

Introducing
**Moody's Mortgage Metrics
Subprime**

just became more transparent.

The tool used by Moody's analysts to reveal the layers of risk in subprime mortgage pools is now available to our clients.

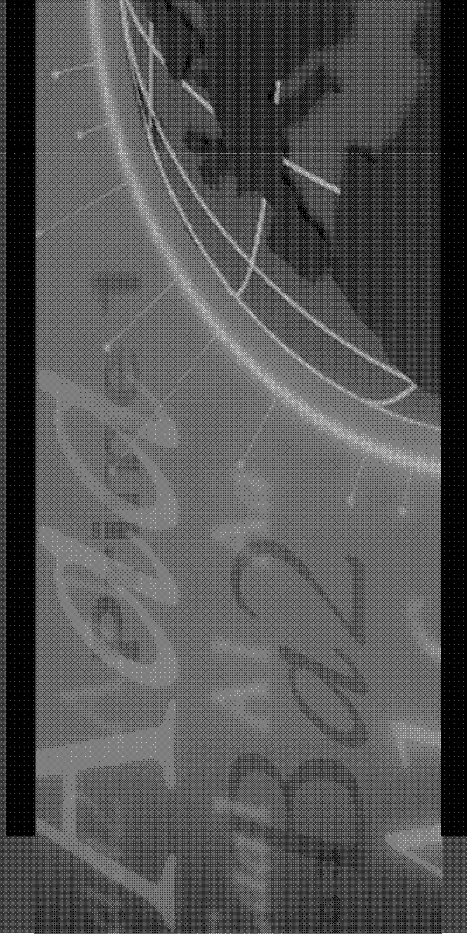


subprime



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Moody's Mortgage Metrics Subprime



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Agenda

- **Motivation for the New Model**
- **How Moody's Analysts Use the Product**
- **Model Analytics**
- **Client Perspective – Bank of America**
- **Data Collection and Cleaning Process**
- **Live Demo**



Key Contacts

- **Analysts**
 - **Warren Kornfeld** **Managing Director**
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 - **Shachar Gonen** **Associate Analyst**
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Why we Developed the Model

- **Previous sub-prime model**
 - Built on older data
 - Some key factors were adjusted outside the model
- **Did not give the transparency of the Moody's Mortgage Metrics Prime Model**
 - Model was not publicly available
 - Did not give the markets sufficient analytical detail



Moody's Mortgage Metrics Subprime Functionality



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Agenda

- **Objective**
- **Data overview**
- **Sensitivities to economic factors**
- **User outputs**
- **Increased precision**



Objective

- **Transparency**
 - Provide the markets sufficient analytical detail
- **Improve utility**
 - Incorporate supplemental analyses
 - Improve analytics



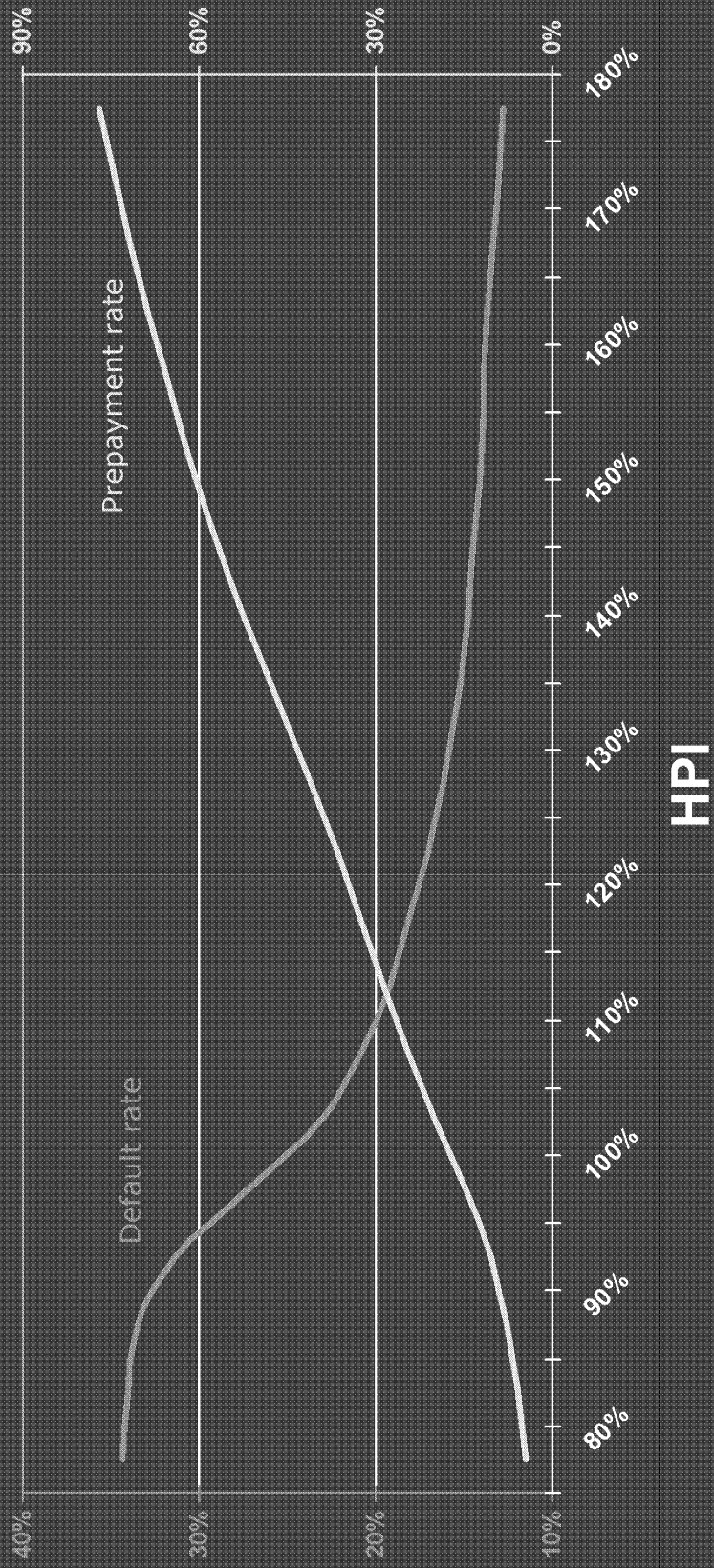
The Database

- **Large, clean database**
 - Two million subprime loans
 - Comprehensive
- **Supplemental analyses: interest only loans and simultaneous seconds**



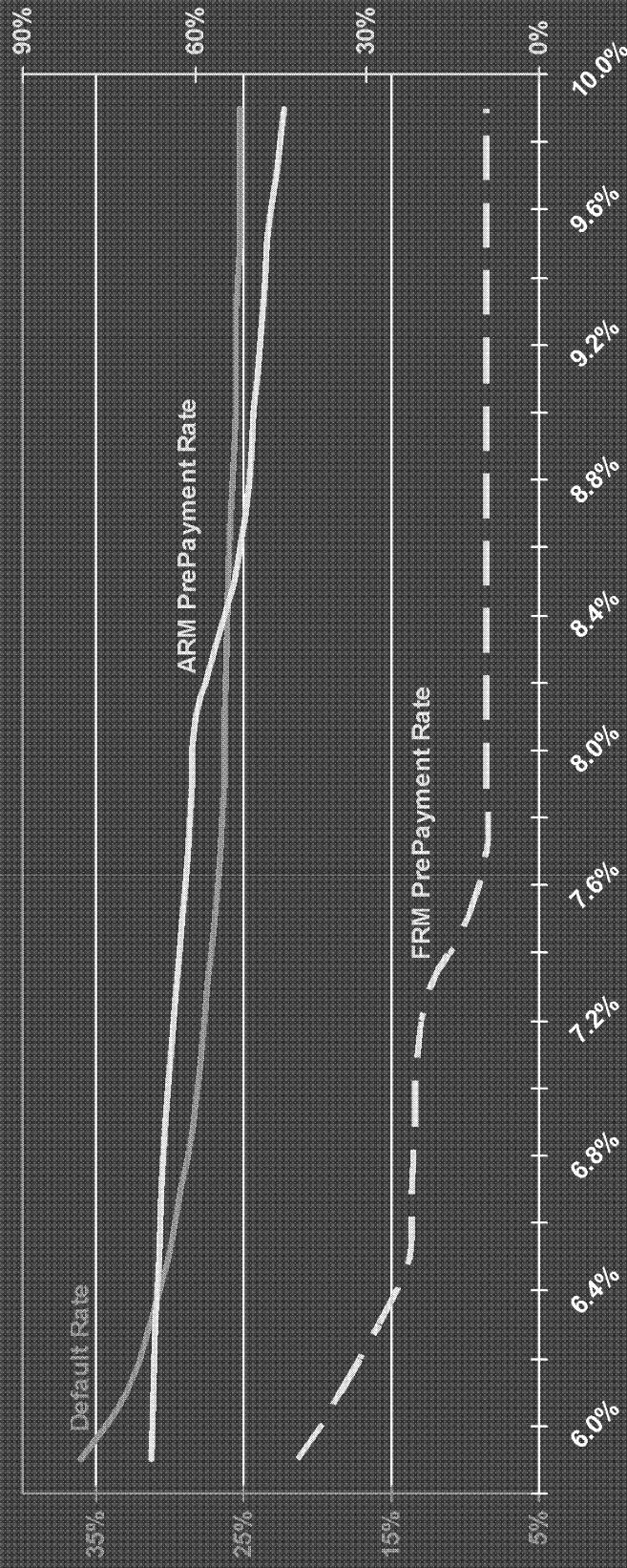
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Moody's Mortgage Metrics Subprime Sensitivity to HPI



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Moody's Mortgage Metrics Subprime Sensitivity to Interest Rates



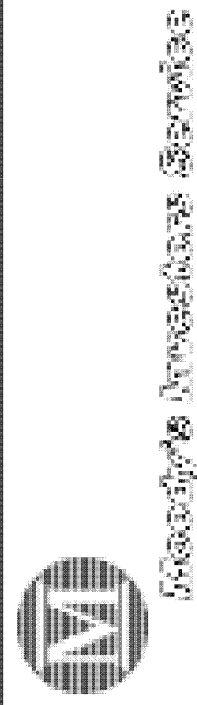
Interest Rate



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Pool Level Output

Pool Summary	Pool Date
10/15/2011	10/15/2011
10/15/2011	10/15/2011
10/15/2011	10/15/2011
10/15/2011	10/15/2011
10/15/2011	10/15/2011



Moody's Mortgage Metrics Subprime - ver 1.1.1

Occur	Own	Invest	Secur	Total	CLTV
					88.8
					83.8
					86.1
					88.6

Rating Summary	Credit Enhancement
Aaa	28.09
Aa2	20.69
A2	14.83
Baa2	10.18
Ba2	7.26
B2	5.50
Loss	5.50

Moody's	98.8%	6.2%	100%	98.8%	6.2%	100%
Moody's	98.8%	6.2%	100%	98.8%	6.2%	100%
Moody's	98.8%	6.2%	100%	98.8%	6.2%	100%
Moody's	98.8%	6.2%	100%	98.8%	6.2%	100%
Moody's	98.8%	6.2%	100%	98.8%	6.2%	100%
Moody's	98.8%	6.2%	100%	98.8%	6.2%	100%



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Riskiest and Largest



Riskiest & Largest Loans	
Loan ID	Subp



Moody's Mortgage Metrics Subp

Riskiest Loans

Loan ID	Loss	Loan Amount	Orig Appr Amt	Updated Appr Amt
6699585	20.76	41,239	55,000	
601768164	20.41	71,907	80,000	80,000
601767967	19.89	51,916	65,000	65,000
601767977	19.60	53,913	60,000	60,000
601780644	19.54	42,733	57,000	57,000



Moody's Mortgage Metrics Subp

Loan ID	Loss	Loan Amount	Orig Appr Amt	Updated Appr Amt
6687321	9.87	999,476	1,250,000	
6695049	3.81	979,518	1,400,000	
6688770	7.55	960,000	1,200,000	
310000553	10.34	959,323	1,200,000	1,200,000
6698941	4.74	930,596	1,163,902	

Jr Ratio	Lien Pos	FICO	DTI	Ins.	Zip	State
0.0%	1	533	11.0		50220	IA
0.0%	1	676	21.0		37406	TN
0.0%	1	575	42.0		19805	DE
0.0%	1	644	46.0		29127	SC
0.0%	1	534	16.0		48227	MI

Loan ID	Loss	Loan Amount	Orig Appr Amt	Updated Appr Amt
6687321	9.87	999,476	1,250,000	
6695049	3.81	979,518	1,400,000	
6688770	7.55	960,000	1,200,000	
310000553	10.34	959,323	1,200,000	1,200,000
6698941	4.74	930,596	1,163,902	

Largest Loans

Loan ID	Loss	Loan Amount	Orig Appr Amt	Updated Appr Amt
6687321	9.87	999,476	1,250,000	
6695049	3.81	979,518	1,400,000	
6688770	7.55	960,000	1,200,000	
310000553	10.34	959,323	1,200,000	1,200,000
6698941	4.74	930,596	1,163,902	

Jr Ratio	Lien Pos	FICO	DTI	Ins.	Zip	State
0.0%	1	627	53.0		60622	IL
0.0%	1	555	15.0		33308	FL
0.0%	1	678	45.0		91325	CA
0.0%	1	685	43.0		80108	CO
0.0%	1	680	40.0		92782	CA



Loan by Loan



Moody's Mortgage Metrics Subprime -



Moody's Mortgage Metrics Subprime			
Loan ID	Aaa	Loss	Loan Amount
6699585	89.29	20.76	41,239
601768164	87.89	20.41	71,907
601767967	85.81	19.89	51,916
601760644	84.38	19.60	53,913
601710564	79.99	18.61	65,467
320000281	79.33	18.28	110,121
601775281	76.23	17.50	55,912
310000150	75.95	17.60	59,791
601783923	75.69	17.37	72,900

Loan ID	Aaa	Loss	Loan Amount	Orig Apprl Amt	Updated Apprl Amt
6699585	89.29	20.76	41,239	55,000	80,000
601768164	87.89	20.41	71,907	80,000	65,000
601767967	85.81	19.89	51,916	60,000	60,000
601760644	84.38	19.54	42,733	57,000	57,000
601710564	79.99	18.61	65,467	85,000	85,000
320000281	79.33	18.28	110,121	551,000	73,500
601775281	76.23	17.50	55,912	80,000	80,000
310000150	75.95	17.60	59,791	88,000	88,000
601783923	75.69	17.37	72,900		

Moody's Mortgage Metrics Subprime			
DTI	Ins.	Zip	State
11		50220	IA
21		37406	TN
42		19805	DE
46		29127	SC
16		48227	MI
48		61080	IL
45		6802	CT
37		48505	MI
40		62052	IL
41		29204	SC

DTI codes have been mapped to:



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Precise Quantification of Layered Risk



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Rating Summary	Credit Enhancement
Aaa	29.96
Aa2	22.07
A2	15.81
Baa2	10.84
Ba2	7.73
B2	5.86
Loss	5.86

Pool Summary	
Wtd. Avg. Gross Margin	5.75%
Wtd. Avg. Rate	8.50%
Wtd Avg CLTV / LTV	80.3 / 80.3
Wtd Avg 1st LienCLTV / 1st LienLTV / JrCLTV	80.3 / 80.3 / 0
% 1st Lien	100.00%
% 1st Liens with Jr Liens	0.00%
1st Lien LTV > 80%	10.6%
Full Doc	0.0%
Purchase	100.0%
Wtd. Avg. DTI	0.0
Wtd. Avg. FICO	582.0
Wtd. Avg. Original Term/Wtd. Avg. Seasoning	360 / 0
Wtd. Avg IO Term / IO%	24 / 100%



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Precise Quantification of Layered Risk

FICO	%	LTV	CLTV	1st Lien LTV	%	FICO	DTI	%	FICO
> 840	0.0%	0.0	0.0	> 95	0.0%	0.0	Null	0.0%	0.0
> 820	0.0%	0.0	0.0	> 90	0.0%	0.0	0	100.0%	582.0
> 800	0.0%	0.0	0.0	> 85	10.6%	593.7	> 0	0.0%	0.0
> 780	0.0%	0.0	0.0	> 80	0.0%	0.0	> 20	0.0%	0.0
> 760	0.0%	0.0	0.0	> 75	82.0%	579.0	> 30	0.0%	0.0
> 740	5.4%	79.3	79.3	> 70	1.2%	629.8	> 35	0.0%	0.0
> 720	5.3%	80.5	80.5	> 65	6.2%	591.6	> 40	0.0%	0.0
> 700	5.4%	79.7	79.7	> 60	0.0%	0.0	> 45	0.0%	0.0
> 680	5.3%	79.9	79.9	> 55	0.0%	0.0	> 50	0.0%	0.0
> 660	5.4%	79.1	79.1	<= 55	0.0%	0.0	> 55	0.0%	0.0
> 640	8.6%	84.0	84.0	Total	100.0%	582.0	> 60	0.0%	0.0
> 620	5.4%	79.7	79.7				> 65	0.0%	0.0
> 600	5.4%	79.9	79.9				> 70	0.0%	0.0
> 580	5.3%	80.7	80.7				Total	100.0%	582.0

FICO	%	LTV	CLTV	1st Lien LTV	%	FICO
> 840	0.0%	0.0	0.0	> 95	0.0%	0.0
> 820	0.0%	0.0	0.0	> 90	0.0%	0.0
> 800	0.0%	0.0	0.0	> 85	10.6%	593.7
> 780	0.0%	0.0	0.0	> 80	0.0%	0.0
> 760	0.0%	0.0	0.0	> 75	82.0%	579.0
> 740	5.4%	79.3	79.3	> 70	1.2%	629.8
> 720	5.3%	80.5	80.5	> 65	6.2%	591.6
> 700	5.4%	79.7	79.7	> 60	0.0%	0.0
> 680	5.3%	79.9	79.9	> 55	0.0%	0.0
> 660	5.4%	79.1	79.1	<= 55	0.0%	0.0
> 640	8.6%	84.0	84.0	Total	100.0%	582.0

Term	%	FICO	LTV	CLTV
40 Year	0.0%	0.0	0.0	0.0
35 Year	0.0%	0.0	0.0	0.0
30 Year	100.0%	582.0	80.3	80.3
25 Year	0.0%	0.0	0.0	0.0
20 Year	0.0%	0.0	0.0	0.0
15 Year	0.0%	0.0	0.0	0.0
10 Year	0.0%	0.0	0.0	0.0
Total	100.0%	582.0	80.3	80.3

1st Lien CLTV	%	FICO
> 95	0.0%	0.0
> 90	0.0%	0.0
> 85	10.6%	593.7
> 80	0.0%	0.0
> 75	82.0%	579.0
> 70	1.2%	629.8
> 65	6.2%	591.6
> 60	0.0%	0.0
> 55	0.0%	0.0
<= 55	0.0%	0.0
Total	100.0%	582.0

- Clean state concentration: 83% CA, 7% FL, 4% NY, 3% NJ
- Layered state concentration: 83% CA, 7% FL, 4% NY, 4% NJ



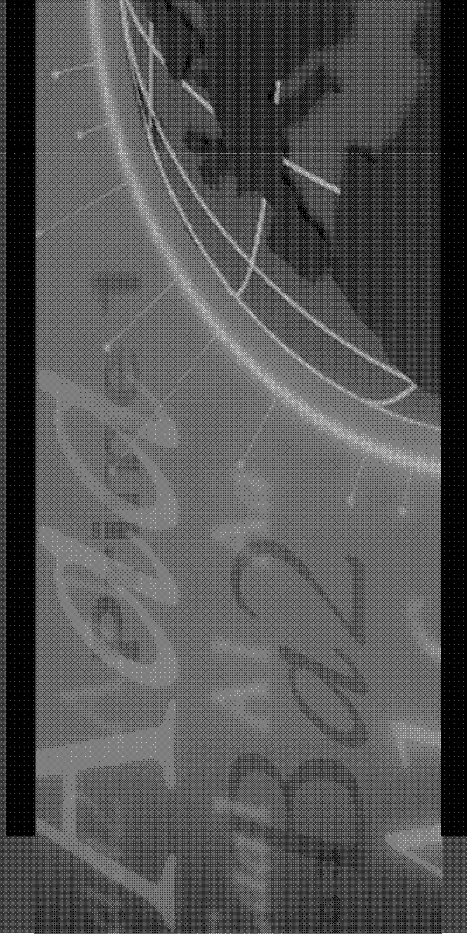
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Precise Quantification of Layered Risk

	Layered Risk	Clean
WA FICO	583 ←	582
FICO <620	59.09%	59.36%
FICO >660	26.98%	26.70%
WA LTV	80.33%	80.33%
WA CLTV	80.41%	80.33%
Simultaneous Seconds	4.10% ←	0%
Full Doc	46.11% ←	47.17%
Purchase	99.38% ←	100%
Investor	1% ←	0.00%
Single Family	99% ←	100%
CA	80% ←	83%
FL	7%	7%
State 3	4%	4%
State 4	4% ←	3%
State 5	4% ←	3%
Aaa	30.77	29.96
EL	6.07	5.86



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Moody's Mortgage Metrics
 Moody's Mortgage Metrics - v1.1.0
 Moody's Mortgage Metrics - v1.1.0
 Moody's Mortgage Metrics - v1.1.0
 Moody's Mortgage Metrics - v1.1.0

Rating Summary

Rating	Value
Aaa	24.86
Aa2	18.48
A2	13.39
Baa2	9.32
Ba2	6.65
B2	5.04
Loss	5.04

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Progress

When you are ready to run the simulations, press the Next button. This could take several minutes.

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Loan ID	Rate	Loss
1	4.75	1.82
2	4.75	1.82
3	4.75	1.82
4	4.75	1.82
5	4.75	1.82
6	4.75	1.82
7	4.75	1.82
8	4.75	1.82
9	4.75	1.82
10	4.75	1.82
11	4.75	1.82
12	4.75	1.82
13	4.75	1.82
14	4.75	1.82
15	4.75	1.82
16	4.75	1.82
17	4.75	1.82
18	4.75	1.82
19	4.75	1.82
20	4.75	1.82
21	4.75	1.82
22	4.75	1.82
23	4.75	1.82
24	4.75	1.82
25	4.75	1.82
26	4.75	1.82
27	4.75	1.82
28	4.75	1.82
29	4.75	1.82
30	4.75	1.82
31	4.75	1.82
32	4.75	1.82
33	4.75	1.82
34	4.75	1.82
35	4.75	1.82
36	4.75	1.82
37	4.75	1.82
38	4.75	1.82
39	4.75	1.82
40	4.75	1.82
41	4.75	1.82
42	4.75	1.82
43	4.75	1.82
44	4.75	1.82
45	4.75	1.82
46	4.75	1.82
47	4.75	1.82
48	4.75	1.82
49	4.75	1.82
50	4.75	1.82
51	4.75	1.82
52	4.75	1.82
53	4.75	1.82
54	4.75	1.82
55	4.75	1.82
56	4.75	1.82
57	4.75	1.82
58	4.75	1.82
59	4.75	1.82
60	4.75	1.82
61	4.75	1.82
62	4.75	1.82
63	4.75	1.82
64	4.75	1.82
65	4.75	1.82
66	4.75	1.82
67	4.75	1.82
68	4.75	1.82
69	4.75	1.82
70	4.75	1.82
71	4.75	1.82
72	4.75	1.82
73	4.75	1.82
74	4.75	1.82
75	4.75	1.82
76	4.75	1.82
77	4.75	1.82
78	4.75	1.82
79	4.75	1.82
80	4.75	1.82
81	4.75	1.82
82	4.75	1.82
83	4.75	1.82
84	4.75	1.82
85	4.75	1.82
86	4.75	1.82
87	4.75	1.82
88	4.75	1.82
89	4.75	1.82
90	4.75	1.82
91	4.75	1.82
92	4.75	1.82
93	4.75	1.82
94	4.75	1.82
95	4.75	1.82
96	4.75	1.82
97	4.75	1.82
98	4.75	1.82
99	4.75	1.82
100	4.75	1.82

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Number of Loans	Abs CE	Mean Loss
250	24.86	5.04
0	N/A	N/A
250	24.86	5.04
250	24.86	5.04

Agenda

- **Factor selection and model estimation**
- **Simulation of loss distribution**
- **Model performance**



The Model



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Moody's Mortgage Metrics for Subprime is a Combination of Models

- **Econometric models of loan behavior**
 - **Prepayment models (ARM and Fixed models)**
 - **Default model**
 - **Severity model**
- **Econometric models of the state of the economy**
 - **Unemployment**
 - **HPI**
 - **Interest rate for various reference rates**
- **A simulation framework that integrates these across a mortgage portfolio to produce a loss distribution for the mortgage pool**
- **A tranching tool that matches expected losses to Moody's guidelines**
- **Supporting validation results suggest good predictive power and intuitive relationships between inputs**



Modeling Process

- **Collection and scrubbing** of historical data (borrower-specific, loan specific, macro-economic, etc.)
- **Estimation** and calibration of econometric models for **loan behavior**
 - Prepayment
 - Default
 - Severity
- **Validation** of econometric models from historical loan and macro data
- **Estimation**, calibration and validation of **macro-economic** models and
- Integration of macro-economic and loan models in **simulation**
- **Calibration** of simulation



Factor Selection and Model Estimation



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Selection Criteria

- 1) Is the factor available for a large number of mortgages and is its construction objective?**
- 2) Does the variable effectively distinguish between behaviors?**
- 3) Is the relationship between the variable and behavior as expected?**



Variable	Default	Prepay	Severity
FICO	X		X
Prepay penalty		X	
Purpose	X	X	X
Occupancy Type	X	X	X
Property type	X	X	X
Documentation type	X	X	X
Loan Amount	X	X	X
CLTV	X	X	X
Borrowers Equity		X	
Unemployment Rate	X		
Burnout		X	

Borrower Equity

$$\text{beq} = \text{AppraisalAmt} * (\text{HPI}(t) / \text{HPI}(0) - \text{activePrinBal})$$



Variable	Default	Prepay	Severity
Region	X	X	X
Current mortgage rate (on loan)	X	X	X
Age	X	X	X
HPI	X	X	X
Carry cost			X
Teaser rate	X		
Seasonality		X	X
Amortization term	X		
Loan type	X	X	
Appraisal amount		X	X
Current market rate	X	X	
Mortgage Premium	X	X	

Mortgage premium
$MP = (\text{currentMtgrate} - \text{SubprimeMktrate}) / \text{currentMtgrate}$

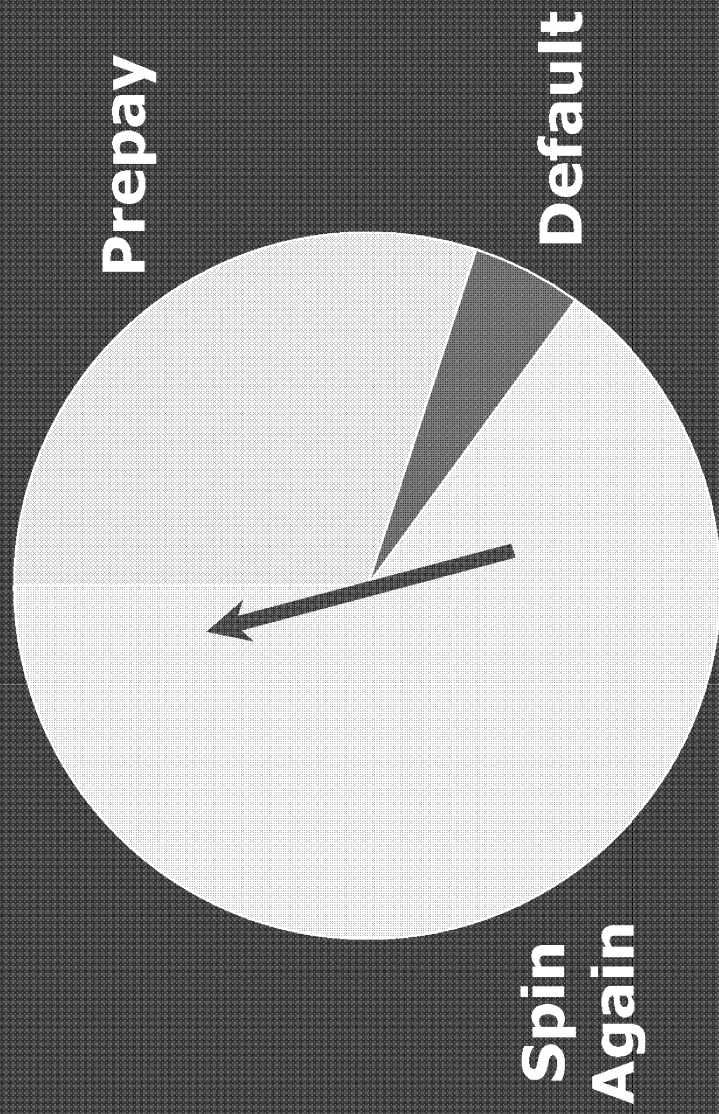


Simulation of Loss Distribution



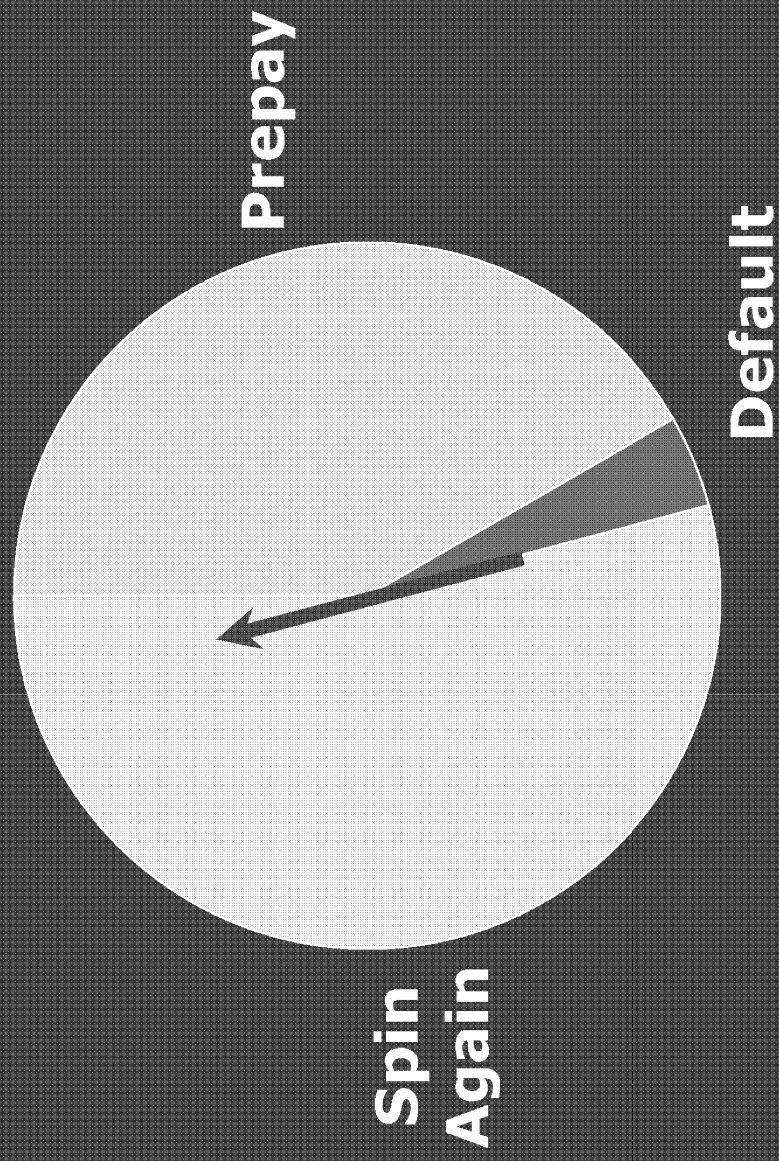
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A Simplified View of the Key Processes



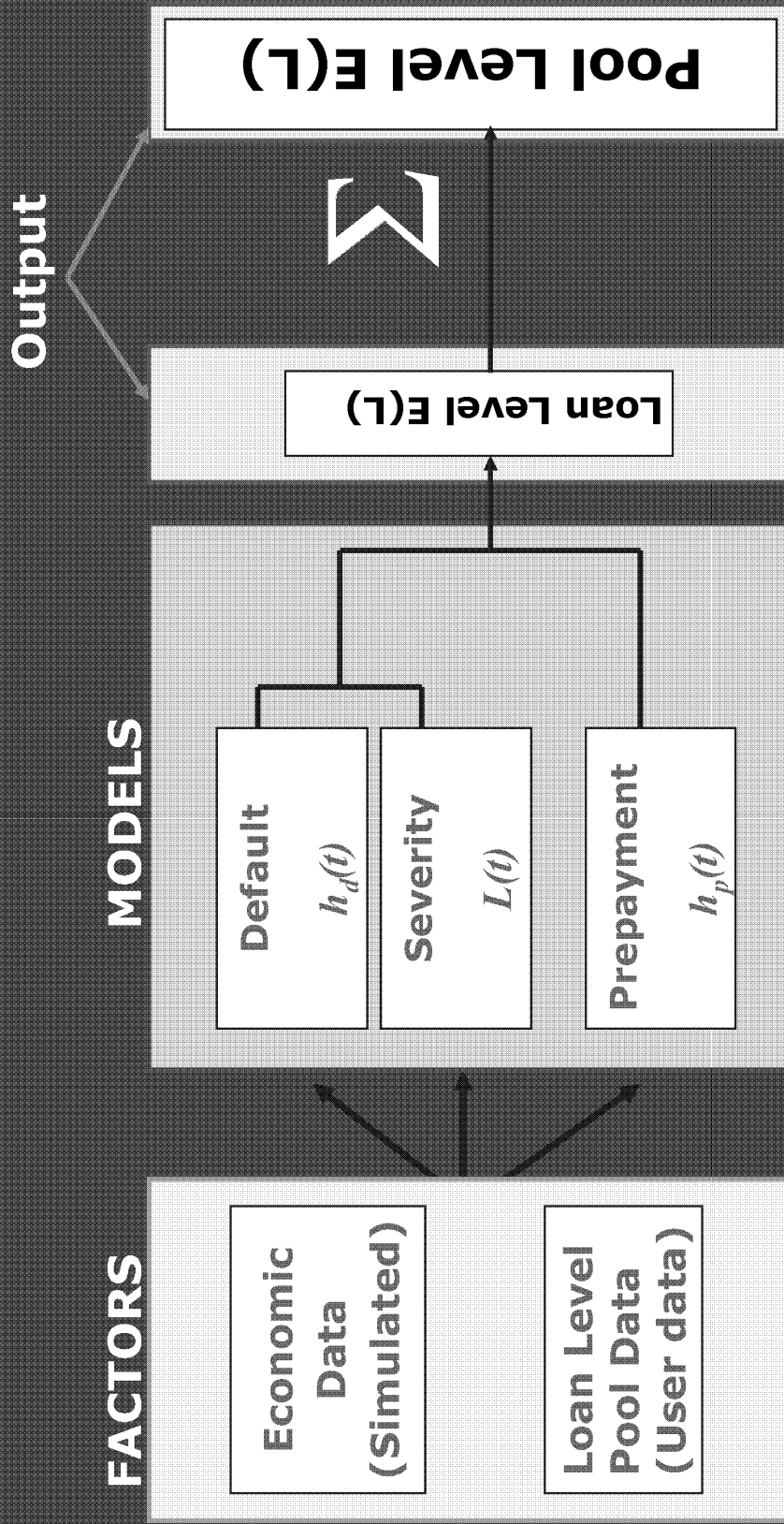
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A Simplified View of the Key Processes



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Model Overview



The Models

- Data transformations (parametric and non-parametric)
- **Prepayment** is modeled in a **hazard rate framework** (2 models) with baselines that differ by loan type and prepayment penalty within each model

$$h_p(t) = h_0(t)e^{\beta f(x)}$$

where $f(x)$ are the transformed factors

- **Default model** has similar functional form

$$h_p(t) = h_0(t)e^{\beta'g(x)}$$

- **LGD model** uses **Beta-transformed OLS**

$$L(t) = \text{Beta}^{-1}(\delta q(x))$$

- Note that we have simplified the notation above: factors are not identical across models

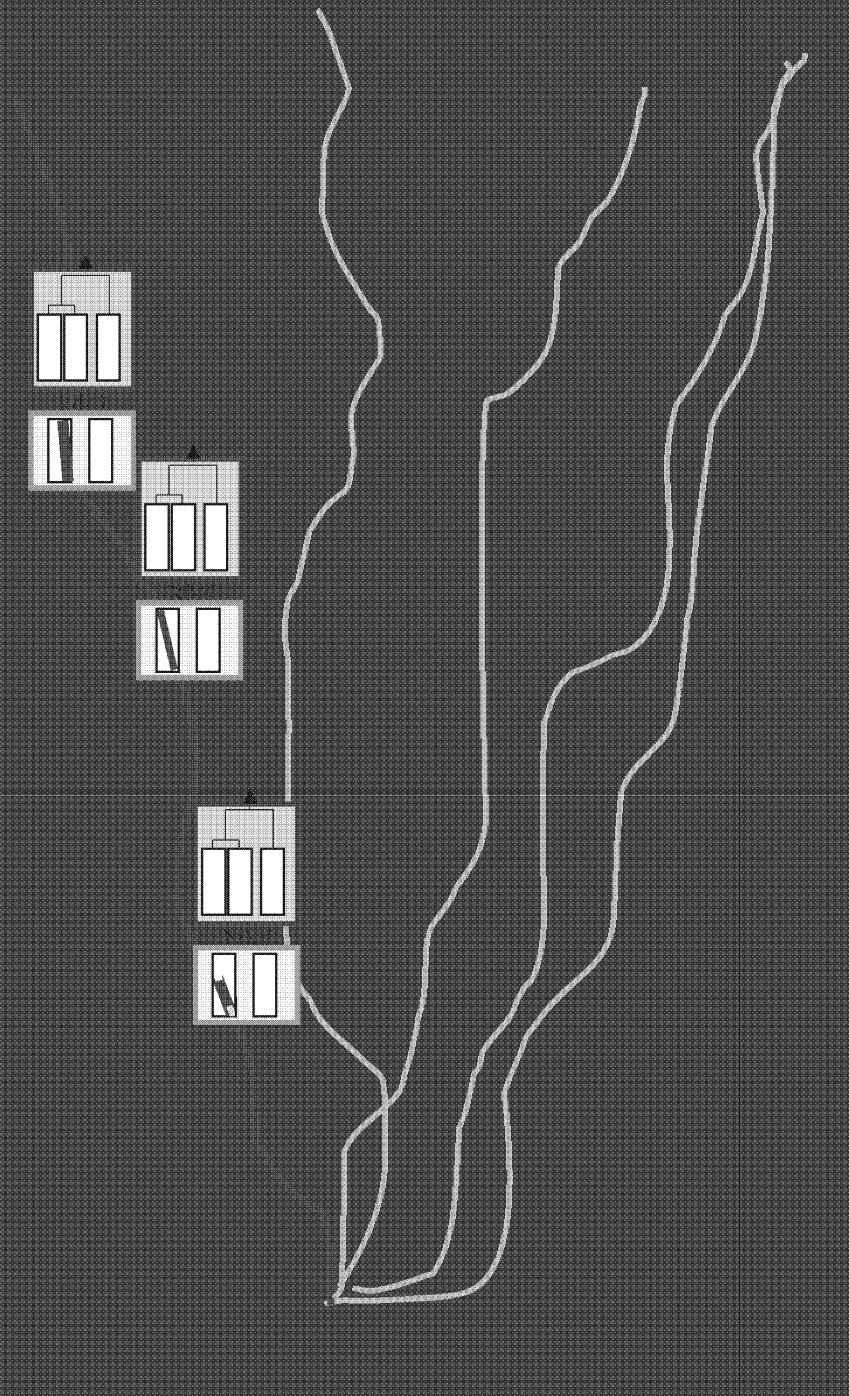


The Simulations

- **Econometric Cross-sectional and time Series** models of unemployment (UNP), HPI, long- and short- rates and Subprime rate
- State-specific HPI and UNP paths
- **Simulation algorithm**
 - For each iteration (1250)
 - Generate jointly one realization of each economic series (40 quarters)
 - For each quarter
 - For each loan
 - » Calculate $h_p(t), h_d(t), L(t)$ using data from pool tape and simulated economic series
 - Sum losses for pool in period 40
 - Integrate losses (probability weighted) across iterations to estimate loss distribution



Simulating economic environments



Today

40 Quarters
from now



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Model Performance



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Walk-Forward testing is one of the approaches we use

➤ **Provides a test of model overfitting and measures the out-of-sample performance.**

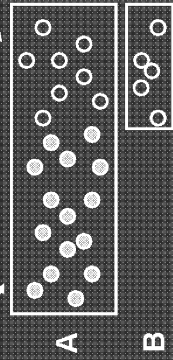
- Estimate the model on the data up to a certain point in the past and score the future year (relative to that point).
- Advance the cutoff for the estimation by one year and estimate the next year.
- Continue in this manner until the data is exhausted.
- Combine the scored “out-of-sample” subsamples and calculate performance statistics

➤ **Tests both model and modeling approach.**

➤ **Simulates the way in which models are used in practice.**

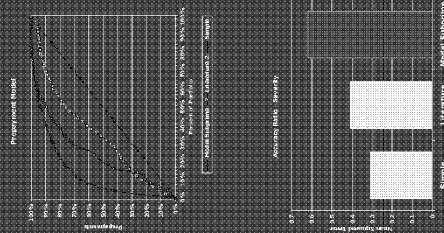
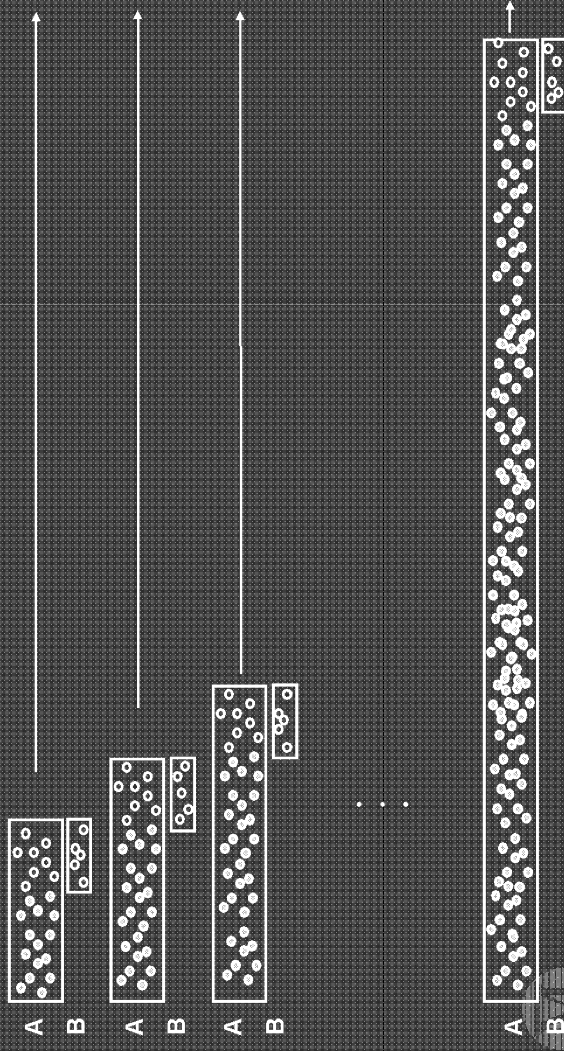


Training set of mortgages taken at t_0 Validation set of original mortgages in training sample but taken at t_1

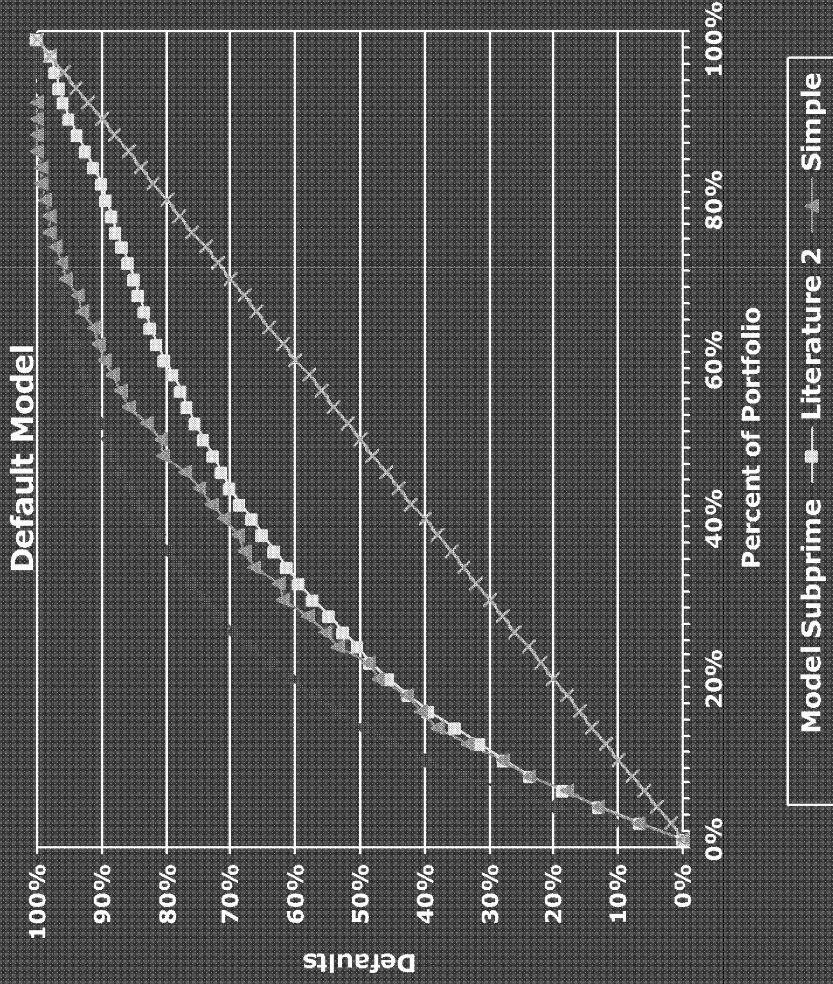


Validation set of new mortgages not in training sample & taken at t_1

1999 2000 2001 2006



Default Model Out of Sample Power Curve



AR

Model Subprime
 Literature 0.35
 Simple 0.43

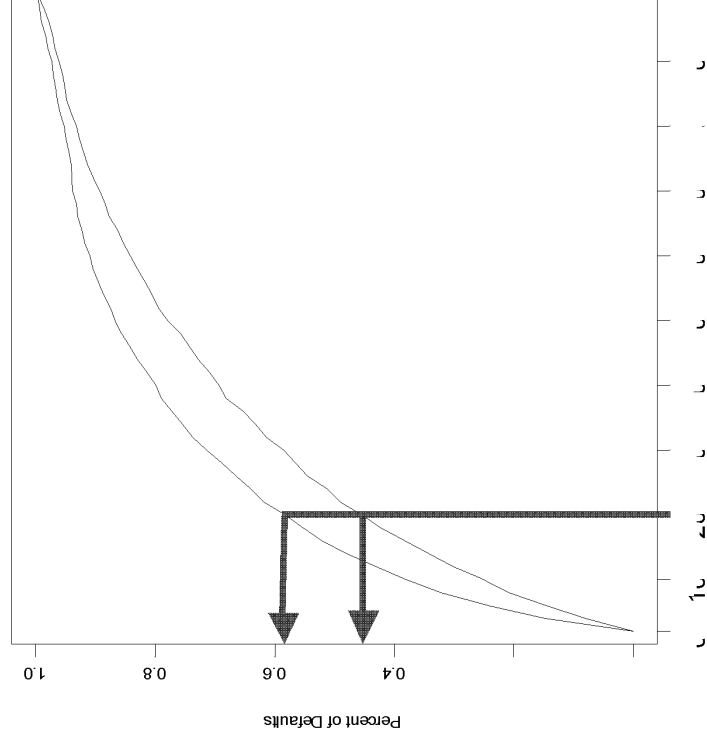
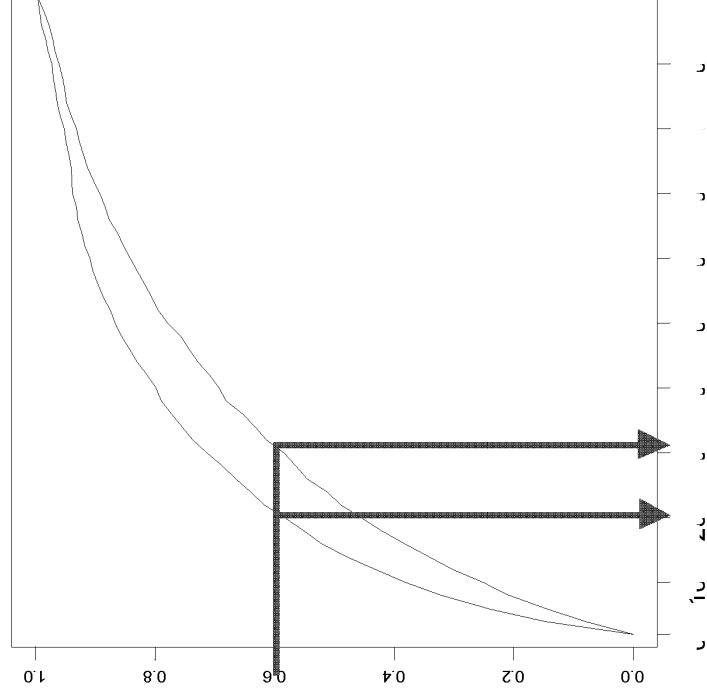


Moody's Investors Service

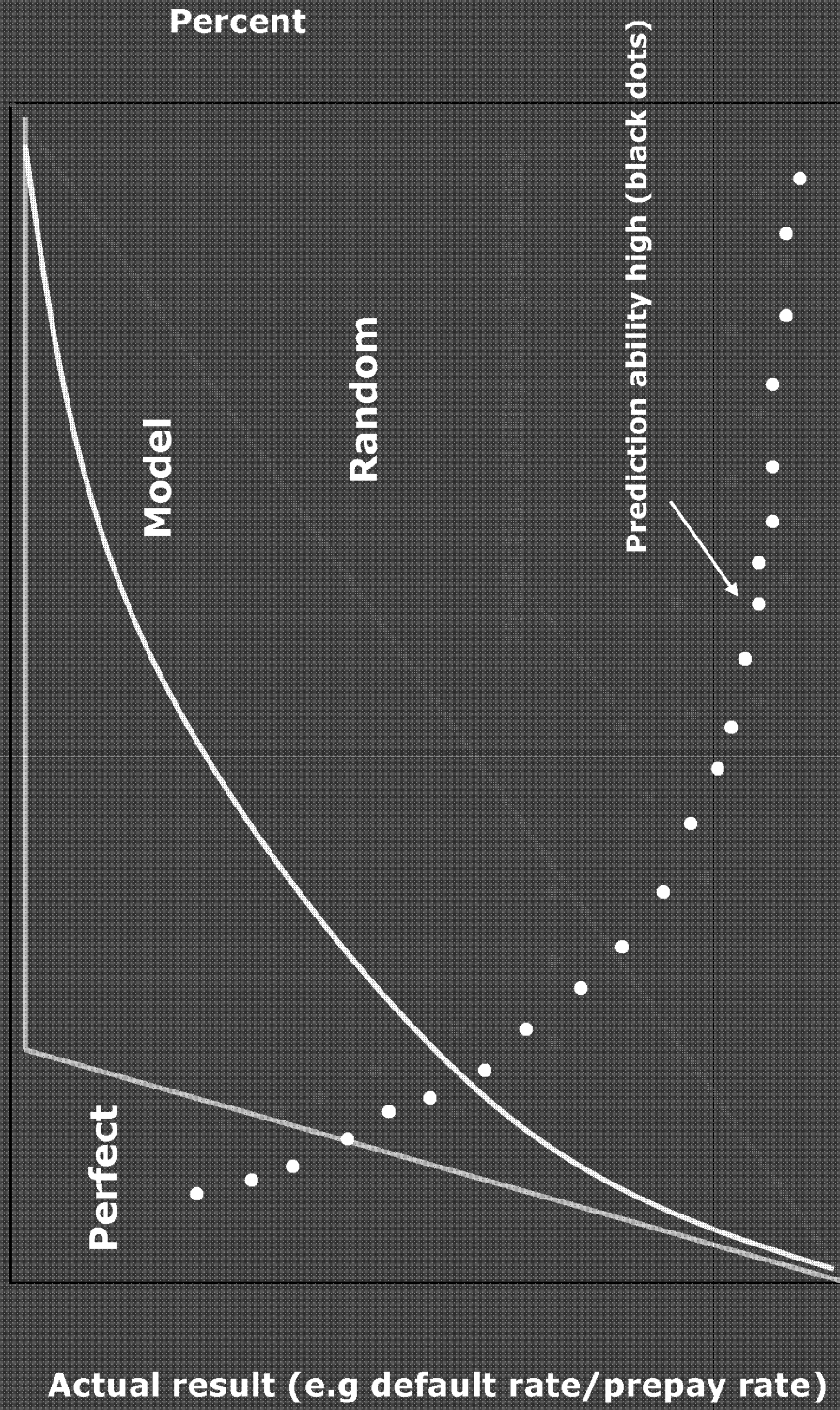
Why more powerful models are better

If our goal is to avoid 60% of the defaults in a mortgage pool, the more powerful model requires us to exclude fewer good loans.

If our goal is to include 80% of a portfolio in a pool, the more powerful model avoids more defaults.



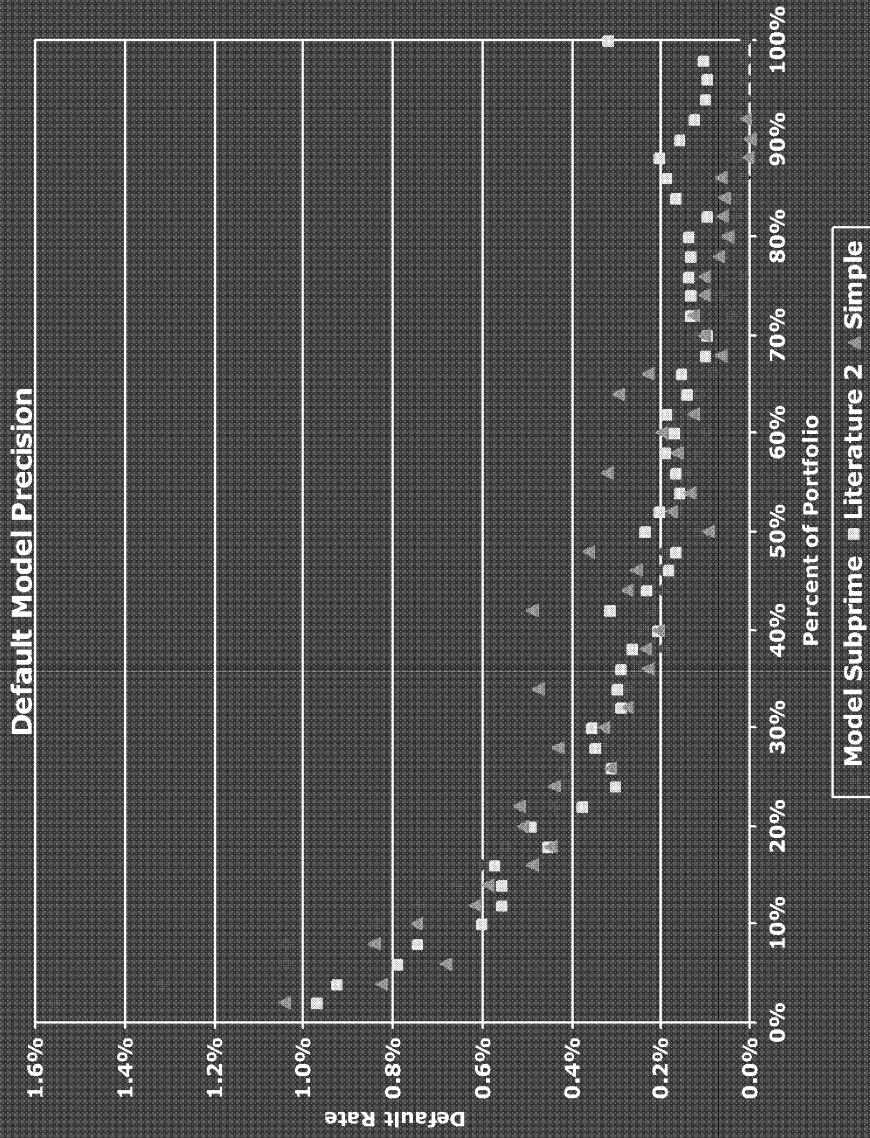
Accuracy Ratio



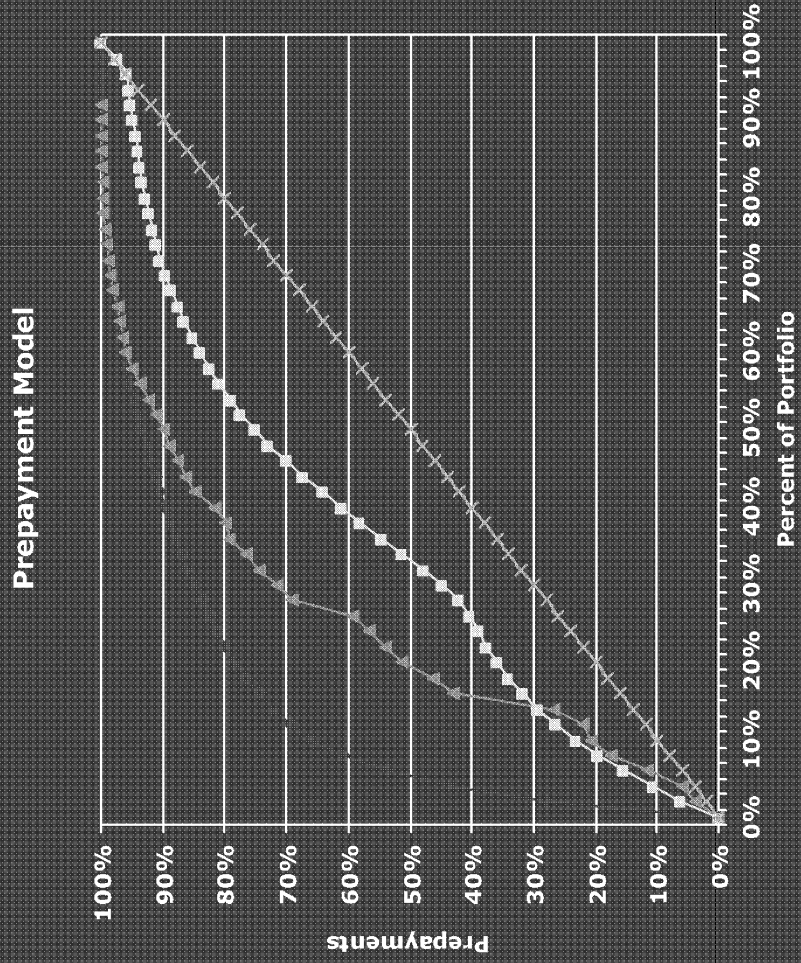
Actual result (e.g default rate/prepay rate)

Ordering of mortgages

Default Model Precision



Prepayment Model Out of Sample Power Curve



Prepayment Model

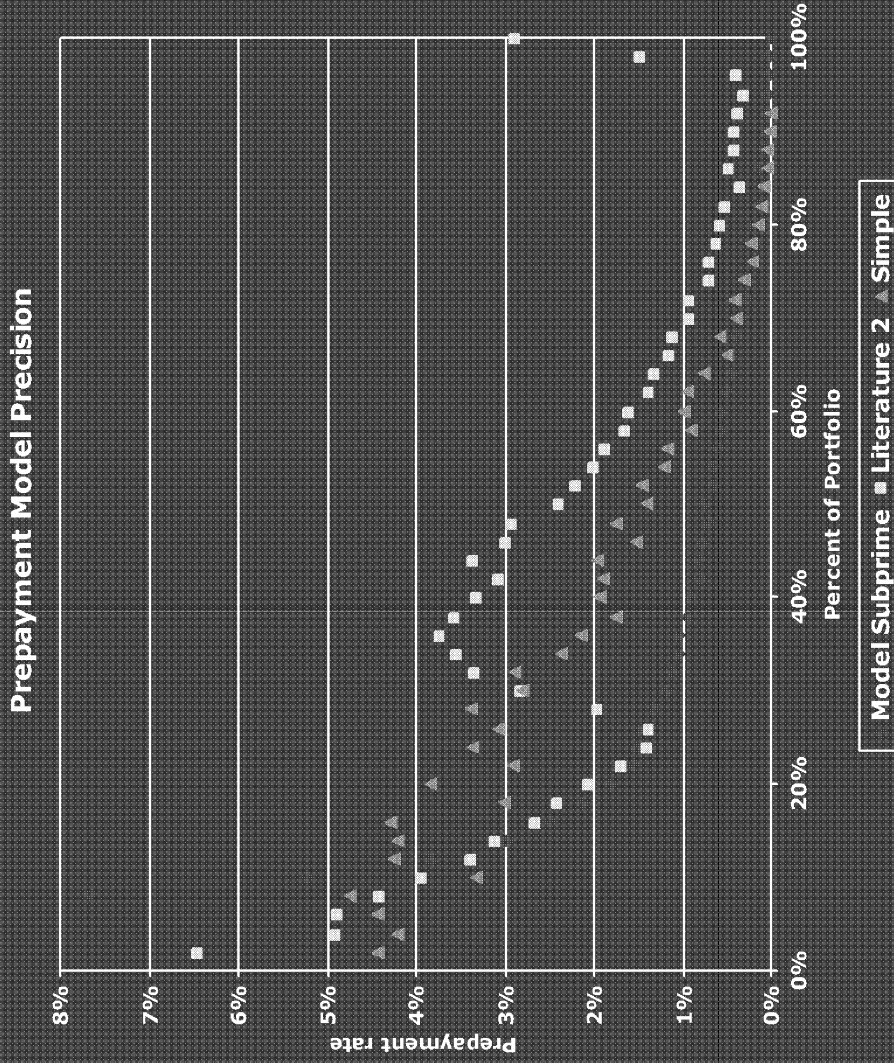
Model Subprime Literature 2 Simple

AR

Model Subprime	Literature 2	Simple
	0.31	0.42

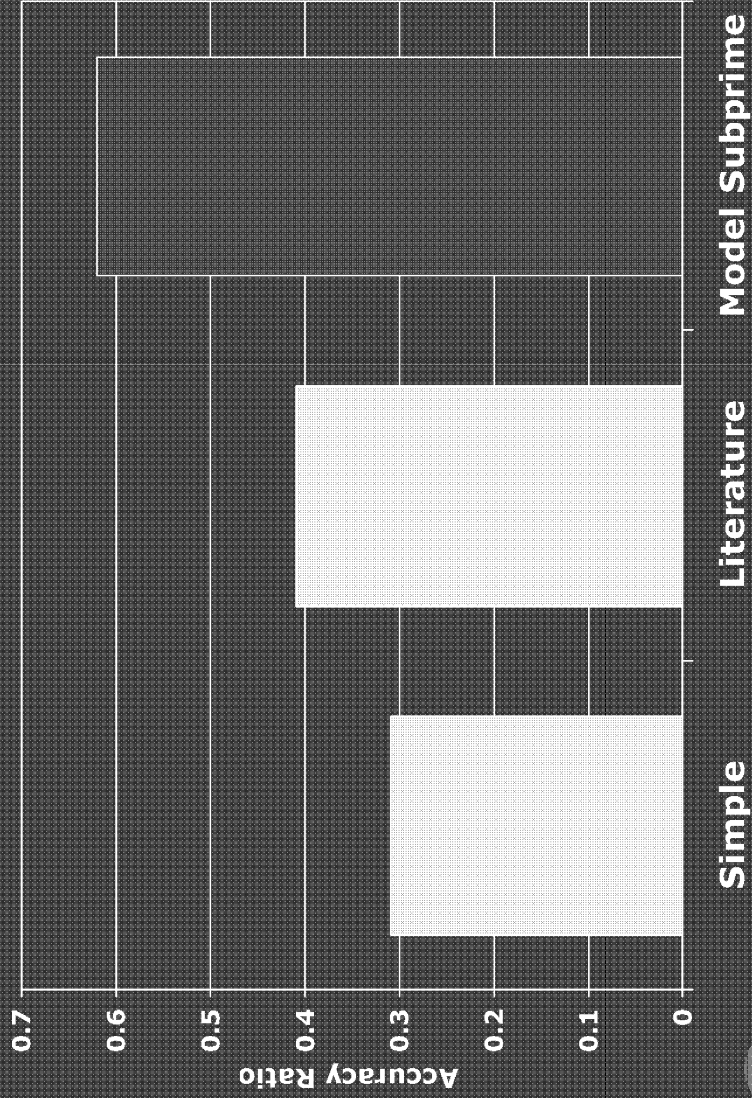


Prepayment Model Precision



Severity Model - Accuracy Ratio

Accuracy Ratio - Severity



Out of Sample AR

Simple

0.31

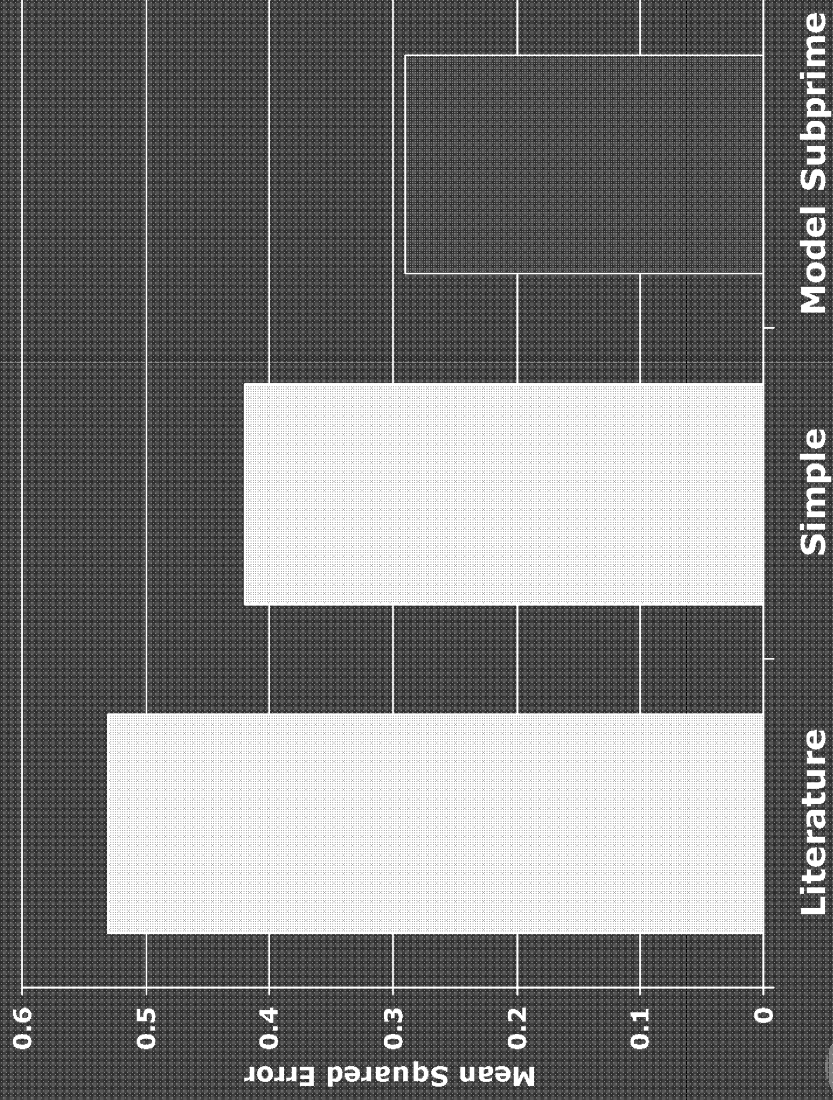
Literature

0.41

Model Subprime



Severity Model – Mean Square Error



Out of Sample MSE
(Low values are better)

Literature	0.53
Simple	0.42
Model Subprime	0.27



Moody's Mortgage Metrics for Subprime is a Combination of Models

- **Econometric models of loan behavior**
 - **Prepayment models (ARMS and Fixed models)**
 - **Default model**
 - **Severity model**
- **Econometric models of the state of the economy**
 - **Unemployment**
 - **HPI**
 - **Interest rate for various reference rates**
- **A simulation framework that integrates these across a mortgage portfolio to produce a loss distribution for the mortgage pool**
- **A tranching tool that matches expected losses to Moody's guidelines**
- **Supporting validation results suggest good predictive power and intuitive relationships between inputs**



Some of Moody's research on model validation

Benchmarking Default Prediction Models: Pitfalls and Remedies in Model Validation, Stein, R. M., **Technical Report #030124 (2002)**.

http://www.moodyskmv.com/research/files/wp/BenchmarkingDefaultPredictionModels_TR030124.pdf

The Relationship Between Default Prediction and Lending Profits: Integrating ROC Analysis and Loan Pricing Roger M. Stein, May, ***Journal of Banking and Finance***, Vol. 29, No. 5. (2003, 2005).

http://www.moodyskmv.com/research/files/wp/JBF_2026.pdf

Inferring the Default Rate in a Population by Comparing Two Incomplete Default Databases, Dwyer, D. W. and Stein, ***Journal of Banking and Finance***, Vol. 30 (2003, 2005)

http://www.moodyskmv.com/research/files/wp/InferringDefaultRate_JBF.pdf

Are the probabilities right?: Dependent Defaults and the Number of Observations Required to Test for Default Rate Accuracy, Stein, R. M., ***Journal of Investment Management***, 2, 4, 2006.

<http://joim.com>

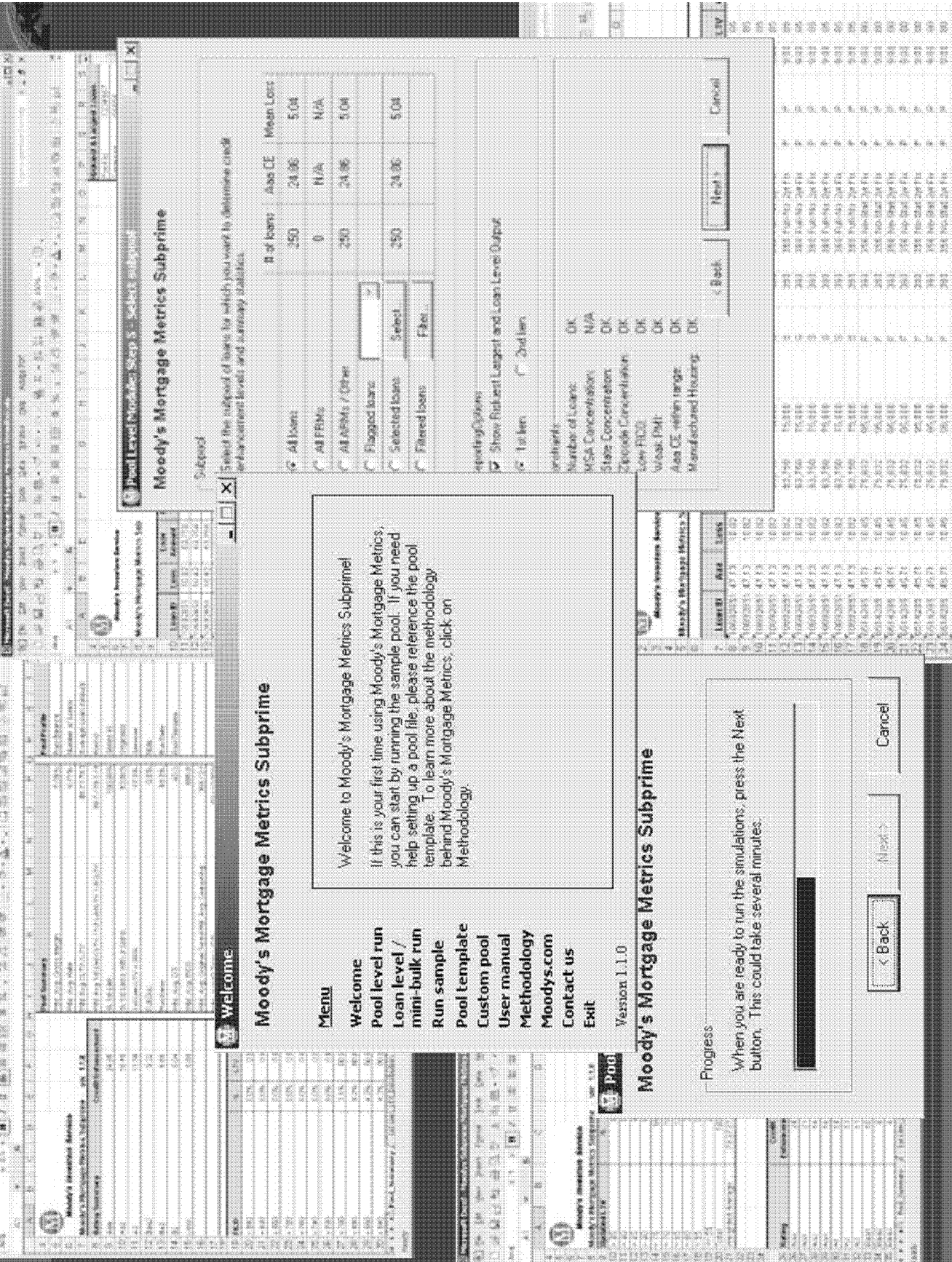
http://www.defaultrisk.com/pp_test_23.htm (draft version)

What is a more powerful model worth?, Stein, R. M. and Felipe Jordão, **Technical Report #030422 (2003)**

http://www.moodyskmv.com/research/files/wp/MorePowerfulModel_TR030124.pdf



Moody's Investors Service



Welcome

Moody's Mortgage Metrics Subprime

Menu

- Welcome
- Pool level run
- Loan level / mini-bulk run
- Run sample
- Pool template
- Custom pool
- User manual
- Methodology
- Moody's.com
- Contact us
- Exit

Version 1.1.0

Moody's Mortgage Metrics Subprime

Progress

When you are ready to run the simulations, press the Next button. This could take several minutes.



< Back

Next >

Cancel

Welcome to Moody's Mortgage Metrics Subprime!

If this is your first time using Moody's Mortgage Metrics, you can start by running the sample pool. If you need help setting up a pool file, please reference the pool template. To learn more about the methodology behind Moody's Mortgage Metrics, click on Methodology.

Moody's Mortgage Metrics Subprime

Setup

Select the range of loans for which you want to determine credit risk-adjustment levels and summary statistics.

	# of loans	Abs CE	Mean Loss
All loans	350	24.96	5.04
All FPMs	0	N/A	N/A
All NPMs / Other	350	24.96	5.04
Flagged loans			
Selected loans	Select		5.04
Filtered loans	Filter		

Show Riskiest Largest and Loan Level Output

Loans

- Number of Loans: OK
- MSA Concentrations: N/A
- State Concentration: OK
- Geocode Concentration: OK
- Loan FICO: OK
- Wash. PMI: OK
- Abs CE within range: OK
- Manufactured Housing: OK

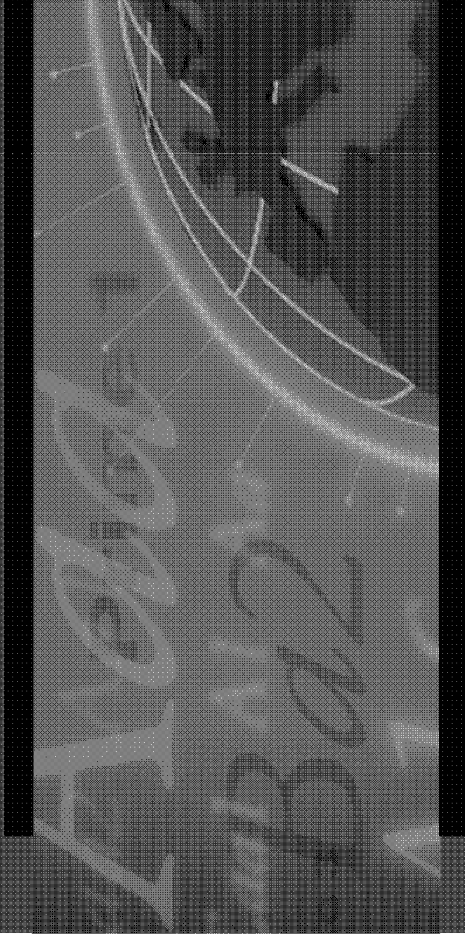
< Back

Next >

Cancel

Loan ID	Loan Size	Loan Type	Loan Age	Loan Status	Loan Loss
1	100,000	ARM	1	OK	0.00
2	150,000	ARM	2	OK	0.00
3	200,000	ARM	3	OK	0.00
4	250,000	ARM	4	OK	0.00
5	300,000	ARM	5	OK	0.00
6	350,000	ARM	6	OK	0.00
7	400,000	ARM	7	OK	0.00
8	450,000	ARM	8	OK	0.00
9	500,000	ARM	9	OK	0.00
10	550,000	ARM	10	OK	0.00
11	600,000	ARM	11	OK	0.00
12	650,000	ARM	12	OK	0.00
13	700,000	ARM	13	OK	0.00
14	750,000	ARM	14	OK	0.00
15	800,000	ARM	15	OK	0.00
16	850,000	ARM	16	OK	0.00
17	900,000	ARM	17	OK	0.00
18	950,000	ARM	18	OK	0.00
19	1,000,000	ARM	19	OK	0.00
20	1,050,000	ARM	20	OK	0.00
21	1,100,000	ARM	21	OK	0.00
22	1,150,000	ARM	22	OK	0.00
23	1,200,000	ARM	23	OK	0.00
24	1,250,000	ARM	24	OK	0.00
25	1,300,000	ARM	25	OK	0.00
26	1,350,000	ARM	26	OK	0.00
27	1,400,000	ARM	27	OK	0.00
28	1,450,000	ARM	28	OK	0.00
29	1,500,000	ARM	29	OK	0.00
30	1,550,000	ARM	30	OK	0.00
31	1,600,000	ARM	31	OK	0.00
32	1,650,000	ARM	32	OK	0.00
33	1,700,000	ARM	33	OK	0.00
34	1,750,000	ARM	34	OK	0.00
35	1,800,000	ARM	35	OK	0.00
36	1,850,000	ARM	36	OK	0.00
37	1,900,000	ARM	37	OK	0.00
38	1,950,000	ARM	38	OK	0.00
39	2,000,000	ARM	39	OK	0.00
40	2,050,000	ARM	40	OK	0.00
41	2,100,000	ARM	41	OK	0.00
42	2,150,000	ARM	42	OK	0.00
43	2,200,000	ARM	43	OK	0.00
44	2,250,000	ARM	44	OK	0.00
45	2,300,000	ARM	45	OK	0.00
46	2,350,000	ARM	46	OK	0.00
47	2,400,000	ARM	47	OK	0.00
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54	2,750,000	ARM	54	OK	0.00
55	2,800,000	ARM	55	OK	0.00
56	2,850,000	ARM	56	OK	0.00
57	2,900,000	ARM	57	OK	0.00
58	2,950,000	ARM	58	OK	0.00
59	3,000,000	ARM	59	OK	0.00
60	3,050,000	ARM	60	OK	0.00
61	3,100,000	ARM	61	OK	0.00
62	3,150,000	ARM	62	OK	0.00
63	3,200,000	ARM	63	OK	0.00
64	3,250,000	ARM	64	OK	0.00
65	3,300,000	ARM	65	OK	0.00
66	3,350,000	ARM	66	OK	0.00
67	3,400,000	ARM	67	OK	0.00
68	3,450,000	ARM	68	OK	0.00
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72	3,650,000	ARM	72	OK	0.00
73	3,700,000	ARM	73	OK	0.00
74	3,750,000	ARM	74	OK	0.00
75	3,800,000	ARM	75	OK	0.00
76	3,850,000	ARM	76	OK	0.00
77	3,900,000	ARM	77	OK	0.00
78	3,950,000	ARM	78	OK	0.00
79	4,000,000	ARM	79	OK	0.00
80	4,050,000	ARM	80	OK	0.00
81	4,100,000	ARM	81	OK	0.00
82	4,150,000	ARM	82	OK	0.00
83	4,200,000	ARM	83	OK	0.00
84	4,250,000	ARM	84	OK	0.00
85	4,300,000	ARM	85	OK	0.00
86	4,350,000	ARM	86	OK	0.00
87	4,400,000	ARM	87	OK	0.00
88	4,450,000	ARM	88	OK	0.00
89	4,500,000	ARM	89	OK	0.00
90	4,550,000	ARM	90	OK	0.00
91	4,600,000	ARM	91	OK	0.00
92	4,650,000	ARM	92	OK	0.00
93	4,700,000	ARM	93	OK	0.00
94	4,750,000	ARM	94	OK	0.00
95	4,800,000	ARM	95	OK	0.00
96	4,850,000	ARM	96	OK	0.00
97	4,900,000	ARM	97	OK	0.00
98	4,950,000	ARM	98	OK	0.00
99	5,000,000	ARM	99	OK	0.00
100	5,050,000	ARM	100	OK	0.00

Moody's Mortgage Metrics Subprime User's Perspective

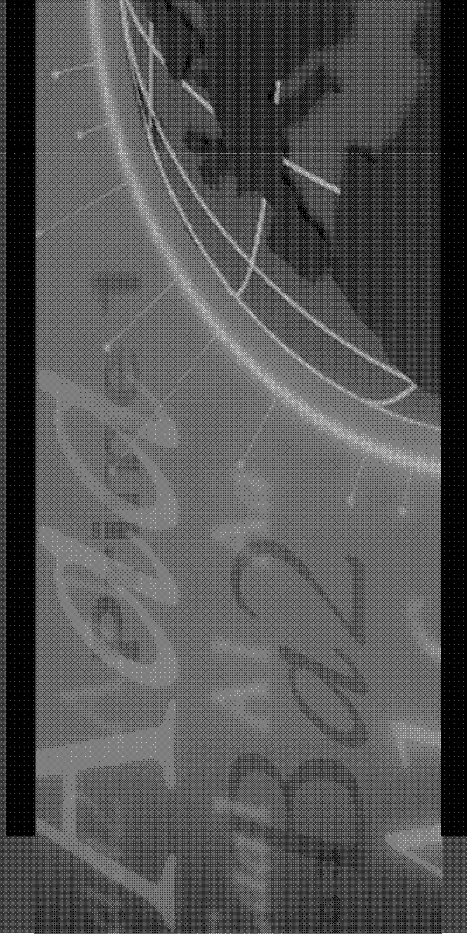


Chris Schiavone
Principal and Head of Home
Equity and Asset Backed
Securities
Bank of America Securities



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Moody's Mortgage Metrics Subprime



Jody Rasch
Vice President
Asset Finance Group
New Products
(212) 553-3797



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Mortgage Credit Research Database



Moody's Investors Service

A Large, High-Quality Data Set of Sub-Prime Loans

- **The Moody's Mortgage Credit Research Database (MCRD) contains highly scrubbed data on about 2 million sub prime loans**
- **Collection efforts continue, currently have 9 data providers, primarily originators**
- **The data goes back to 1995**



Data Cleaning Process



Moody's Investors Service

Overview

- **Mapping – least common denominator**
- **Outliers – simple and statistical techniques**
 - Developed over 100 rules for cleaning
 - Used Cook's Distance measure for outliers
- **Provided clean research database**



Data Mapping and Cleaning

- **Different number of fields (doc type)**
- **Missing fields**
- **Use uniform standards for content and formats**
 - Map data sets into our format
 - Same data scale
- **Manual entry**
 - Typos
 - Fields swap positions, etc.



Example of Business Rules

- **Over 100 business rules put in place**
 - CLTV can't be less than LTV
 - Mortgage rate >0
 - Remaining term \leq Original term, etc.
 - Use constraints on all loan attributes that will be included in our model
- **Raw data contained a significant amount of common sense errors**



Statistical Techniques to Detect Outliers



Moody's Investors Service

Statistical Data Cleaning Techniques

- **Outlier with respect to the predictors - Data is Outside a Range**
- **Outlier with respect to response variable - Result is Outside a Range**
- **Cook's Distance - Impact on the Model Result**
- **Etc.**



Data Cleaning – One Provider

Margin_Freq	Frequency	Percent	Cumulative Frequency	Cumulative Percent
(20, inf)	2	0	2	0
(10, 20]	174	0.02	176	0.02
(9, 10]	1019	0.13	1195	0.15
(8, 9]	4703	0.6	5898	0.75
(7,8]	40396	5.13	46294	5.88
(6,7]	132574	16.84	178868	22.72
(5,6]	236022	29.98	414890	52.7
(0,5]	118088	15	532978	67.7
null or 0	254269	32.3	787247	100

There are two loans with Margin larger than 20 (These outliers are often detected by the COOK'S DISTANCE test). We find the margins for these two loans are 545 and 710. We also find that the other loan attributes are quite normal. So we correct these two loans' margins from 545 to 5.45, and 710 to 7.10.

Data Eliminated

LTV_Freq	Frequency	Percent	Cumulative Frequency	Cumulative Percent
(140,inf)	11	0	11	0
(120, 140]	10	0	21	0
(100, 120]	122	0.02	143	0.02
(80, 100]	253414	32.19	253557	32.21
(70, 80]	452201	57.44	705758	89.65
(60, 70]	59243	7.53	765001	97.17
(40, 60]	13839	1.76	778840	98.93
(0, 40]	8407	1.07	787247	100

There are 11 loans with LTV larger than 140. Most of these are 3-digit values, like 280, 230, etc. It's really hard to correct them. We just delete 8 loans from our data set with LTV greater than 150.



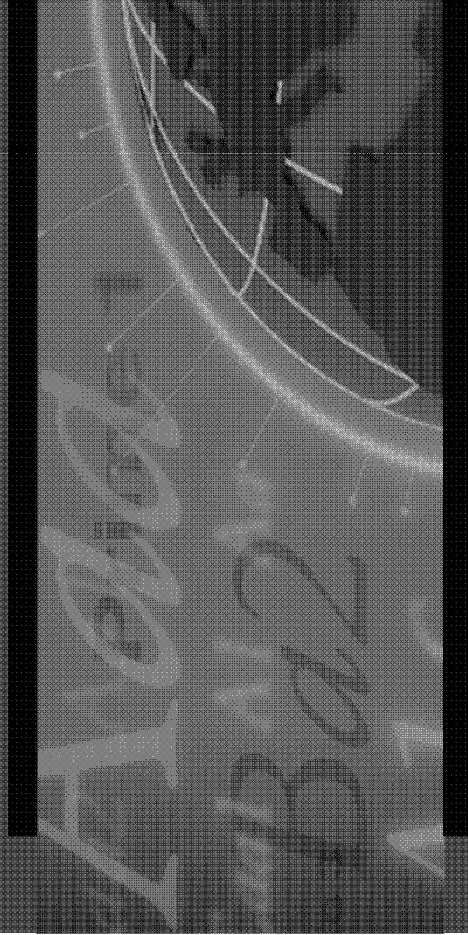
Data Substituted

FICO_Freq	Frequency	Percent	Cumulative Frequency	Cumulative Percent
(1000, inf)	1148	0.15	1148	0.15
(800, 1000]	2905	0.37	4503	0.51
(600, 800]	356844	45.33	360897	45.84
(400, 600]	362910	46.1	723807	91.94
(200, 400]	1018	0.13	724826	92.07
(0, 200]	388	0.05	725214	92.12
null or 0	62033	7.88	787247	100

Here we have 1,148 loans with unreasonable FICO values. Since there are 62033 loans with 0 or missing FICO in our data set, we set missing values for all these 1,148 loans.



**For a demonstration of
Moody's Mortgage Metrics Subprime
please contact Kelly Slicklein**



**Kelly Slicklein
Assistant Vice President
Product Specialist
Investor Services Group
(212) 553-4703**



Moody's Investors Service

Introducing
**Moody's Mortgage Metrics
Subprime**

just became more transparent.

The tool used by Moody's investors to reveal the extent of risk in
subprime mortgage pools is now available to our clients.



subprime



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