Finance as Social Science
The Subprime Example

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SECTION 1

Subprime Mortgage Loan Losses
Predicting 2006 Subprime Mortgage Loan Losses

♦ Multi Factor Regression aka the “Physics Model” => 5% losses
♦ Social Science Model Dec 2006: Default Timing Curve Model => 11% losses
♦ Social Science Model Oct 2007: Shutdown Model => 16% losses
♦ Social Science Model Nov 2007: Higher LGD => 20% losses
♦ Social Science Model Apr 2008: Still Higher LGD => 25% losses
The Failure of the Physics Model

- Explanatory variables: FICO, LTV, HPA, Payment Shock, Debt to income, income verification
- Mortgage application data was inaccurate
- “Soft” unreported underwriting variables deteriorated
- Explanatory variables were out of the range of historical observation
- The multiplicative effects of explanatory variables were out of the range of historical observation
The Social Science Model

♦ Default timing curves predict how many more defaults are going to occur in a mortgage pool given how many defaults have already occurred and the WALA (or seasoning) of the mortgage loan portfolio.

This approach is like measuring sixth graders and predicting their heights as adults.

♦ The “Shutdown Model” reflects the loss of re-financing opportunity and higher delinquency “roll rates”.

♦ Higher loss given default reflects worse HPA prediction.
Behavioral Feedback Loops

Home Price Appreciation

♦ High home price appreciation decreased mortgage loan defaults and losses

♦ Low loan losses decreased loan underwriting vigilance, made mortgage credit more readily available
  ♦ “Affordability” mortgage loan products embed payment shock or high LTV or both

♦ Easy mortgage lending supported HPA

Unfortunately, the process can also work in reverse
Behavioral Feedback Loops

No Skin in the Game

♦ Mortgage brokers were paid to originate loans, not screen applicant credit risk
♦ Mortgage originators transferred almost all risk to Wall Street
♦ Wall Street transferred almost all risk to subprime investors
♦ ABS CDO managers were paid for assets under management and early payments from mortgage loans

Unfortunately, when the music stopped, participants up and down the chain were left holding the risk they hadn’t passed on
Next Behavioral Effect

Change in Willingness to Pay

♦ Homeowners who can pay their mortgage will choose not to

♦ www.youwalkaway.com

♦ Homeowners can be educated to increase their wealth by “walking away” just as they were educated to save money by refinancing
SECTION 2

ABS CDO Losses
Russian Dolls

Risk Profile of Subprime Mortgage Loans

- **Borrower Credit**
  - Good
  - Bad

- **Borrower Down Payment**
  - Low
  - High

- **Subprime Mortgage Loans**

Subprime Mortgage Bonds

- AAA: 81%
- AA: 11%
- A: 4%
- BBB: 3%
- BB, NR: 1%, not in all deals

Other credit support: Excess Spread, Over-collateralization

High Grade ABS CDO

- Senior AAA: 88%
- Junior AAA: 5%
- AA: 3%
- A: 2%
- BBB: 1%
- NR: 1%

Mezz ABS CDO

- Senior AAA: 62%
- Junior AAA: 14%
- AA: 8%
- A: 6%
- BBB: 6%
- BB, NR: 1%, not in all deals

Other credit support: Excess Spread

CDO²

- Senior AAA: 60%
- Junior AAA: 27%
- AA: 4%
- A: 3%
- BBB: 3%
- BB, NR: 2%

Other credit support: Excess Spread
Residential Mortgage Deals in 420 ABS CDOs

Using the old November 2007 model of mortgage loan losses

<table>
<thead>
<tr>
<th>Vintage</th>
<th>Subprime</th>
<th>Alt-A</th>
<th>Seconds</th>
<th>Prime</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997-2002</td>
<td>175</td>
<td>31</td>
<td>2</td>
<td>43</td>
<td>251</td>
</tr>
<tr>
<td>2003</td>
<td>215</td>
<td>71</td>
<td>7</td>
<td>136</td>
<td>429</td>
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<tr>
<td>2004</td>
<td>368</td>
<td>259</td>
<td>27</td>
<td>182</td>
<td>836</td>
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<tr>
<td>2005</td>
<td>483</td>
<td>473</td>
<td>64</td>
<td>191</td>
<td>1,211</td>
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<tr>
<td>2006</td>
<td>516</td>
<td>497</td>
<td>72</td>
<td>135</td>
<td>1,220</td>
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<tr>
<td>2007</td>
<td>150</td>
<td>115</td>
<td>21</td>
<td>26</td>
<td>312</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,907</strong></td>
<td><strong>1,446</strong></td>
<td><strong>193</strong></td>
<td><strong>713</strong></td>
<td><strong>4,259</strong></td>
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<table>
<thead>
<tr>
<th>Vintage</th>
<th>Subprime</th>
<th>Alt-A</th>
<th>Seconds</th>
<th>Prime</th>
<th>Average</th>
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</thead>
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<td>1997-2002</td>
<td>5.0</td>
<td>0.7</td>
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<td>2003</td>
<td>2.9</td>
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<td>4.5</td>
<td>0.0</td>
<td>1.6</td>
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<tr>
<td>2004</td>
<td>3.0</td>
<td>0.5</td>
<td>6.5</td>
<td>0.1</td>
<td>1.7</td>
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<tr>
<td>2005</td>
<td>7.5</td>
<td>1.5</td>
<td>17.8</td>
<td>0.2</td>
<td>4.5</td>
</tr>
<tr>
<td>2006</td>
<td>19.5</td>
<td>4.6</td>
<td>46.9</td>
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<tr>
<td>2007</td>
<td>22.8</td>
<td>6.2</td>
<td>65.1</td>
<td>0.6</td>
<td>17.7</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>10.3</strong></td>
<td><strong>2.7</strong></td>
<td><strong>31.6</strong></td>
<td><strong>0.2</strong></td>
<td><strong>7.0</strong></td>
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</tbody>
</table>

These statistics are of mortgage deals whose bonds were purchased by ABS CDOs and are not necessarily representative of all mortgage deals.
**Subprime Mortgage Bond Losses**

**Using the old November 2007 model of mortgage loan losses**

<table>
<thead>
<tr>
<th>Vintage</th>
<th>AAA</th>
<th>Aa1</th>
<th>Aa2</th>
<th>Aa3</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>Baa1</th>
<th>Baa2</th>
<th>Baa3</th>
<th>BIG</th>
<th>NA</th>
<th>Ratings</th>
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<td>1997-2002</td>
<td>24</td>
<td>24</td>
<td>55</td>
<td>1</td>
<td>10</td>
<td>76</td>
<td>24</td>
<td>5</td>
<td>28</td>
<td>247</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
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<td>69</td>
<td>122</td>
<td>73</td>
<td>1</td>
<td>15</td>
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<td>493</td>
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<tr>
<td>2004</td>
<td>117</td>
<td>75</td>
<td>204</td>
<td>87</td>
<td>92</td>
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<td>176</td>
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<td>326</td>
<td>279</td>
<td>61</td>
<td>43</td>
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<tr>
<td>2005</td>
<td>269</td>
<td>294</td>
<td>416</td>
<td>332</td>
<td>314</td>
<td>425</td>
<td>382</td>
<td>420</td>
<td>409</td>
<td>405</td>
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<tr>
<td>2006</td>
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<td>4,124</td>
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<tr>
<td>2007</td>
<td>62</td>
<td>30</td>
<td>81</td>
<td>61</td>
<td>59</td>
<td>73</td>
<td>88</td>
<td>82</td>
<td>84</td>
<td>57</td>
<td>8</td>
<td>19</td>
<td>704</td>
</tr>
<tr>
<td>All Vintages</td>
<td>668</td>
<td>652</td>
<td>1,183</td>
<td>860</td>
<td>861</td>
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<td>1,124</td>
<td>1,303</td>
<td>1,461</td>
<td>1,241</td>
<td>468</td>
<td>353</td>
<td>11,557</td>
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<table>
<thead>
<tr>
<th>Vintage</th>
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<th>Aa1</th>
<th>Aa2</th>
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<th>A1</th>
<th>A2</th>
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<th>NA</th>
<th>Ratings</th>
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</thead>
<tbody>
<tr>
<td>1997-2002</td>
<td>12%</td>
<td>28%</td>
<td>17%</td>
<td>0%</td>
<td>8%</td>
<td>11%</td>
<td>8%</td>
<td>60%</td>
<td>48%</td>
<td>19%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>6%</td>
<td>19%</td>
<td>41%</td>
<td>12%</td>
<td>18%</td>
<td>22%</td>
<td>12%</td>
<td>14%</td>
<td>18%</td>
<td>71%</td>
<td>12%</td>
<td>16%</td>
<td></td>
</tr>
<tr>
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<td>12%</td>
<td>6%</td>
<td>9%</td>
<td>7%</td>
<td>17%</td>
<td>11%</td>
<td>10%</td>
<td>10%</td>
<td>12%</td>
<td>20%</td>
<td>30%</td>
<td>36%</td>
<td>13%</td>
</tr>
<tr>
<td>2005</td>
<td>10%</td>
<td>4%</td>
<td>8%</td>
<td>7%</td>
<td>11%</td>
<td>14%</td>
<td>20%</td>
<td>30%</td>
<td>41%</td>
<td>53%</td>
<td>69%</td>
<td>35%</td>
<td>24%</td>
</tr>
<tr>
<td>2006</td>
<td>22%</td>
<td>30%</td>
<td>47%</td>
<td>59%</td>
<td>66%</td>
<td>69%</td>
<td>80%</td>
<td>83%</td>
<td>89%</td>
<td>91%</td>
<td>97%</td>
<td>88%</td>
<td>70%</td>
</tr>
<tr>
<td>2007</td>
<td>27%</td>
<td>55%</td>
<td>57%</td>
<td>74%</td>
<td>77%</td>
<td>72%</td>
<td>80%</td>
<td>84%</td>
<td>84%</td>
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<td>88%</td>
<td>89%</td>
<td>71%</td>
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<td>15%</td>
<td>17%</td>
<td>26%</td>
<td>35%</td>
<td>41%</td>
<td>35%</td>
<td>46%</td>
<td>46%</td>
<td>48%</td>
<td>56%</td>
<td>76%</td>
<td>57%</td>
<td>41%</td>
</tr>
</tbody>
</table>

These statistics are of subprime mortgage bonds purchased by ABS CDOs and are not necessarily representative of all subprime mortgage bonds. Many highly-rated securities are from scratch-and-dent deals.
Collateral Losses of 2006-7 Mezz ABS CDOs

Using the old November 2007 model of mortgage loan losses

<table>
<thead>
<tr>
<th>Tranche</th>
<th>Threshold Collateral Losses That Threaten Tranche</th>
<th>% of CDOs Whose Predicted Losses Exceed Threshold</th>
<th>Loss Given Default</th>
<th>Tranche Expected Losses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sr. AAA</td>
<td>37% +</td>
<td>86%</td>
<td>51%</td>
<td>43%</td>
</tr>
<tr>
<td>Jr. AAA</td>
<td>24% +</td>
<td>93%</td>
<td>97%</td>
<td>90%</td>
</tr>
<tr>
<td>AA</td>
<td>16% +</td>
<td>96%</td>
<td>99%</td>
<td>95%</td>
</tr>
<tr>
<td>A</td>
<td>12% +</td>
<td>97%</td>
<td>100%</td>
<td>96%</td>
</tr>
<tr>
<td>BBB</td>
<td>7% +</td>
<td>99%</td>
<td>99%</td>
<td>98%</td>
</tr>
</tbody>
</table>
Why Haven’t We Updated CDO Loss Estimates?

Underlying mortgage bond losses are only one part of ABS CDO losses. Other issues, just as important are:

- Interest and principal “waterfalls” in CDO structure
- Effect of ABS CDO collateral downgrades in changing cash flow waterfalls
- Tranche voting rights
- CDO documentation issues
- All of these factors vary across ABS CDOs
Thinking About Losses: Physics vs. Social Science

♦ Increased default correlation?
♦ Fatter tail distributions?
♦ Higher default and loss rates?
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