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Corporate Pension Funding and Credit Spreads

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Corporate pension liabilities and the bond market

Rating agencies now explicitly recognise the underfunded amount of pension plans as debt of the sponsor company. The rating agencies treat the difference between the PBO and the fair value of plan assets like any other long-term obligation of the sponsor company

***IMF Global Financial Stability Report**, September 2004, chapter 3, p. 108*

Issues

- Do market bond prices reflect corporate pension liabilities?
- Does the bond market treat pension deficits like any other form of debt?
- Has the market learnt about pension liabilities over time?
- Does the market price corporate pension liabilities in the same way across countries?

Corporate finance literature and DB plans

- Are pension obligations a corporate liability? "Traditional" perspective and consolidated balance sheet model (Bulow et al., 1985, Bodie et al., 1986)
- Differences between pension liabilities and other form of debt: optionalities (Sharpe, 1976), labour contracts (Ippolito, 1985), institutional factors and tax rules
- Empirical evidence is mixed on "value transparency" of the stock market and credit ratings (Carroll and Niehaus, 1998; Coronado and Sharpe, 2003)

The "extended balance sheet"

ASSETS	LIABILITIES & EQUITY
CORPORATE ASSETS	CORPORATE BORROWINGS
	Short-Term borrowings
	Long-Term Borrowings
PENSION ASSETS	PENSION LIABILITIES
	Funded Pension Liabilities
	Unfunded Pension Liabilities
	MARKET VALUE OF EQUITY

Enterprise value under the extended balance sheet approach is equal to market cap plus corporate borrowings plus pension liabilities

Data

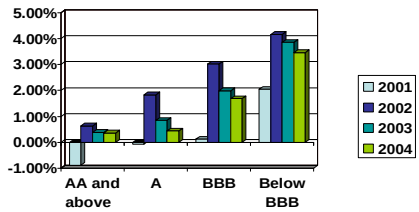
- Financials and pension plan fundamentals of Fortune 1000 companies with a defined benefit plan (Watson Wyatt FAS Survey) for financials years 2001-2004
- Matched with corporate spreads from Merrill Lynch Global Bond Index (investment grades and high yields) as of 31/12 of each year between 2001 and 2004
- Financials and pension plan fundamentals (2001-2004) of large Japanese companies (from Nikkei) and FTSE 350 UK companies (from Watson Wyatt Pension Finance Database)

Overview of the sample

	N. of companies	N. of bonds	Average spread (bp)	Mean PBO/EV	Mean Pension Deficit/EV
2001	382	3,168	229	11.60%	0.58%
2002	436	3,442	328	12.82%	3.08%
2003	451	3,572	155	12.49%	2.39%
2004	353	2,556	126	12.18%	2.01%

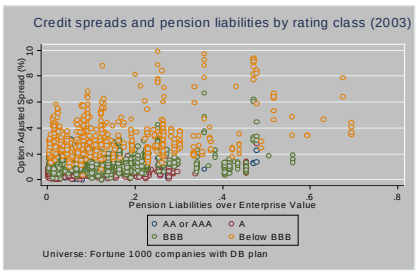
PBO is projected benefit obligation, **EV** is Enterprise Value

Credit ratings and pension deficits

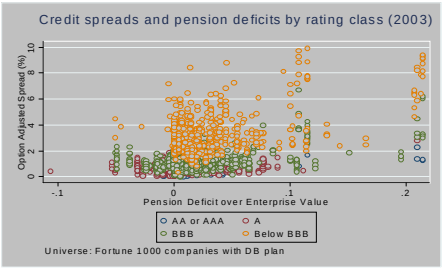


Unfunded pension obligations appear to be under increasing scrutiny by rating agencies

Is there a relationship between credit spreads and pension liabilities?



Or between credit spreads and pension deficits?



Empirical implementation

- Test of whether pension deficits are priced by corporate spreads of traded bonds
- Under a Merton (1974)-type structural approach credit spreads are a function of leverage and firm volatility

$$cs(T) = -\frac{1}{T}\ln\left[N(d_2) + \frac{V_t}{Fe^{-rT}}N(-d_1)\right]$$

- Leverage is defined as the ratio of promised payment to enterprise value and is broken down into corporate borrowings leverage (short-term + long-term) and pension leverage (funded + unfunded)
- Firm volatility proxied by equity volatility, dummies for bond maturity and financial years included as control variables

Baseline model

$$SP_{it} = \mu + \beta_1 pdef_{it} + \beta_2 passet_{it} + \beta_3 levlt_{it} + \beta_4 levst_{it} + \beta_5 vol_{it} + \beta_6 dur2_{it} + \beta_7 dur3_{it} + \beta_8 dur4_{it} + \beta_9 year2_{it} + \beta_{10} year3_{it} + \beta_{11} year4_{it} + \alpha_i + \varepsilon_{it}$$

	DEFINITION	PREDICTED SIGN
pdef	*(Pension Liabilities - Pension Assets)/Enterprise Value*	+
passet	*Pension Assets/Enterprise Value*	+
levlt	*Long-Term Borrowings/Enterprise Value*	+
levst	*Short-Term Borrowings/Enterprise Value*	+
volatility_3y	*Stock Price Volatility (over 3-years annualised)*	+

Panel model is estimated with **random effects**

dur2-dur4 are duration dummies. Each dummy corresponds to a given bond duration bracket (e.g. dur4 corresponds to over 10 years)

year2-year4 are year dummies (e.g. year2 corresponds to 2002 etc)

Dependent variable is option-adjusted spread

Discussion on empirical implementation

- **Model specification** (fixed vs. random effects)
- **Measurement of variables** (gross vs. net debt definition)
- **Simultaneity** (what if volatility and spreads are both endogenous?)
- **Missing variables** (do other pension firm, bond and pension plan fundamentals matter?)

Results: All Companies

Number of observations is 11,352 and overall R-square is 36.44%

spreadpc	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
pdef	15.63	0.93	16.72	0.00	13.80	17.46
passet	2.58	0.39	6.58	0.00	1.81	3.35
levlt	5.46	0.24	23.20	0.00	5.00	5.92
levst	0.57	0.20	2.82	0.01	0.17	0.96
volatility_3y	4.89	0.20	24.18	0.00	4.49	5.29
dur2	0.17	0.45	0.37	0.71	-0.71	1.05
dur3	0.10	0.45	0.23	0.82	-0.78	0.98
dur4	-0.27	0.45	-0.61	0.54	-1.15	0.60
year2	0.26	0.06	4.43	0.00	0.14	0.37
year3	-0.82	0.06	-14.15	0.00	-0.93	-0.70
year4	-0.79	0.07	-11.92	0.00	-0.93	-0.66
_cons	-1.60	0.46	-3.48	0.00	-2.50	-0.70

Spreads sensitivity is **three times greater** for pension deficits compared to ordinary leverage: is this a **risk premium**?

Results: Overfunded vs. Underfunded

Number of observations is 2,073 (overfunded) and 1,137 (underfunded IV quartile)

Overfunded

spreadpc	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
pdef	1.08	1.23	0.88	0.38	-1.33	3.49
passet	3.29	0.42	7.85	0.00	2.47	4.11
levlt	1.78	0.23	7.67	0.00	1.33	2.24
levst	0.40	0.22	1.83	0.07	-0.03	0.83
volatility_3y	1.08	0.18	6.15	0.00	0.74	1.43

Underfunded IV quartile

spreadpc	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
pdef	24.99	1.96	12.75	0.00	21.15	28.84
passet	0.71	0.91	0.78	0.44	-1.07	2.49
levlt	5.84	0.59	9.88	0.00	4.68	7.00
levst	0.78	1.01	0.78	0.44	-1.19	2.76
volatility_3y	6.64	0.49	13.60	0.00	5.68	7.60

R-square jumps from 14.38% (overfunded) to 46.66% (underfunded IV quartile): **overfunding does not reduce risk**

Results: increasing awareness or overreaction?

2001

spreadpc	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
pdef	8.32	2.17	3.83	0.00	4.07	12.57
passet	1.23	0.55	2.22	0.03	0.14	2.31
levlt	4.25	0.50	8.52	0.00	3.27	5.22
levst	-1.19	0.15	-8.18	0.00	-1.48	-0.91
volatility_3y	7.58	0.85	8.88	0.00	5.91	9.26

2004

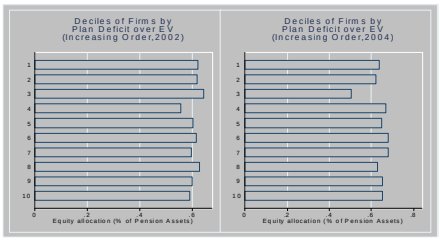
spreadpc	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
pdef	24.36	2.97	8.19	0.00	18.53	30.19
passet	1.64	0.31	5.23	0.00	1.02	2.25
levlt	2.36	0.21	11.36	0.00	1.95	2.77
levst	0.39	0.12	3.28	0.00	0.16	0.63
volatility_3y	2.23	0.24	9.16	0.00	1.76	2.71

Note: the estimation here is carried out using **ordinary least squares** with robust standard errors and R-square goes up from 39.64% (2001) to 48.86% (2004)

Asset allocation and pension leverage

- "Pension put" effect (Treynor, 1977): corporations are not liable for shortfall between assets and liabilities
- Impossibility to ditch contractual obligations without insolvency (PBGC/PPF rules)
- Equity investments in the pension plan increase firm-specific risk and are a further source of leverage (Black, 1980)

Does asset allocation change with pension leverage?



Not substantially. Corporations do not seem to take an **integrated risk management approach**

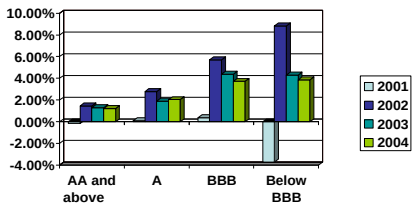
Accounting bias?

spreadpc	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
pdef_recognised	19.96	1.38	14.42	0.00	17.25	22.68
pdef_off-balance sheet	9.33	1.06	8.77	0.00	7.24	11.42
passet	4.73	0.49	9.76	0.00	3.78	5.69
levlt_p	5.26	0.24	22.32	0.00	4.80	5.72
levst_p	0.63	0.20	3.15	0.00	0.24	1.03
volatility_3y	5.35	0.20	26.91	0.00	4.96	5.74

Value transparency has been recently questioned for the stock market by studies such as Coronado and Sharpe (2003) or Picconi (2004)

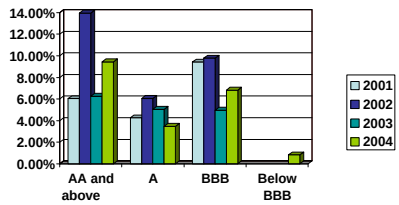
These results show that the bond market may also suffer from **accounting bias** as it weighs balance sheet liabilities more

Credit ratings and pension deficits: what about the UK?



Pension deficits did not seem to be factored in by rating agencies before 2001

And Japan?



…and not even in 2004 for Japanese companies

Results: UK Companies

Number of observations is 1,579 and overall R-square is 50.69%

spreadpc	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
pdef	-1.58	0.81	-1.95	0.05	-3.17	0.01
passet	2.77	0.24	11.70	0.00	2.31	3.24
levlt	1.84	0.20	9.16	0.00	1.45	2.23
levst	-0.20	0.10	-1.99	0.05	-0.40	0.00
volatility_3y	3.44	0.22	15.87	0.00	3.01	3.86
dur2	-0.29	0.34	-0.86	0.39	-0.95	0.37
dur3	-0.08	0.34	-0.22	0.82	-0.73	0.58
dur4	0.04	0.33	0.12	0.91	-0.62	0.69
year2	0.04	0.05	0.84	0.40	-0.06	0.14
year3	-0.30	0.05	-6.16	0.00	-0.40	-0.21
year4	-0.18	0.05	-3.41	0.00	-0.28	-0.08
_cons	-0.56	0.35	-1.62	0.11	-1.24	0.12

In the UK it is the **relative size of liabilities** what appears to matter (but it is hard to say because relative size of deficits is highly correlated)

Results: Japanese Companies

Number of observations is 2,913 and overall R-square is (only) 2.41%

spreadpc	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
pdef_recognised	-0.49	0.32	-1.52	0.13	-1.12	0.14
pdef_off-balance sheet	0.82	0.33	2.49	0.01	0.18	1.47
passet	-0.41	0.25	-1.61	0.11	-0.91	0.09
levlt_p	-0.39	0.10	-3.95	0.00	-0.58	-0.20
levst_p	0.30	0.08	3.80	0.00	0.15	0.46
volatility_3y	0.03	0.10	0.26	0.79	-0.17	0.22
dur2	0.11	0.09	1.14	0.25	-0.08	0.29
dur3	0.24	0.09	2.62	0.01	0.06	0.42
dur4	0.24	0.09	2.68	0.01	0.06	0.42
year2	-0.03	0.02	-2.15	0.03	-0.06	0.00
year3	0.00	0.02	0.09	0.93	-0.03	0.03
year4	-0.09	0.02	-4.37	0.00	-0.14	-0.05
_cons	0.12	0.11	1.05	0.29	-0.10	0.34

In Japan the model breaks down but **off-balance sheet** liabilities are significant

Summary of results

- Defined benefit plan liabilities appear to be recognised by the US bond market and more so if they are unfunded
- Deficits are bad for creditors but surpluses do not seem to matter
- The US bond market consider deficits three times riskier than ordinary leverage and the effect is stronger in more recent years: is this a premium for cashflow uncertainty or market overreaction?
- Nevertheless, the bond market still appears to suffer from accounting bias and is less severe with unrecognised deficits
- In the UK the bond market process pension information differently: absolute size of liabilities and not deficits matter
- In Japan unrecognised deficits matter more than recognised ones, but there may be a missing variable problem due to heterogeneity of pension landscape

Conclusion

- Do market bond prices reflect corporate pension liabilities?
  Yes, at least in US and UK
- Does the bond market treat pension deficits like any other form of debt?
  Not entirely, size of liabilities matter as well and overfunded liabilities are treated asymmetrically
- Has the market learnt about pension liabilities over time?
  Yes, although it is still fooled by pension accounting
- Does the market price corporate pension liabilities in the same way across countries?
  No, country-specific factors and concerns play a major role