The Role of Public Information and Credit Ratings in the Corporate Bond Market

James Partridge

The University of Western Ontario

Macro Lunch

Credit Ratings

- 3 major credit rating agencies (CRAs)
  - S&P, Moody's, and Fitch (also Duff & Phelps)
- 3 major markets: sovereign/gov't, corporate, structured finance
  - I focus on corporate bond ratings
- The bond issuer pays for the rating

Credit Ratings

- Rating system designed to measure relative credit risk
  - Credit ratings are used as an aggregate measure of risk
- AAA, AA, A & BBB bonds considered investment grade (IG)
- BB, B, CCC, CC & C bonds considered speculative grade (SG)
- Legal restrictions on "institutional investors" (e.g. pension funds) intended to limit risks in managed portfolios

Puzzling Observation

- Number of AAA firms (S&P): now 4, down from 34 in 1985!
- Number of AAA and AA rated firms have decreased, while the total number of firms with a rating has increased.

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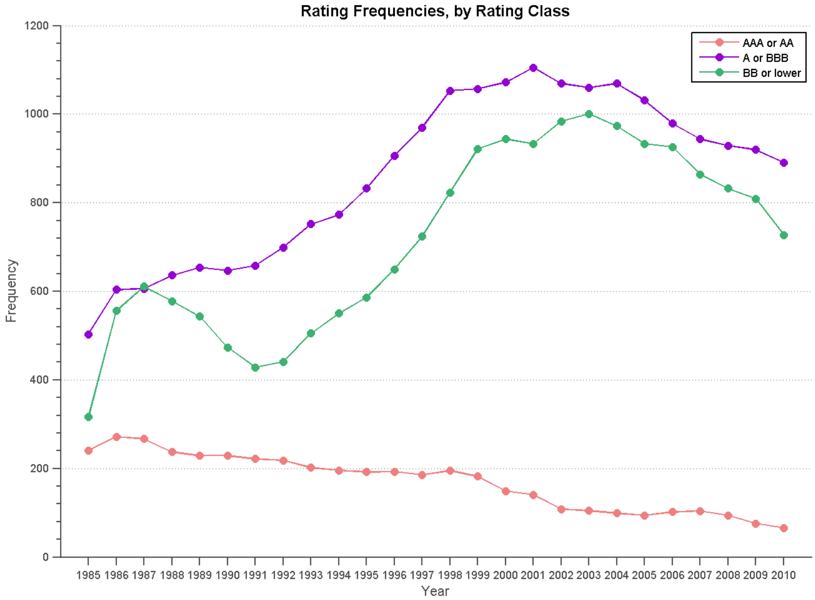
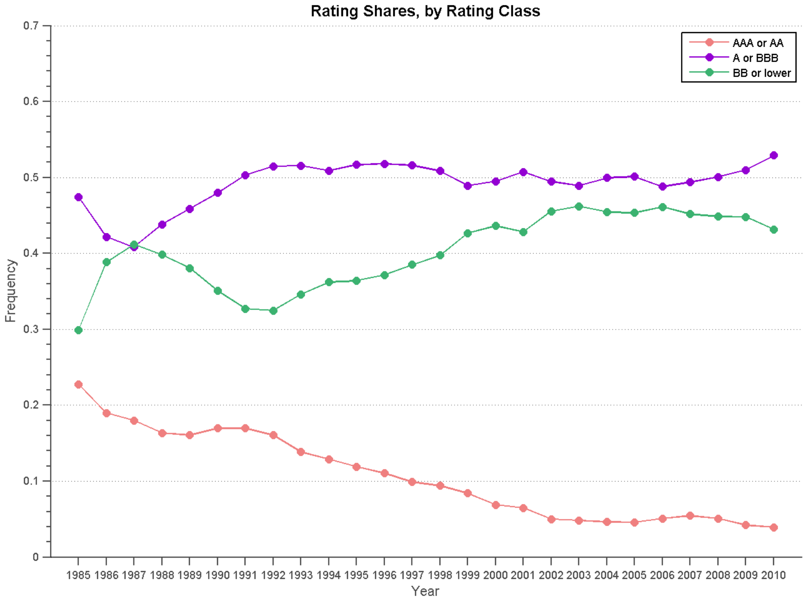
My conjecture:

Ratings have value as a signal, but this value has diminished as information proliferation has increased.


Rating Frequencies, by Rating Class
AAA or AA
A or BBB
BB or lower
Frequency
Year
0
200
400
600
800
1000
1200
1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010


Rating Shares, by Rating Class
AAA or AA
A or BBB
BB or lower
Frequency
Year
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010

What I Do

- Show distribution of bond ratings has shifted away from high ratings
- Develop a model with credit ratings and public information to match this fact
- Test the following implication: price dispersion has increased for high-rated bonds

The Fall of Highest Rated Firms is "Robust"

- Not a question of evolving CRA standards/incentives
  - leverage ratios are stable by rating
  - leverage ratios are slightly higher by cohort

▸ Appendix

- These firms aren't simply merging
  - ignoring the financial sector, the assets controlled by AAA and AA firms have also decreased

	1985	1990	1995	2000	2005	2010
AAA	34	26	17	8	4	1
AA	0	4	8	3	6	8
A	0	1	3	9	6	7
BBB	0	0	1	2	3	3
B	0	1	1	0	0	0
Merged	0	1	2	6	6	6
Retired	0	1	2	6	9	9

Table: Evolution of circa 1985 AAA firms

Motivation

- There has been a shift from bank to bond and equity financing
  - Bonds have doubled as a proportion of corporate liabilities
- Policy changes vis-à-vis CRAs may not have intended effect
- CRAs have received much attention/criticism due to MBS and CDO ratings, but corporate bonds are a different product
- Financial press suggests three answers:
  - investors in general have larger appetite for risk
  - knowledgeable investors place less emphasis on CRA ratings
  - firms now find it too costly to maintain high ratings
- All three indicate that elite ratings now have a lower value
- What is the fundamental change?

Story

- Then: CRA ratings were the primary source of firm information, few had access to SEC filings, firm prospectus,. . .
- Now: Bloomberg, WSJ Online, etc. all provide market data and firm analysis; firm info is readily available
- Rating and third-party market analysis both act as signals of firm's well-being or quality
- Cost required to achieve high ratings

Investors now have direct information on firm quality –
high quality firms no longer willing to incur cost of high ratings

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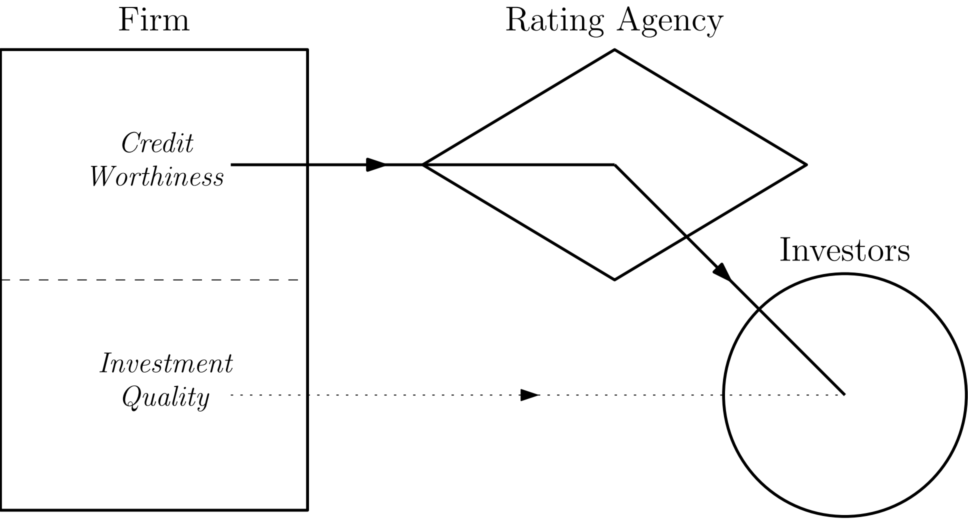
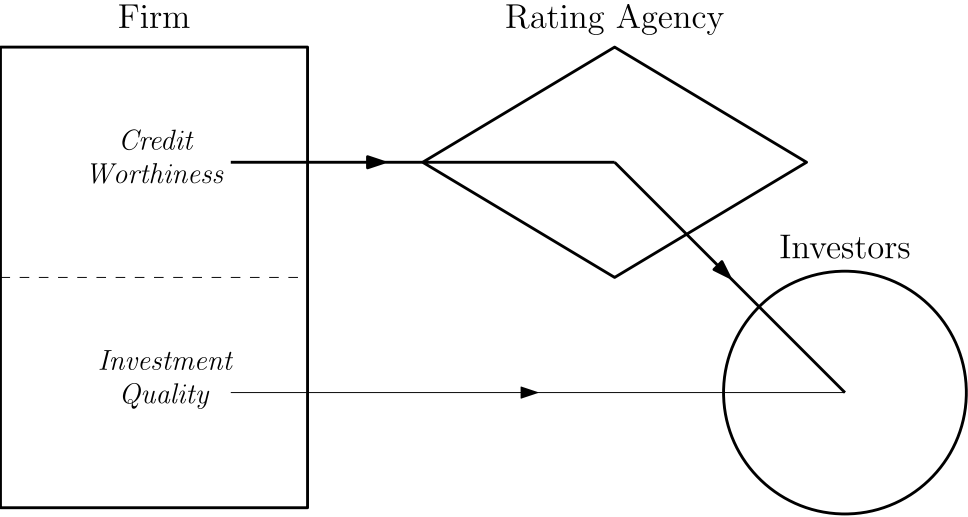

Firm
Rating Agency
Credit Worthiness
Investors
Investment Quality



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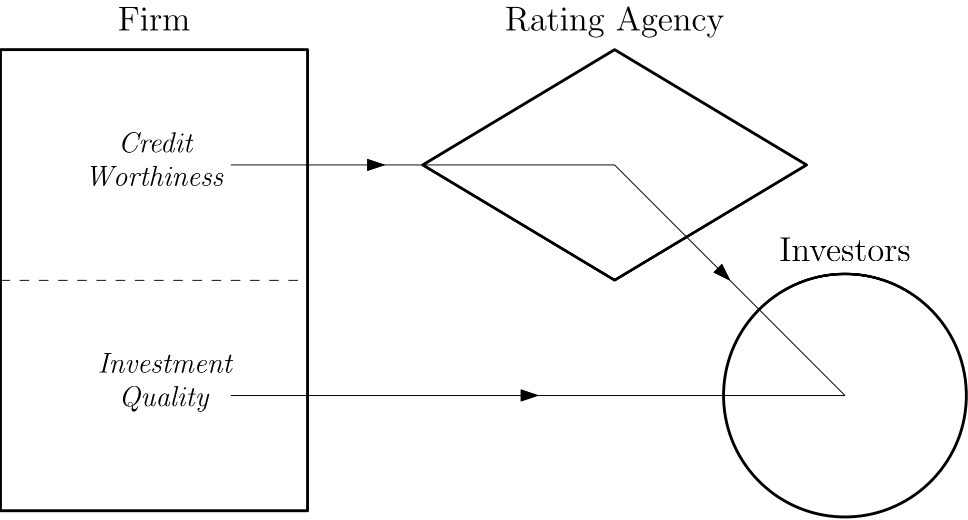

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Literature

- Academic literature has focused on other questions
  - CRA incentives in structured finance market well-studied
  - feedback effects
  - bond, equity or bank financing
- Unique to this paper: firms influence their rating

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  - CRA incentives in structured finance market well-studied
    - Mathis, McAndrews & Rochet 2009
    - Skreta & Veldkamp 2009
    - Bolton, Freixas & Shapiro 2009
    - He, Qian & Strahan 2011
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Environment

- Firms are of **type** $\theta \epsilon \{G, B\}$, unobserved by all
  - determines probability the firm's project is successful
- Economy receives a **signal**, ν, about firm's type
  - probability signal is 'accurate' is ω
  - assume $\omega > 0.5$
- The firm invests in the rating process, economy then observes **rating**
  - accuracy of rating depends on investment

Timing

1. Ex ante:
   - known: public signal (H or L)
   - unknown: type (G or B)
2. Interim:
   - firm chooses π
   - rating is formed and observed (A, B or C)
   - debt contracts are issued, interest rates conditioned on h and ν
3. Ex post:
   - outcome of project is realized (0 or y)
   - debt is paid if project pays off

Model

- Firms:
  - endowed with a project that might earn y if investment is received
  - project requires investment D, fixed
  - $\mathbb{1}(h, \nu) = 1$ if investment is received, 0 otherwise

$$V(\nu) = \max_{\pi} \ -c(\pi) + \mathrm{E}_{\theta,h}\left[\mathbb{1}(h,\nu)\left(y - DR(h,\nu)\right)|\nu\right] \tag{1}$$

- Investors:
  - investors observe ν and h
  - have access to risk free outside option which pays Dr
  - expected return is then:

$$\mathrm{E}_{\theta}\left[DR(h,\nu)|h,\nu\right] = Dr \tag{2}$$

Distributions

- Types:
  - $Pr\left[\theta = G\right] = \lambda$
  - $Pr\left[\theta = B\right] = 1 - \lambda$
- Ratings:
  - $Pr\left[h = A|\theta = G\right] = Pr\left[h = C|\theta = B\right] = p_1 + (p_2 + p_3)\pi$
  - $Pr\left[h = B|\theta = G\right] = Pr\left[h = B|\theta = B\right] = p_2(1 - \pi)$
  - $Pr\left[h = C|\theta = G\right] = Pr\left[h = A|\theta = B\right] = p_3(1 - \pi)$
- Signals:
  - $Pr\left[\nu = H|\theta = G\right] = Pr\left[\nu = L|\theta = B\right] = \omega$
  - $Pr\left[\nu = L|\theta = G\right] = Pr\left[\nu = H|\theta = B\right] = 1 - \omega$

Equilibrium

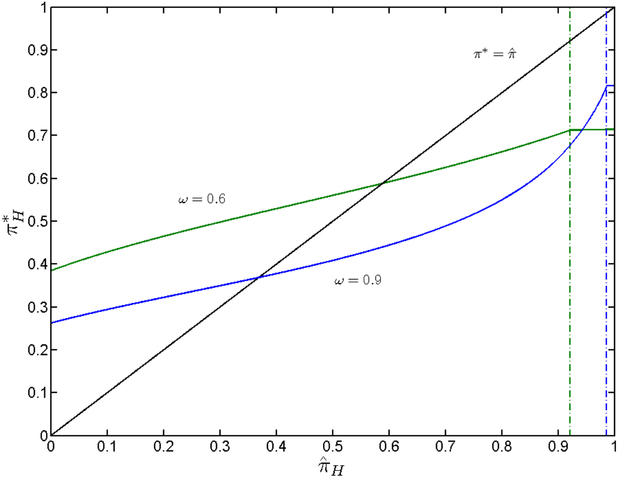
Definition

An equilibrium is a set of interest rates, $\mathbf{R}^* = \{R^*(h,\nu)\}_{h\epsilon\{A,B,C\}}^{\nu\epsilon\{H,L\}}$, and rating investment allocations, $\{\pi_\nu^*\}^{\nu\epsilon\{H,L\}}$ such that:

1. given $\mathbf{R}^*$, π_ν^* maximizes $V(\nu)$;
2. $\mathrm{E}_\theta\left[DR^*(h,\nu)|h,\nu\right] = Dr \;\forall h,\nu$.

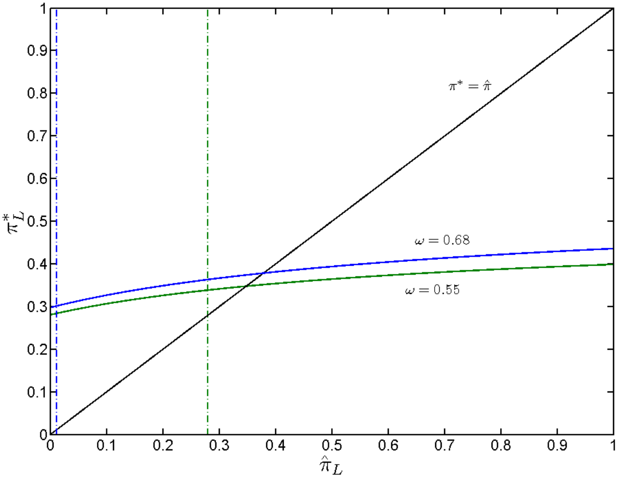
- Rational expectations implies π^* is consistent with investor beliefs about π.
  - Limit focus to interest rates that are mutually consistent, and consistent with π^*.

Equilibrium



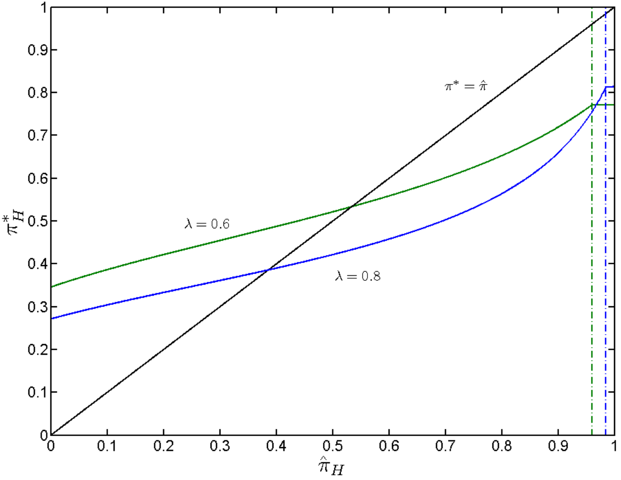
π_H^* decreases as ω increases from 0.6 to 0.9.

Equilibrium



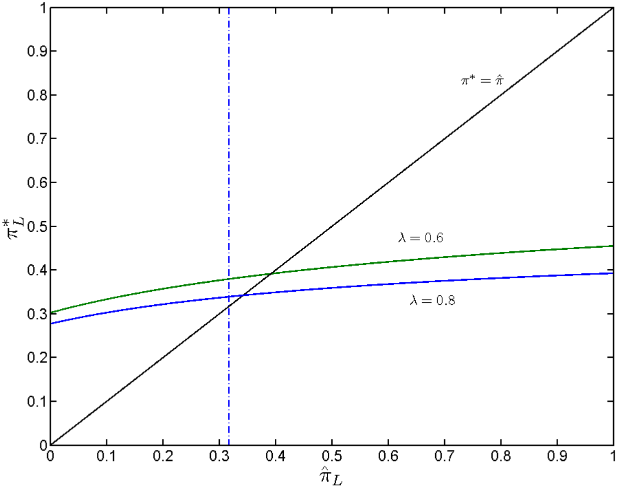
π_L^* increases as ω increases from 0.55 to 0.68.

Equilibrium



π_H^* decreases as λ increases from 0.6 to 0.8.

Equilibrium



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Mechanism

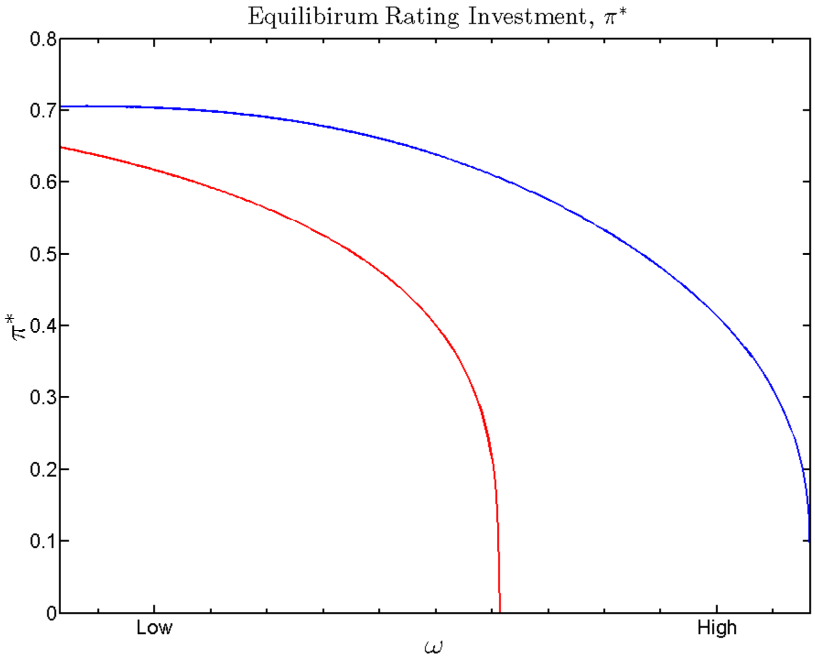
- At certain interest rates $y - DR(h, \nu) < 0$ so firms cannot commit to honour debt
- Implies firms that are (almost) known to be type B will not get an investment
- Firms weigh benefit of lower borrowing cost against increasing cost of π knowing they might be lowering the probability of investment if they are a B type
- As ω increases correlation between signal and type increases, thus firms (and investors) learn more about their type

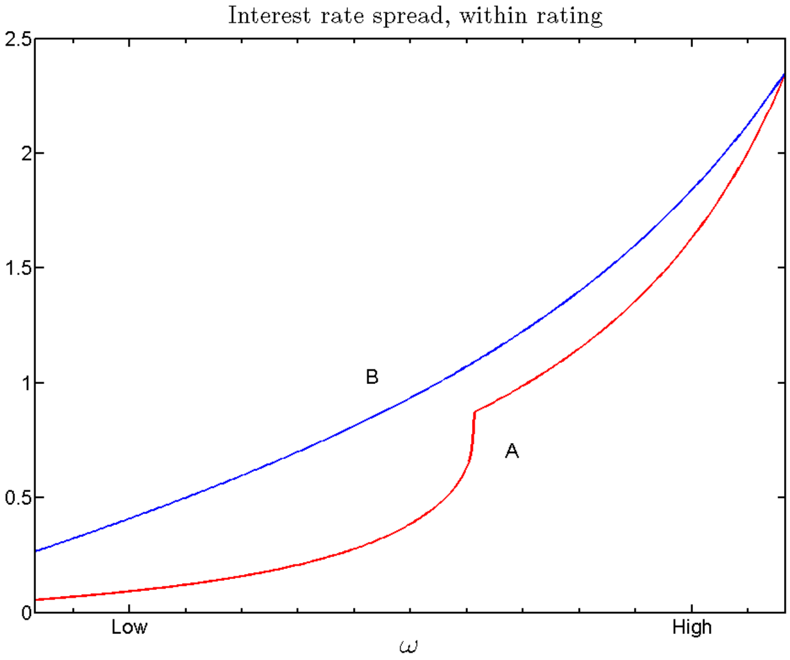
Result

Proposition

There exists some $\bar{\omega}$ such that π_H^* is decreasing in ω $\forall \omega > \bar{\omega}$.

- As ω increases, all firms choose lower π
  - leads to less A, more B ratings
- Interest rate spread increases for firms with different signal, same rating
  - testable implication


Equilibirum Rating Investment, π^*
π^*
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Low
High
ω


Interest rate spread, within rating
2.5
2
1.5
1
0.5
0
B
A
Low
High
ω

Data

Mergent Fixed Income Securities Database

- All of the information is sourced from prospectuses
- For CUSIP and ratings data, Mergent obtains direct feeds
- Has ratings from the 4 major agencies

Data

- 4 year bins starting in 1990, ending 2009
- Use yield to maturity spread over treasury bonds at offering
  - Captures the risk/default premium paid by firms
- Keep only fixed coupon bonds (90-100% in every year)
- Use the rating closest to offering
  - 80% within 2 days of offering, 80% before offering
- 8,755 offerings

Data

Ratings	1990-1993	1994-1997	1998-2001	2002-2005	2006-2009
All	1080	1624	2422	2071	1551
AAA/AA	223	228	287	134	91
A/BBB	719	980	1346	866	902
SG	138	416	789	1071	558

Table: Observations in each rating-period bin

Data

Ratings	1990-1993	1994-1997	1998-2001	2002-2005	2006-2009
All	410	769	1205	1208	736
AAA/AA	77	65	111	57	30
A/BBB	271	396	560	397	325
SG	69	332	583	783	408

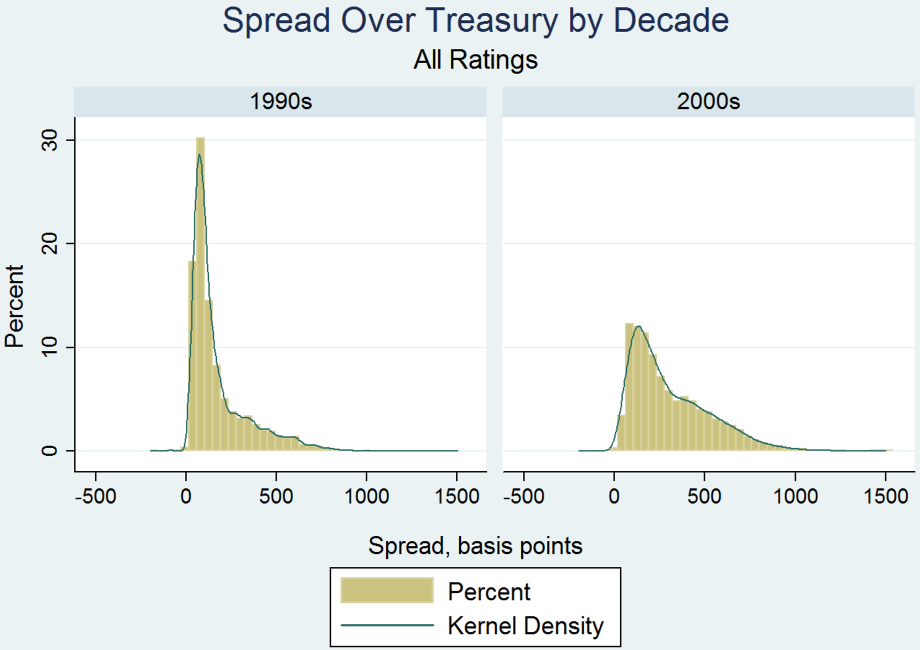
Table: Number of firms issuing debt in each rating-period bin

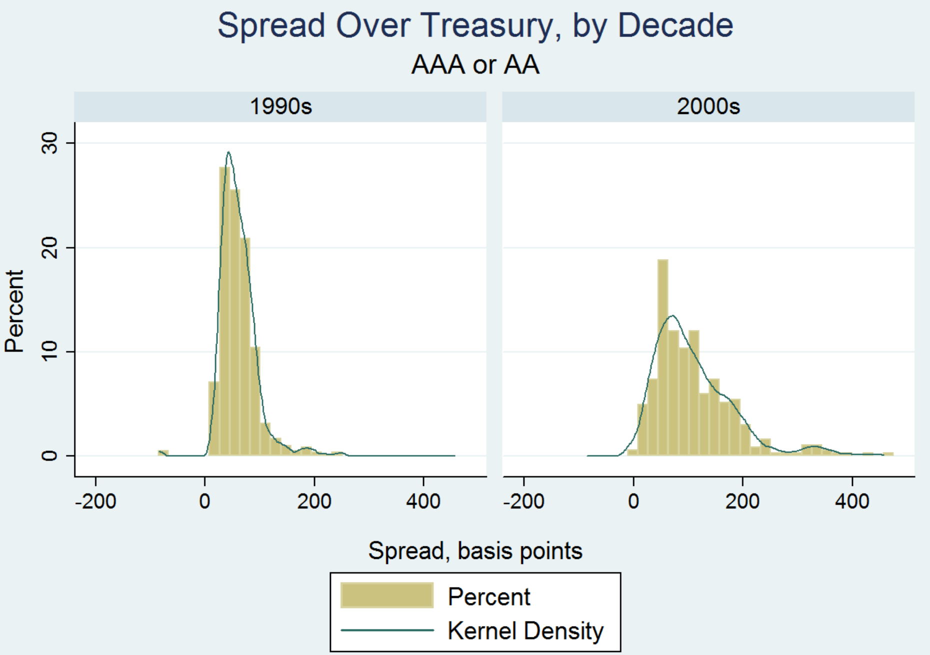
Bond Types

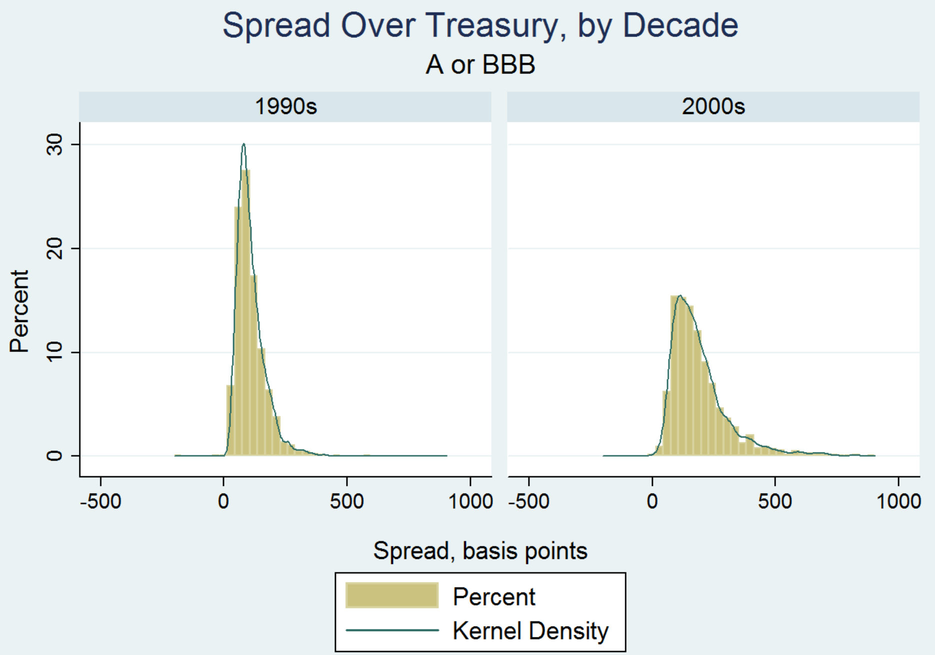
	1990-2009		1990-1999		2000-2009	
Type	#	%	#	%	#	%
CCOV	2	0.02	2	0.05	0	
CCUR	284	3.24	56	1.38	228	4.86
CDEB	7,625	87.09	3,520	87.00	4,105	87.47
CMTN	217	2.48	127	3.13	90	1.92
CPAS	391	4.47	312	7.68	79	1.68
CPIK	24	0.27	1	0.02	23	0.49
EBON	193	2.20	26	0.64	167	3.56
PS	6	0.07	6	0.15	0	
PSTK	5	0.06	5	0.12	0	
TPCS	7	0.08	7	0.17	0	
UCID	1	0.01	0		1	0.02
Total	8,755		4,062		4,693	

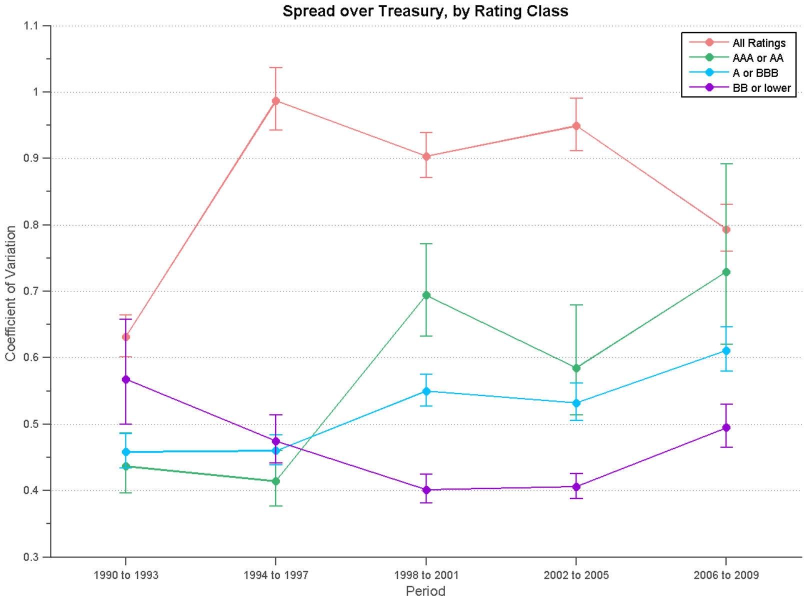
Price Dispersion

- As information proliferates bond prices are affected
  - Investors condition on ratings *and* public information
- Standard deviation of bond prices increasing for each rating class...
  - but so is the mean...
  - so use coeffecient of variation (CV) instead
- Can test for statistical significance


Spread Over Treasury by Decade
All Ratings
1990s
2000s
Percent
0
10
20
30
-500
0
500
1000
1500
Spread, basis points
Percent
Kernel Density


Spread Over Treasury, by Decade
AAA or AA
1990s
2000s
Percent
0
10
20
30
-200
0
200
400
-200
0
200
400
Spread, basis points
Percent
Kernel Density


Spread Over Treasury, by Decade
A or BBB
1990s
2000s
Percent
0
10
20
30
-500
0
500
1000
Spread, basis points
Percent
Kernel Density



Spread over Treasury, by Rating Class
All Ratings
AAA or AA
A or BBB
BB or lower
Coefficient of Variation
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
1990 to 1993
1994 to 1997
1998 to 2001
2002 to 2005
2006 to 2009
Period

Conclusion

- Vanishing AAAs consistent with improved information about firm quality
- Story implies an increase in bond price dispersion
- Consistent with new data:
  1. distribution of bond ratings has shifted away from high ratings
  2. price dispersion has increased within rating
- Changes in rating distribution aren't necessarily caused by changing CRA standards

Appendix

- Leverage ratios

  ▸ By Rating ▸ By Cohort

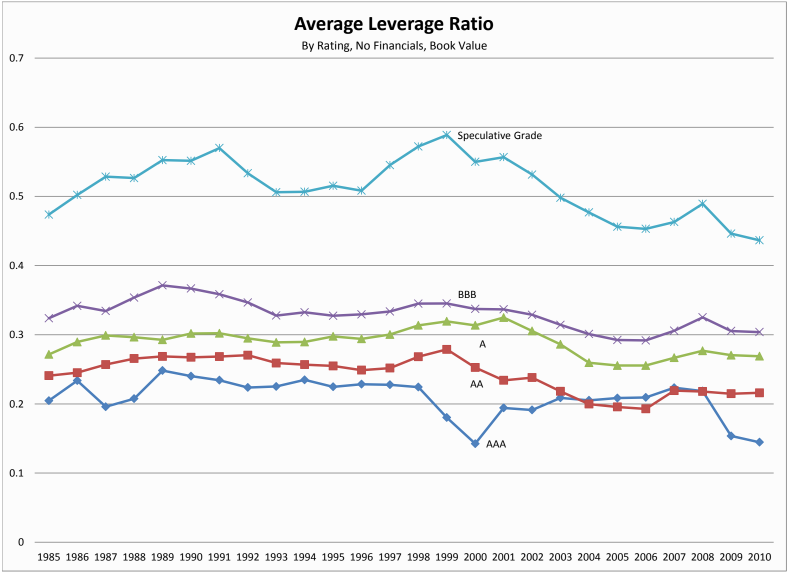
- Assets

  ▸ Assets

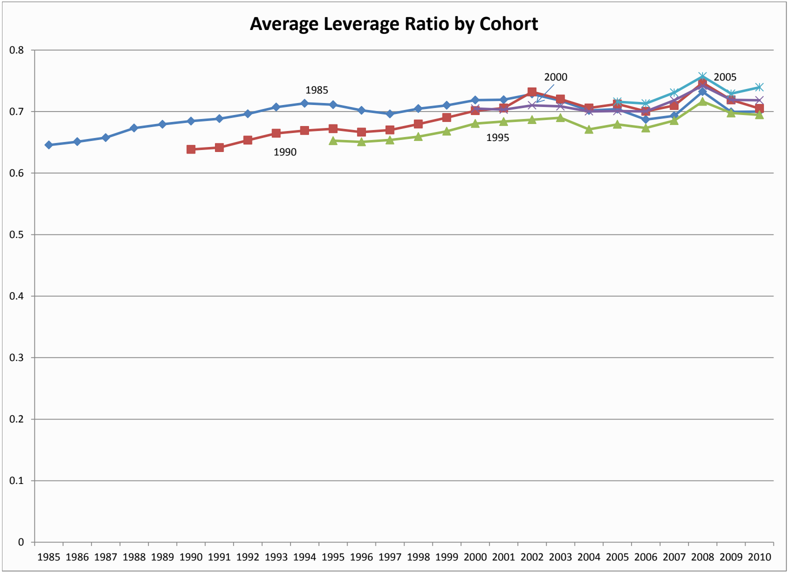
- Numbers dropping in every cohort of AAA and AA

  ▸ Cohorts

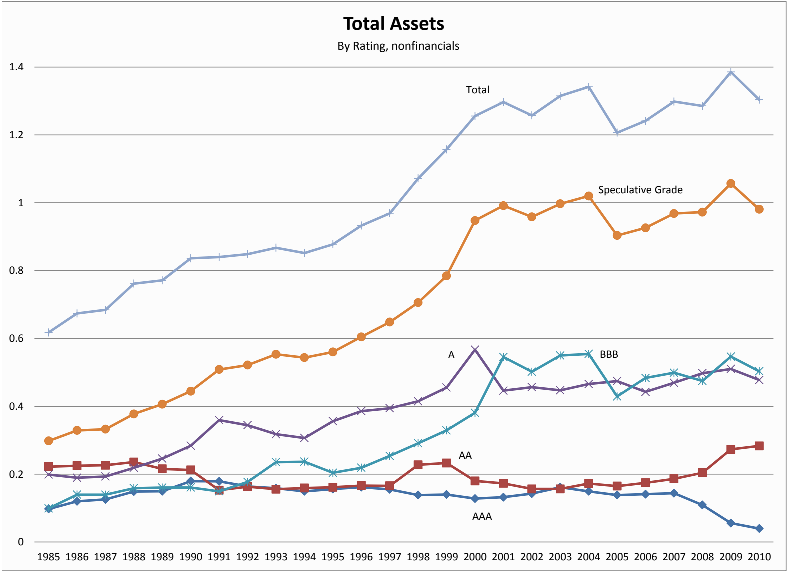
▸ Back


Average Leverage Ratio
By Rating, No Financials, Book Value
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Speculative Grade
BBB
A
AA
AAA

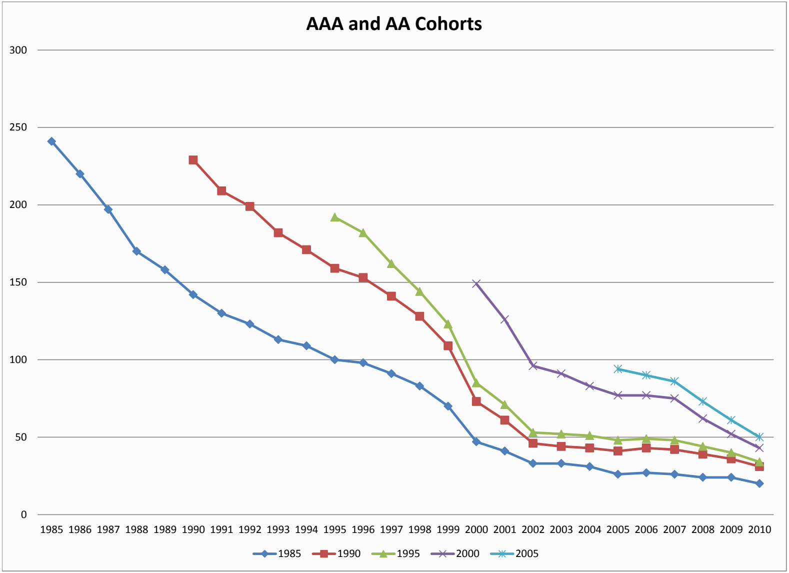
Back


Average Leverage Ratio by Cohort
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1985
1990
1995
2000
2005
1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010

Back

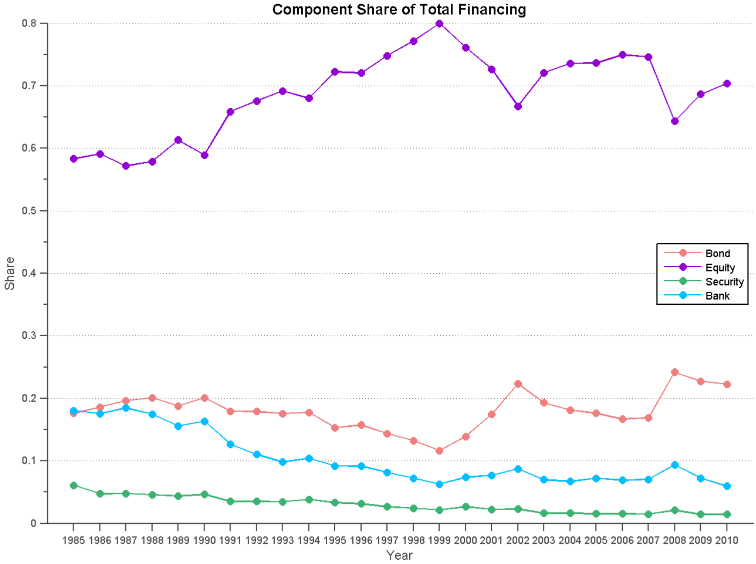

Total Assets
By Rating, nonfinancials
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Total
Speculative Grade
A
BBB
AA
AAA
1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010

Back



AAA and AA Cohorts
300
250
200
150
100
50
0
1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
1985
1990
1995
2000
2005

Back


Component Share of Total Financing
Share
Year
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Bond
Equity
Security
Bank

Back

CV Confidence Intervals

- Suppose r.v. X is distributed log-normal with mean μ and std. dev. σ
- We want a confidence interval on $CV = \sqrt{Var(X)}/E(X)$

$$
\begin{aligned}
E(X) &= \exp(\mu + \frac{1}{2}\sigma^2) \\
Var(X) &= \exp(2\mu + \sigma^2)(\exp(\sigma^2) - 1) \\
CV &= \sqrt{\exp(\sigma^2) - 1}
\end{aligned}
\tag{3}
$$

CV Confidence Intervals

- Let $Y = \ln X$
- Y is distributed $N(\mu, \sigma^2)$ and the test statistic for σ^2 is:

$$\frac{(n-1)s^2}{\sigma^2} \sim \chi^2_{n-1}$$

- The lower and and upper bounds can be defined as follows:

$$a_L \equiv \frac{(n-1)s^2}{F_{\chi^2}(n-1)^{-1}(1-\alpha/2)}$$

$$a_U \equiv \frac{(n-1)s^2}{F_{\chi^2}(n-1)^{-1}(\alpha/2)}$$

- Thus, using these bounds on σ^2 and eq. (3), the following is a $1-\alpha$ confidence interval for the coeffecient of variation of X:

$$\left[\sqrt{\exp(a_L)}, \sqrt{\exp(a_U)}\right]$$