0, 89]	80.5%	[0.0%, 115.7%]
Liquidation	1	3	0	[0, 0]	93.7%	[81.2%, 100.0%]
<b>Other Restructuring</b>	<b>6</b>	<b>27</b>	<b>16</b>	<b>[0, 80]</b>	<b>87.3%</b>	<b>[14.0%, 100.0%]</b>
Acquisition	2	6	40	[0, 80]	76.1%	[14.0%, 100.0%]
Emergence	4	21	4	[0, 17]	90.6%	[40.2%, 100.0%]

- The vast majority of recoveries refer to bankruptcies. 1.5 years workout period and 55.5% average recovery rate
- Default&cure/other restructurings excluded from the analysis due to low numbers
- Distressed exchange events typically last only 2 days and the recovery rates are very high – Excluded from the analysis

# Is there time variation in recovery rates?



- Clear business cycle dependence for all 3 default outcomes
- Cyclical behavior not always synchronized across the 3 default outcomes

# Econometric modelling of recovery rates

- Recovery rate distribution has significant mass at 0% and 100%
  - Simple Beta regression assumes that the dependent variable takes value in the (0,1) interval
  - Beta regression might provide inferior predictions when there significant mass at the boundaries of its support
- Many alternatives have been proposed in the literature
  - Beta regression with transformed dependent variable to force values in the (0,1) interval
  - Fractional response regression
  - Gaussian mixtures
  - Zero-one inflated Beta regression
- I choose the zero-one inflated Beta regression

$$f(y; \pi_0, \pi_1, \mu, \varphi) = \begin{cases} \pi_0, & \text{if } y = 0 \\ (1 - \pi_0)(1 - \pi_1)f_{beta}(y; \mu, \varphi), & \text{if } 0 < y < 1 \\ \pi_1, & \text{if } y = 1 \end{cases}$$
$$\pi_0 = \frac{e^{X_0\beta_0}}{1 + e^{X_0\beta_0}}, \pi_1 = \frac{e^{X_1\beta_1}}{1 + e^{X_1\beta_1}}, \mu = \frac{e^{X\beta}}{1 + e^{X\beta}}$$

# Recovery rates parameter estimates

Parameter	Estimate	Std. Error
Const.	-0.3969	0.1400
$I_{Revolver}$	0.7756	0.0905
$I_{TermLoan}$	0.5988	0.0786
$I_{SeniorSecured}$	0.6166	0.0794
$I_{SeniorUnsecured}$	0.2713	0.0610
$I_{Rank=1}$	0.6205	0.1248
$I_{Rank=2 3}$	0.2687	0.0992
Percent Above	-0.9379	0.1153
Debt	5.1295	0.5998
$I_{Consumer}$	-0.1521	0.0688
$I_{Energy}$	-0.1867	0.0843
$I_{Financials}$	0.3017	0.1354
$I_{Media}$	0.2338	0.0825
$I_{Retail}$	-0.5089	0.0764
$I_{Technology}$	-0.7143	0.0793
$I_{Transportation}$	-0.3501	0.0876
$I_{Unassigned}$	-0.6510	0.1179
$I_{Utilities}$	0.6708	0.1951
$DR^d$	-7.8932	1.3002
$CFNAI^{avg}$	0.3878	0.0397
$\tau$	-0.00043	0.00006

Parameter	Estimate	Std. Error
Const.	-3.4993	0.5162
$I_{Revolver}$	3.4750	0.2484
$I_{TermLoan}$	2.8451	0.2446
$I_{SeniorSecured}$	1.6124	0.2492
$I_{SeniorUnsecured}$	1.2729	0.2390
$I_{Rank=1}$	1.9292	0.4784
$I_{Rank=2 3}$	1.2465	0.4765
$I_{Consumer}$	-0.3907	0.1347
$I_{Energy}$	-0.3492	0.1799
$I_{Financials}$	-1.4723	0.3965
$I_{Media}$	-0.7634	0.1783
$I_{Retail}$	-0.7846	0.1633
$I_{Technology}$	-0.7299	0.1619
$I_{Transportation}$	-0.1330	0.1748
$I_{Unassigned}$	-0.7280	0.2262
$I_{Utilities}$	2.9432	0.2465
$DR^d$	-20.2597	2.6562
$CFNAI^{avg}$	0.3800	0.0778

Parameter	Estimate	Std. Error
Const.	-3.4200	0.3583
$I_{Rank=1}$	-1.4622	0.4968
$I_{Rank=2 3}$	-0.4133	0.2192
Percent Above	3.6485	0.3425
Debt	-21.9332	4.0884
$I_{Consumer}$	-0.6441	0.2172
$I_{Energy}$	-1.2465	0.4495
$I_{Technology}$	0.6851	0.2121
$CFNAI^{avg}$	-0.3047	0.1224
$\tau$	0.00060	0.00017

$0 < \gamma < 1$

$\gamma = 1$

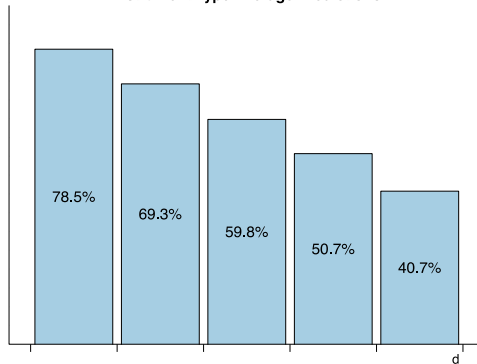
$\gamma = 0$

# Recovery rates parameter estimates

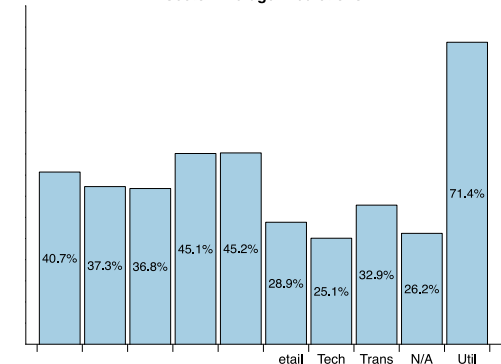
- Instrument type and seniority do matter
  - Loan recoveries higher than bonds
  - Seniority (bond type, rank and percent of debt above) highly significant
- Disparity of average recovery rates per industry sector
  - Securities issued by Utilities companies typically recover more
  - Loss rates typically higher for Technology firms
  - Mixed results for rest of sectors
- Issuer debt is positively correlated to recoveries
  - Higher debt amount typically indicates bigger companies
- Lengthy workout periods reduce recovery rates
  - Costs
  - Stakeholders do not agree on the fair value of the defaulted firm's assets relative to its liabilities
- Economic conditions affect recoveries
  - Higher than normal aggregate default rate at time of default leads to lower recovery rates
    - Default rates reflect macro-financial conditions
    - High default rates indicate low asset values (relative to debt) -> low asset values are likely to lead to low recoveries
  - Average economic conditions throughout the workout period also impact recoveries
    - CFNAI used as a proxy

# Recovery rates predictions

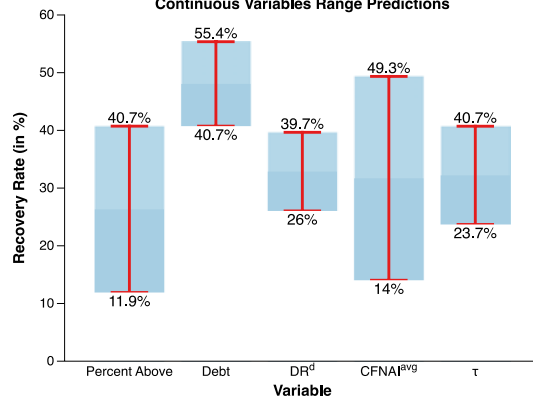
Instrument Type Average Predictions



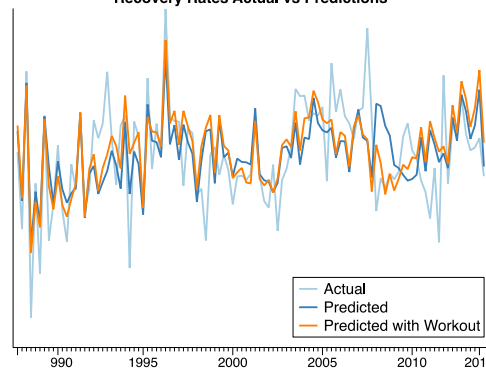
Sector Average Predictions



Continuous Variables Range Predictions



Recovery Rates Actual vs Predictions



- Instrument type and seniority a clear driver of recoveries
- Industry recovery rates are materially different for Utilities, Technology and Retail
- Workout period and forward looking economic conditions improves fit

# Econometric modelling of the workout period

- Time to recovery is modelled using the lognormal distribution
  - The lognormal model gives a better fit as compared to the Weibull, log-logistic and generalized gamma models across the 3 default outcomes

$$\log(\tau_i) = \mathbf{X}_i\boldsymbol{\beta} + u_i, \quad u_i \sim N(0, \sigma^2)$$
$$f(\tau_i) = \frac{1}{\tau_i\sigma\sqrt{2\pi}} \exp\left[-\frac{1}{2\sigma^2}(\log(\tau_i) - \mathbf{X}_i\boldsymbol{\beta})^2\right], \quad S(\tau_i) = 1 - \Phi\left(\frac{\log(\tau_i) - \mathbf{X}_i\boldsymbol{\beta}}{\sigma}\right)$$

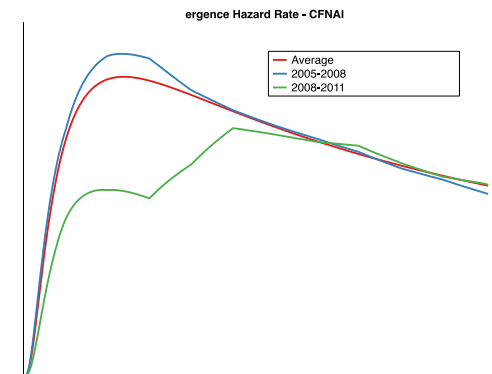
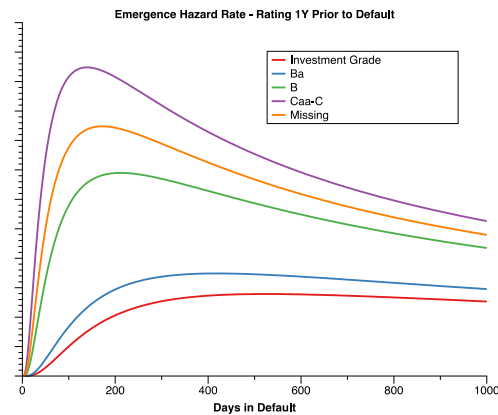
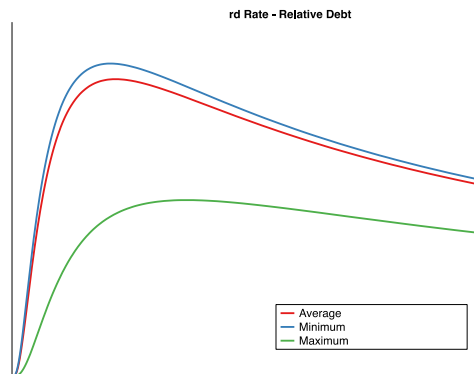
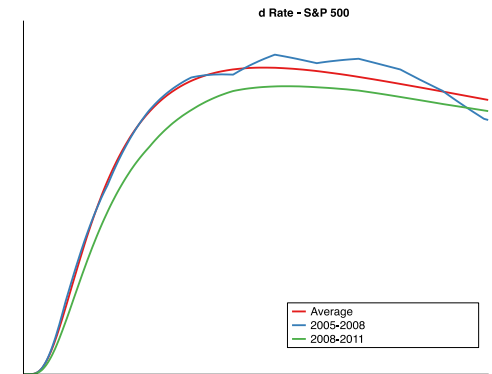
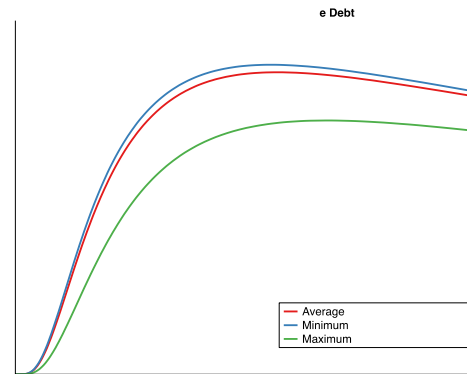
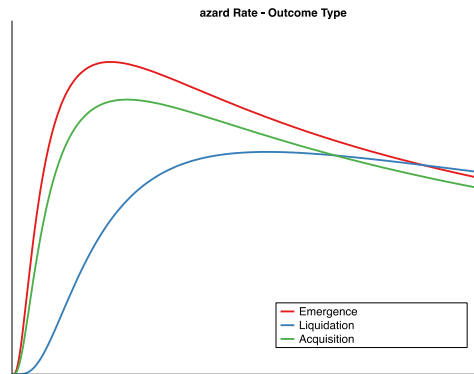
- Emergence period
  - Adequate amount of data
  - Include rating information 1 year prior to default
  - Adjust for relative debt level of issuer
  - Time to emerge depends the state of the economic cycle (CFNAI)
- Liquidation period
  - Not enough data to account for the issuer's rating
  - Adjust for relative debt of issuer
  - Time to liquidation depends on the equity market conditions post-default (S&P 500)
- Acquisition period
  - Very few data points
  - Simple baseline effects with no macroeconomic dependence

# Workout period parameter estimates

Parameter	Estimate	Std. Error
$I_{Acq}$	5.7058	0.1117
$I_{Emer}^{no\ Rtg}$	5.3635	0.0896
$I_{Emer}^{IG}$	6.4767	0.2437
$I_{Emer}^{Ba}$	6.2531	0.1493
$I_{Emer}^B$	5.5697	0.0667
$I_{Emer}^{Caa}$	5.1514	0.0682
$I_{Liq}$	6.1307	0.0609
$SP^{Liq}$	-0.8485	0.3204
$CFNAI^{Emer}$	-0.1371	0.0530
$Debt^{Liq, Emer}$	5.7259	2.0422
$\log(\sigma_{Acq})$	-0.1144	0.0303
$\log(\sigma_{Emer})$	-0.3371	0.0592
$\log(\sigma_{Liq})$	-0.1240	0.0891

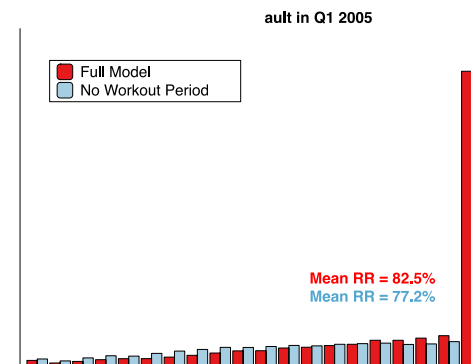
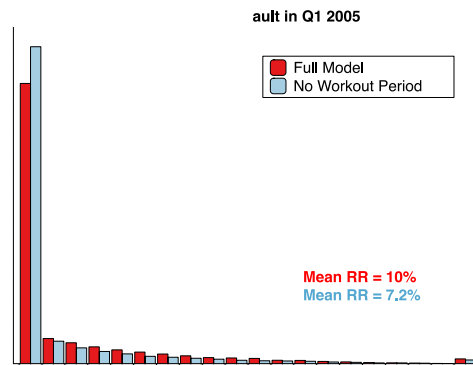
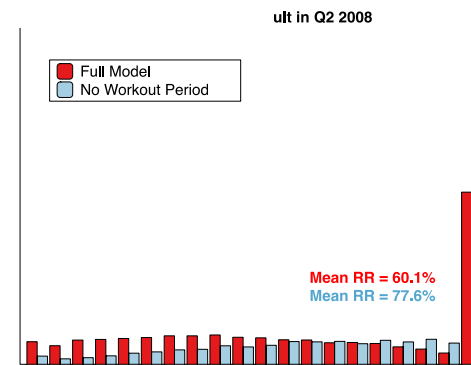
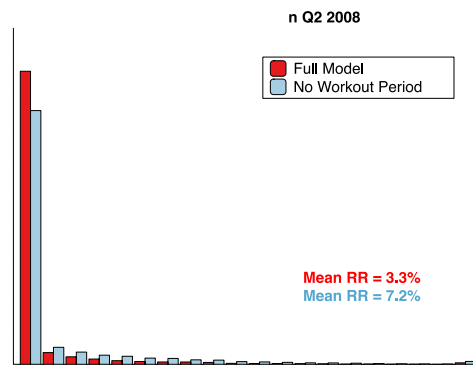
- Issuers that emerge as a going-concern
  - Higher rated issuers emerged from default later
  - Issuers with no rating 1-year prior to default have time to emerge similar to B-Caa rated issuers
  - Corporate workout takes more time for sizeable amounts of debt
  - The state of the business cycle can prolong emergence – during recessions is more difficult to see issuers emerge from bankruptcy
- Corporates that are liquidated
  - Larger amounts of debt take longer to liquidate
  - Unlike emerged issuers, liquidations depend on asset price movements (S&P 500 changes)
- Corporates that are acquired
  - Only baseline hazard contributions
  - Baseline hazard rate between emergence and liquidation

# Workout period predictions



- Liquidations have very different time profile
- Rating very important driver of emergence period
- Impact of economic conditions very pronounced for emergence hazard rate

# Is workout period that important?



- Simulated recovery rate distributions for issuers defaulting in Q1 2005 and Q2 2008
- Bad Quality: Subordinated, low rank instrument, 100% debt above - B-rated corporate
- Good Quality: Senior Secured, high rank instrument, 0% debt above – IG corporate

# Questions

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