Regulatory reform and risk-taking
replacing ratings

Bo Becker and Marcus Opp

Stockholm, UC

2015
Regulatory reform and risk-taking: replacing ratings

considers an important capital requirement reform for insurance companies
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Main results

1 New inputs to capital regulation
   ▶ Useful measures of credit risk (similar to ratings)
   ▶ We cannot detect manipulation by Pimco / BlackRock

2 New system of capital regulation
   ▶ Theory: redesign of capital buffers
     ⋆ applies the law of large numbers to structured securities
     ⋆ no cushion against adverse macro scenarios
   ▶ Empirical results: capital requirements reduced by 81% ($15.63 bn)

3 Response by insurers
   significant increase in risk-taking by insurers within MBS portfolio
   ▶ but not for asset classes unaffected by regulatory change
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2. Macroprudential view
   - Insurance market: avoid failures of (life) insurers
   - MBS market: avoid causing firesale due to regulatory capital requirements
   - regulators spot “alpha” in MBS market

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difficult to disentangle “ultimate intentions” and unintended consequences
Literature

- Insurance companies and capital regulation
  - Product market distortions (Koijen, Yogo 2013a, 2013b)
  - Portfolio allocation: reaching for yield (Becker, Ivashina 2012)

- Criticism of credit ratings
  - Use of ratings in regulation feeds back into the accuracy of ratings (Opp, Opp, Harris 2013)
  - Credit ratings do not distinguish between idiosyncratic and systematic risk (Coval, Jurek, Stafford 2008, Iannotta, Pennacchi 2012)
  - CRAs exploit naivete of investors (Bolton, Freixas, Shapiro 2012)
  - Competition leads to lower standards (Becker, Milbourn 2011)
A primer in insurance regulation

- All insurance companies are subject to minimum capital regulation based on risk-based capital ratio (determined yearly)

\[
\text{RBC ratio} = \frac{\text{Equity}}{\text{Risk-based capital requirement}} \geq 2
\]

Risk-based capital requirement depends on asset risk and liability risk:

\[
\text{Risk-based capital requirement} = R_0 + \sqrt{R_1^2 + 5 \sum_{i=2}^{n} R_i^2}
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- Asset risks: (subsidiaries, fixed income, and equities)
- Liability risks: (insurance business)

Square-root formula treats risk sources as independent.
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- \( R_3 - R_5 \) = liability risks (insurance business)
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- Our study concerns a regulatory change in fixed income \( R_1 \)
Previous ratings-based system for fixed income

- Risk-based capital requirement for fixed income portfolio:

\[ R_1 = \sum_{j=1}^{N} \text{RBC\%}_j \text{BV}_j \]
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- Risk classification based on ratings

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<td>30%</td>
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Institutional background

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still applies for all fixed income assets, except non-agency MBS
Regulatory change: replacing ratings

- Regulator solicited for bids from alternative credit risk providers
  - RMBS (since 2009): Pimco selected based on “expertise and safeguards against conflict of interest”
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- Discounted expected losses of principal for each bond (by CUSIP)
  - state-contingent losses \( L \) are discounted by coupon rate \( c \)
  - continuous measure \( ELOSS = \frac{\mathbb{E}(L)}{1+c} \in [0, 1] \) vs. ordinal ratings
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- $ELOSS$ determines intrinsic value, the reference point for regulation

\[ IV = 1 - ELOSS \]
Major takeaway: Intrinsic value (IV) is a proxy for market price.

On average: IV > Market Price = 1 − ELOSS (reason: see next slide).
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- On average: $IV > MP = 1 - ELOSS$ (reason: see next slide)
Theory: market price versus intrinsic value

Market price of any risky-bond can be decomposed into:

$$MP = 1 - R_F - ELOSS_M + PV\ (\text{Coupons})$$

Present value of Principal

$ELOSS_M = E(L^m) = E(L) + r_F + Cov(m, L)$

denotes (correctly) discounted state-contingent losses of principal

$Iv = 1 - ELOSS$ 

$Iv - MP = ELOSS - ELOSS + R_F - PV\ (\text{Coupons})$

$ELOSS > 0$ since $ELOSS = E(L) + c < E(L) + r_F < E(m\cdot L)$

Bonds with low (high) coupons are more likely above (below) 45 degree line. (Generally, MBS tranches are issued below par)
Theory: market price versus intrinsic value

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- \( 1 - R_F \) is price of risk-free zero-coupon bond with same maturity and present value of principal.

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Actual risk-based capital requirements do not account for “risk!”

\[ RBC \approx BV - IV \]
Actual implementation of new system (NAIC 1-6)

Cutoffs are designed so that "intuition" is approximated discontinuously.
Actual implementation of new system (NAIC 1-6)

Cutoffs are designed so that “intuition” is approximated discontinuously.
What’s risk got to do with it?

- Toy example with two equi-probable macro states and two securities:
  - Bond 1 defaults only in low macro state with 0% recovery rate
  - Bond 2 always defaults, 50% recovery rate in both states

Both have high credit “risk” (poor ratings, high ELOSS) but different systematic risk: bond 1 is risky, bond 2 is risk-free

Assume risk-neutrality and no discounting: IV = MP = BV = 0.5

- New system: Both bonds riskless (RBC% = 0)
- Old system: Both bonds risky (RBC% = 30%)

Structured securities are Economic Catastrophe Bonds

- Losses don’t wash out (Law of large numbers does not apply)
- RMBS / CMBS resemble type 1 bonds

⇒ Insufficient capital
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Data

- ELOSS for all non-agency MBS securities for the first two years
  - CMBS: (2010) 5,293 CUSIPs and (2011) 5,974 CUSIPs

- Ratings and asset information (seniority, par value, etc.) from S&P, Moody’s, and eMAXX. Of RMBS 2009 universe
  - 6.8% of securities are unrated,
  - 22.7% have one rating
  - 70.6% have two or more ratings
  - S&P, Moody’s and Fitch cover 82%, 89% and 27% of securities

- Year-end holdings by CUSIP for all US insurers and other institutional investors (Pimco / BlackRock) from NAIC and eMAXX

- Regulatory RBC ratios for all insurers from Ellul et al. (2013)
The outcome: massive capital relief

---

**RMBS**

- **RBC new**
- **RBC old**

**CMBS**

- **RBC new**
- **RBC old**

---

2011 aggregate MBS RBC: $3.7 billion vs. $19.4 billion – 81% “discount.”
The outcome: massive capital relief

2012 aggregate MBS RBC: $3.7 billion vs. $19.4 billion – 81% “discount.”
## Fixed income holdings and capital savings

### FIXED INCOME

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<tr>
<th></th>
<th>BV</th>
<th>MV</th>
<th>RBC FI Share</th>
<th>BV</th>
<th>MV</th>
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<tr>
<td><strong>Life</strong></td>
<td>2445</td>
<td>2542</td>
<td>30 4%</td>
<td>110</td>
<td>100</td>
<td>3</td>
<td>13</td>
<td>-77%</td>
<td>-24%</td>
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<tr>
<td><strong>P&amp;C</strong></td>
<td>893</td>
<td>923</td>
<td>4 2%</td>
<td>14</td>
<td>14</td>
<td>0</td>
<td>1</td>
<td>-92%</td>
<td>-19%</td>
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<tr>
<td><strong>Other</strong></td>
<td>137</td>
<td>142</td>
<td>1 3%</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>-80%</td>
<td>-25%</td>
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<tr>
<td><strong>Total</strong></td>
<td>3475</td>
<td>3607</td>
<td>36 4%</td>
<td>127</td>
<td>117</td>
<td>3</td>
<td>14</td>
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</tr>
<tr>
<td><strong>Other</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20%</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-7%</td>
<td>0%</td>
</tr>
</tbody>
</table>
### Fixed income holdings and capital savings

<table>
<thead>
<tr>
<th>FIXED INCOME</th>
<th>RMBS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BV</strong></td>
<td><strong>MV</strong></td>
</tr>
<tr>
<td>Life</td>
<td>2445</td>
</tr>
<tr>
<td>P&amp;C</td>
<td>893</td>
</tr>
<tr>
<td>Other</td>
<td>137</td>
</tr>
<tr>
<td>Total</td>
<td>3475</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CMBS</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Share</strong></td>
<td></td>
<td><strong>BV</strong></td>
<td><strong>MV</strong></td>
<td><strong>RBC new</strong></td>
<td><strong>RBC old</strong></td>
<td><strong>RBC disc.</strong></td>
<td><strong>RBC disc. FI</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Life</td>
<td>2445</td>
<td>2542</td>
<td>30</td>
<td>6%</td>
<td>143</td>
<td>145</td>
<td>1.8</td>
<td>1.9</td>
<td>-7%</td>
<td>0%</td>
</tr>
<tr>
<td>P&amp;C</td>
<td>893</td>
<td>923</td>
<td>4</td>
<td>3%</td>
<td>24</td>
<td>25</td>
<td>0.1</td>
<td>0.1</td>
<td>-15%</td>
<td>0%</td>
</tr>
<tr>
<td>Other</td>
<td>137</td>
<td>142</td>
<td>1</td>
<td>3%</td>
<td>4</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>20%</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td>3475</td>
<td>3607</td>
<td>36</td>
<td>5%</td>
<td>172</td>
<td>175</td>
<td>1.9</td>
<td>2</td>
<td>-7%</td>
<td>0%</td>
</tr>
</tbody>
</table>

- Despite small portfolio share of non-agency MBS, savings are large
- Met Life and Teachers Insurance and Annuity with $1.5bn savings
Regulatory reform and risk-taking

- Examination of aggregate response of industry to a regulatory change
Regulatory reform and risk-taking

- Examination of aggregate response of industry to a regulatory change
- Regulation also applies to new issues (mostly CMBS)
Regulatory reform and risk-taking

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- Regulation also applies to new issues (mostly CMBS)
- Only non-agency MBS are affected by regulatory change

First (raw) prediction:
- The fraction of investment grade purchases by insurers is smaller for non-agency MBS (relative to other asset classes)
- post reform (relative to before 2010)
Regulatory reform and risk-taking

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New issues: risk-taking across asset classes

The figure plots the composition of the insurance industry's purchases of newly issued securities 2008-2012, by asset category. Asset categories are Corporate Bonds, Municipal Bonds, MBS, Other Asset Backed (Federal Government securities are excluded). Only rated securities with a category indicated in NAIC data are included. Each graph represents the fraction of aggregate purchases in a category (valued at par) that are rated investment grade. For expository clarity, exact values are only displayed for MBS. Total purchases of $980 billion are reflected in the graph.

New, low capital requirements implemented for CMBS end 2010.
Regulatory reform and risk-taking

Formal empirical analysis in two steps
Regulatory reform and risk-taking

Formal empirical analysis in two steps

1. **New issues prediction:**
   Insurers purchase a larger fraction (compared to other investors) post-reform (relative to pre) in non-agency MBS (relative to other asset classes) if asset is of high risk (relative to low risk).

   ▶ Exploit cross-sectional variation of MP and IV across securities

   Prediction: Trade towards assets with high yields and low ELOSS.
Regulatory reform and risk-taking

Formal empirical analysis in two steps

1. New issues prediction:
   Insurers purchase a larger fraction (compared to other investors)
   post-reform (relative to pre)

2. If asset is of high risk (relative to low risk)

Existing stock of securities (within MBS)

▶ Exploit cross-sectional variation of MP and IV across securities

▶ Prediction: Trade towards assets with high yields and low ELOSS
Regulatory reform and risk-taking

Formal empirical analysis in two steps

1. New issues prediction:
   Insurers purchase a larger fraction (compared to other investors)
   - post-reform (relative to pre)
   - in non-agency MBS (relative to other asset classes)
Analysis

Regulatory reform and risk-taking

Formal empirical analysis in two steps

1. New issues prediction:
   Insurers purchase a larger fraction (compared to other investors)
   1. post-reform (relative to pre)
   2. in non-agency MBS (relative to other asset classes)
   3. if asset is of high risk (relative to low risk)

Regulatory reform and risk-taking

2015 19 / 24
Regulatory reform and risk-taking

Formal empirical analysis in two steps

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     - post-reform (relative to pre)
     - in non-agency MBS (relative to other asset classes)
     - if asset is of high risk (relative to low risk)

2. Existing stock of securities (within MBS)

Exploit cross-sectional variation of MP and IV across securities
Prediction: Trade towards assets with high yields and low ELOSS
Regulatory reform and risk-taking

Formal empirical analysis in two steps

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   3. if asset is of high risk (relative to low risk)

2. Existing stock of securities (within MBS)
   ▶ Exploit cross-sectional variation of MP and IV across securities
   ▶ Prediction: Trade towards assets with high yields and low ELOSS
## New issues: risk-taking across asset classes II

<table>
<thead>
<tr>
<th>Dep. Variable</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of new issue bought by insurers</td>
<td>0.039</td>
<td>0.130</td>
<td>0.037</td>
<td>0.148</td>
<td>0.040</td>
<td>0.535</td>
<td></td>
</tr>
<tr>
<td>Low RBC share</td>
<td>0.148</td>
<td>0.040</td>
<td>0.130</td>
<td>0.037</td>
<td>0.148</td>
<td>0.040</td>
<td>0.535</td>
</tr>
</tbody>
</table>

### Indicator (MBS; Post change; High yield security)
- **(1)** $0.056^{***}$
- **(2)** $0.099^{***}$
- **(3)** $0.094^{**}$
- **(4)** $0.127^{***}$
- **(5)** $0.013^{*}$

### Indicator (MBS; Post change)
- **(6)** $1.363^{***}$
- **(7)** $3.169^{***}$

### Dimensions
- **Issue year * High Yield indicator FE**
- **Category * High Yield indicator FE**
- **Issue year FE * coupon yield**
- **Category FE * coupon yield**

### Other Statistics
- **R-squared**
- **N**

Becker Opp (BO) (Stockholm, UC) [Regulatory reform and risk-taking](#) 2015 20 / 24
### Existing securities: MBS portfolio

<table>
<thead>
<tr>
<th>Category</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insurance companies</td>
<td>All</td>
<td>Very Low RBC</td>
<td>Low RBC</td>
<td>High RBC</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Dep. Variable</td>
<td>One year % change in par value, non-defaulted securities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dep. Var. mean</td>
<td>-0.210</td>
<td>-0.491</td>
<td>-0.220</td>
<td>-0.150</td>
<td>-0.192</td>
<td>-0.192</td>
</tr>
<tr>
<td>Market price – Intrinsic value</td>
<td>-0.571*** (0.022)</td>
<td>-0.759*** (0.230)</td>
<td>-0.653*** (0.102)</td>
<td>-0.460*** (0.024)</td>
<td>-0.569*** (0.037)</td>
<td></td>
</tr>
<tr>
<td>Market price</td>
<td>-0.743*** (0.044)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intrinsic value</td>
<td>0.205*** (0.033)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Par at issue, log</td>
<td>-0.016*** (0.006)</td>
<td>-0.011* (0.006)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mezzanine tranche</td>
<td>-0.037** (0.014)</td>
<td>-0.092*** (0.015)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subordinated tranche</td>
<td>-0.059*** (0.022)</td>
<td>-0.138*** (0.0122)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Credit rating</td>
<td>-0.003*** (0.001)</td>
<td>0.003** (0.001)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Issue year FE</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Maturity year FE</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-squared</td>
<td>0.045</td>
<td>0.026</td>
<td>0.025</td>
<td>0.037</td>
<td>0.054</td>
<td>0.066</td>
</tr>
<tr>
<td>N</td>
<td>11,437</td>
<td>538</td>
<td>1,096</td>
<td>8,561</td>
<td>6,136</td>
<td>6,136</td>
</tr>
</tbody>
</table>
## Conflicts of interest by provider

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intrinsic value (= 1 - ELOSS)</td>
<td>Intrinsic value (= 1 - ELOSS)</td>
<td></td>
<td>Intrinsic value (= 1 - ELOSS)</td>
<td></td>
</tr>
<tr>
<td>Pimco</td>
<td>0.819</td>
<td>0.862</td>
<td>0.878</td>
<td>0.896</td>
<td></td>
</tr>
<tr>
<td>Pimco or BlackRock holdings (log)</td>
<td>-0.000</td>
<td>0.004***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pimco or BlackRock net trade, next 4 quarters</td>
<td>0.046</td>
<td>0.561**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insurance holdings, log</td>
<td>0.009***</td>
<td>0.022***</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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  - New system is made artificially complex
  - Why replace “ratings” if goal is to “eliminate” capital requirements?
- Macroprudential benefits of capital relief are temporary
Conclusion

- Regulatory change caused large reduction in capital requirements
  - new input: Pimco and BlackRock provide proxies of the market price
  - new system: no protection against aggregate risks

⇒ Replacing ratings is a "side-show"
New system applies to existing stock as well as to new acquisitions
- Strong incentive to take risk preferentially in MBS
- Reflected in a historic shift in risk taking in MBS
→ have to be traded off against benefits
Ultimate normative question: "Do we need capital requirements?"
Follow-up research: Does regulatory reform have pricing implications?
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