Do pension plans manipulate pension liabilities?

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What we do ... and what we find ...

- Focus on U.S. corporate defined benefit pension plans
- Use detailed actuarial information (Form 5500)
- Historically, DB plans had to report two liability measures
- Investigate how much those measures differ
- The difference increases with level of plan underfunding
- Show that results are not driven by credit risk

Literature

How do frictions affect pension management?

- Bergstresser et al. (2006): ROA manipulation
- Rauh (2009): risk shifting and asset allocation
- Novy-Marx and Rauh (2011): public plans use wrong discount rate
- Andonov et al. (2014): asset allocation of pension plans across countries

A primer on pension funding law

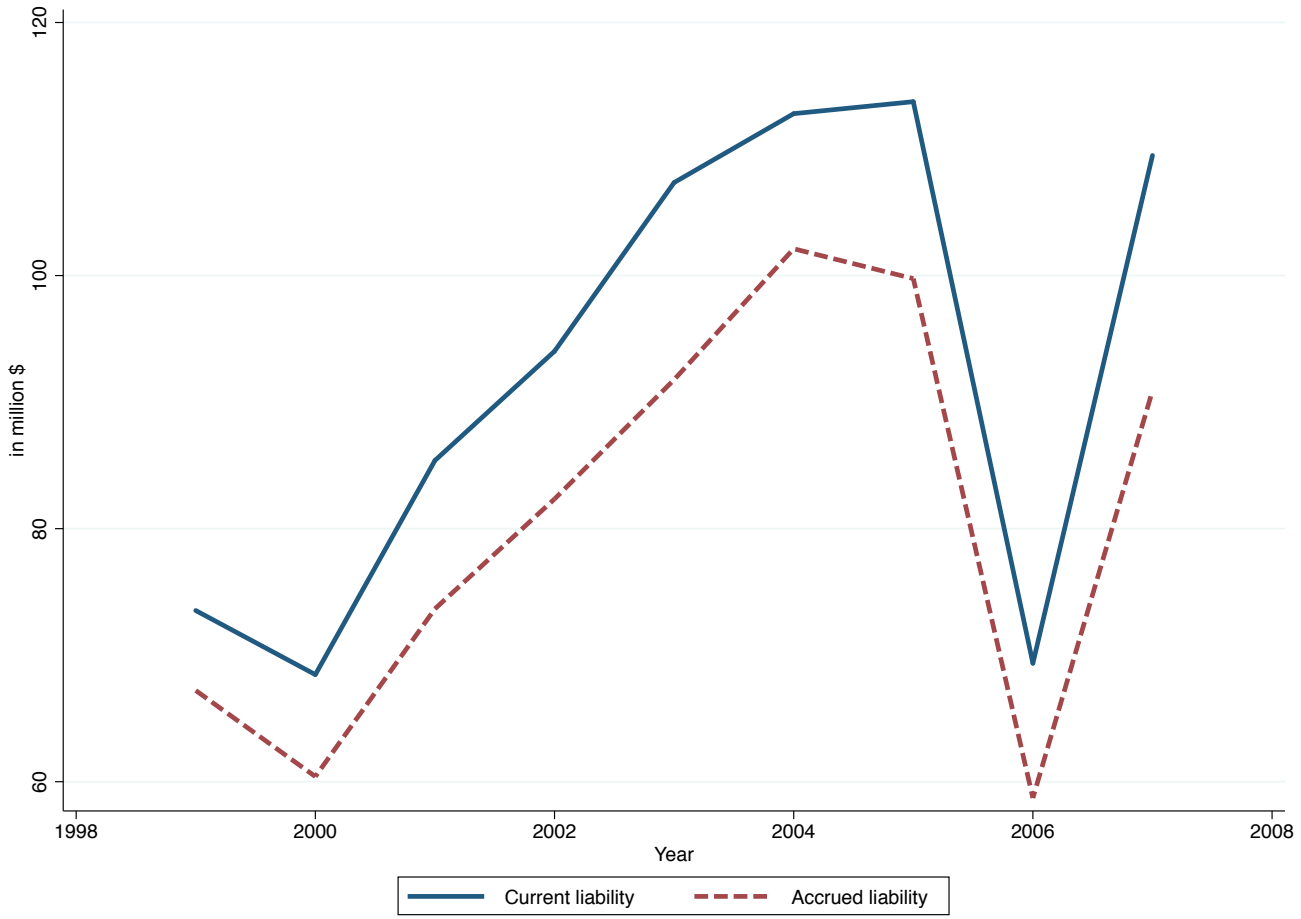
U.S. pension law employed two liability concepts until 2008

- Accrued pension liability (AL)
  - Relevant for normal level of pension contributions
  - Assumptions set by plan sponsor and actuary
- Current liability measure (CL)
  - Relevant for additional pension contributions
  - Assumptions are regulated
    - Discount rate: 30-year Treasuries / IG corporate bonds
    - Mortality table: GAM-1983 / RP-2000 Table

Data Source

- Period from 1999 to 2007
- Form 5500: pension plan data
  - 11,963 plans (48,880 plan-years)
- Compustat: plan sponsor data
  - 670 sponsors (2,797 sponsor-years)

Comparison of current and accrued pension liabilities



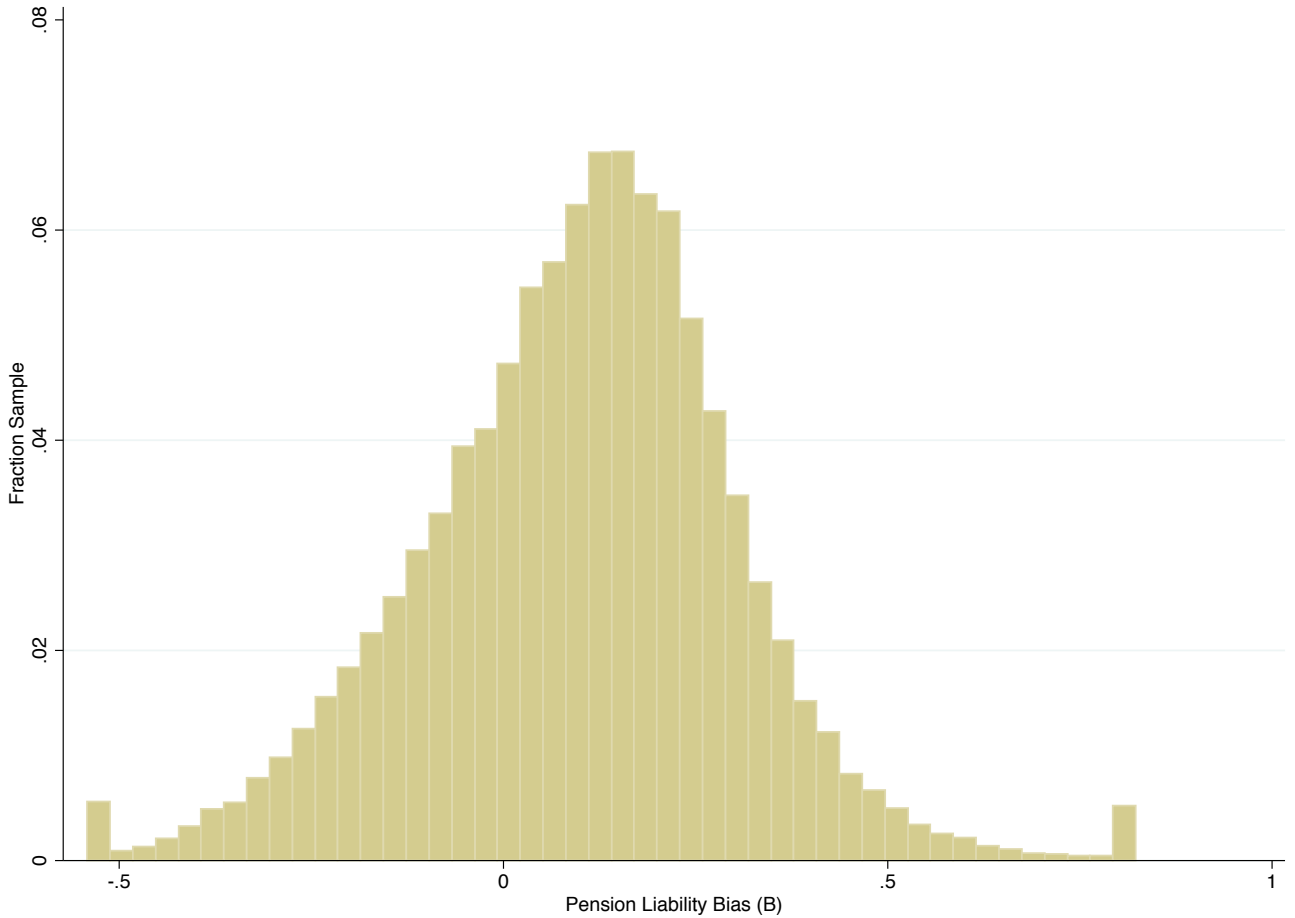
How to measure pension liability manipulation?

- Average values mask a lot of variation
- Therefore focus on firm-specific difference
- Define liability bias measure $B_{i,t}$

$$B_{i,t} \equiv \frac{CL_{i,t} - AL_{i,t}}{AL_{i,t}} \tag{1}$$

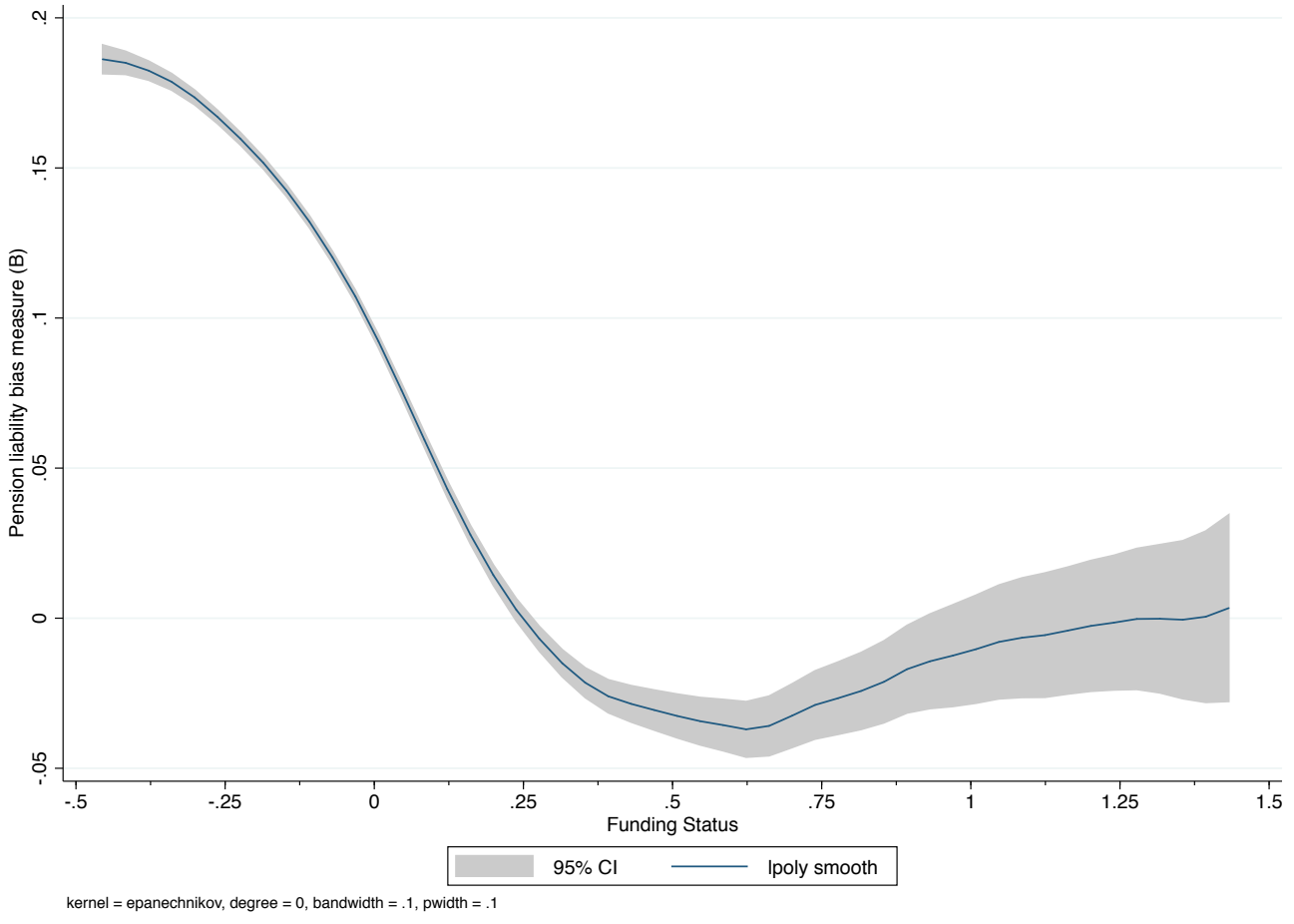
Distribution of pension liability bias

Average (median) bias of 10 percent



Funding levels and pension liability bias

Negative correlation between funding and *B*



What should explain the liability bias measure?

- Difference in discount rate assumptions
- Difference in mortality tables
- Size? Duration liabilities? Asset allocation?
- Industry or plan-fixed effects?
- But no economic role for funding levels

Funding levels and pension liability bias

$$B_{i,t} = \alpha + \theta \text{funding}_{i,t} + \beta_1 r^{\Delta}_{i,t} + \beta_2 LE^{\Delta}_{i,t} + \delta X_{i,t} + \gamma_k + \eta_t + \epsilon_{i,t}$$

Panel A: OLS Estimation				
funding_{it}	-0.1623***	-0.1622***	-0.1645***	
$r^{\Delta}_{i,t}$	-0.0014***	-0.0013***	-0.0013***	-0.0012***
$LE^{\Delta}_{i,t}$	0.0271***	0.0274***	0.0253***	0.0238***
$\text{size}_{i,t}$		-0.0039***	-0.0009+	0.0019***
$\text{duration}_{i,t}$		0.2201***	0.1848***	0.1753***
$\text{risky}_{i,t}$		0.0378***	0.0272***	0.0346***
funding^{+}_{it}				-0.1119***
funding^{-}_{it}				0.3730***
time dummies	yes	yes	yes	yes
industry dummies	yes	yes	yes	yes
N	48880	48880	48880	48880
R^2	0.3274	0.3606	0.3934	0.4048

Funding levels and pension liability bias

$$B_{i,t} = \alpha + \theta \text{funding}_{i,t} + \beta_1 r^{\Delta}_{i,t} + \beta_2 LE^{\Delta}_{i,t} + \delta X_{i,t} + \gamma_k + \eta_t + \epsilon_{i,t}$$

Panel B: Fixed Effect Estimation				
funding_{it}	-0.1480***	-0.1705***	-0.1918***	
$r^{\Delta}_{i,t}$	-0.0013***	-0.0013***	-0.0011***	-0.0011***
$LE^{\Delta}_{i,t}$	0.0189***	0.0230***	0.0212***	0.0213***
$\text{size}_{i,t}$		0.0590***	0.0417***	0.0455***
$\text{duration}_{i,t}$		0.0527***	0.0240*	0.0221*
$\text{risky}_{i,t}$		0.0126*	0.0127*	0.0150**
funding^{+}_{it}				-0.1812***
funding^{-}_{it}				0.2353***
time dummies	yes	yes	yes	yes
industry dummies	no	no	no	no
N	48880	48880	48880	48880
R^2	0.3703	0.3936	0.4191	0.42

Does credit risk explain the pension liability bias?

- Results show that underfunded plans report lower AL
- Law does not state that AL should reflect credit risk
- But law also does not regulate AL
- Credit risk differences could explain bias
- Focus on sub-sample that is merged with Compustat

Funding levels and pension liability bias

Compustat subsample yields similar results

Panel A: OLS Estimation				
$\text{funding}_{j,t}$	-0.1103***	-0.1108***	-0.1209***	
$r^{\Delta}_{j,t}$	-0.0012***	-0.0012***	-0.0012***	-0.0011***
$LE^{\Delta}_{j,t}$	0.0106	0.0084	0.0104	0.0097
$\text{size}_{j,t}$		-0.0046**	-0.0040*	-0.0015
$\text{duration}_{j,t}$		0.0836***	0.1045***	0.0982***
$\text{risky}_{j,t}$		0.0678***	0.0749***	0.0815***
$\text{funding}^{+}_{j,t}$				-0.0808***
$\text{funding}^{-}_{j,t}$				0.3161***
time dummies	yes	yes	yes	yes
industry dummies	yes	yes	yes	yes
N	3053	3053	3053	3053
R^2	0.3065	0.3182	0.3591	0.3705

Funding levels, pension liabilities and credit risk

A two-stage approach

- In the first stage, we control for impact of credit risk on liability bias

$$B_{j,t} = \alpha + \beta_1 r^{\Delta}_{j,t} + \beta_2 LE^{\Delta}_{j,t} + \delta X_{j,t} + \lambda Y_{j,t} + \gamma_k + \eta_t + \epsilon_{j,t} \quad (2)$$

  where Y includes Altman's z-score, the consolidated leverage ratios and other firm characteristics

- In the second stage, we estimate the impact of funding on the residual from first-stage regression

$$\hat{\epsilon}_{j,t} = \alpha + \theta \text{funding}_{j,t} + \nu_{j,t} \quad (3)$$

Funding levels, pension liabilities and credit risk

Evidence from second-stage regression

	OLS		Fixed effects	
	1	2	3	4
$\text{funding}_{j,t}$	-0.0809***		-0.0935***	
$\text{funding}^{+}_{j,t}$		-0.0541**		-0.1025**
$\text{funding}^{-}_{j,t}$		0.1786***		0.0633*
N	2797	2797	2797	2797
R^2	0.0364	0.0422	0.0513	0.0522

Funding levels, pension liabilities and credit risk

Evidence from second-stage regression: robustness

	Small Plan		Large Plan	
	Low leverage	High leverage	Low leverage	High leverage
$\text{funding}^{+}_{j,t}$	-0.0779*	-0.0458	-0.0762***	0.0046
$\text{funding}^{-}_{j,t}$	0.1914***	0.1940**	0.2025***	0.1558***
N	818	581	581	817.0000
R^2	0.061	0.0379	0.0811	0.0236

Effect persists even among small plans with low leverage

Direct test of discount rate assumptions

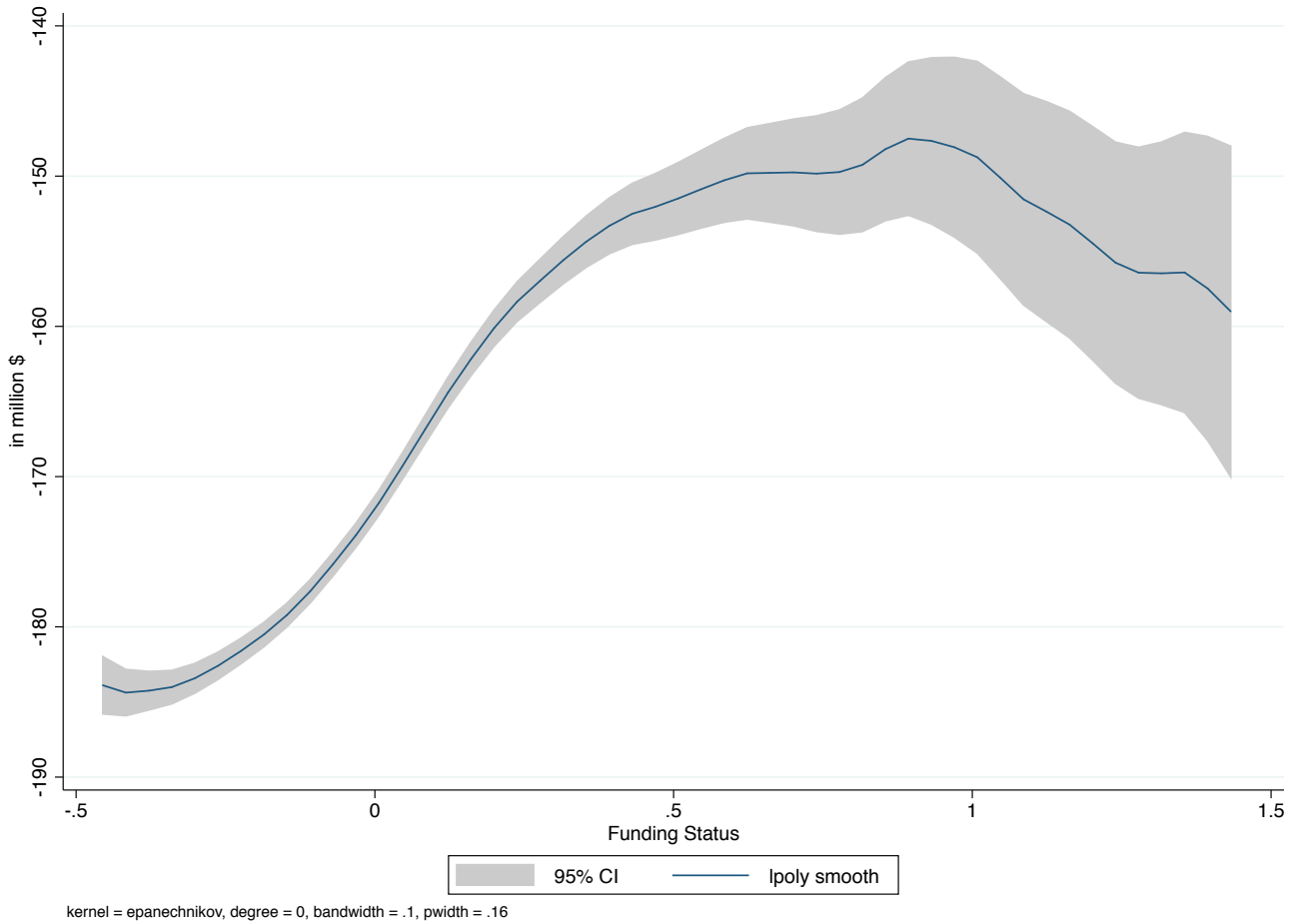
- Discount rate assumptions are available in Form 5500

$$r_{i,t}^{\Delta} = r_{i,t}^{CL} - r_{i,t}^{AL} \tag{4}$$

- Repeat previous tests with $r_{i,t}^{\Delta}$ as the dependent variable
- Selective results on following slides
  - Univariate evidence
  - Two-stage evidence

Funding levels and discount rate bias

Positive correlation between funding and $r^{\Delta}_{i,t}$



Funding levels, discount rates and credit risk

Evidence from second-stage regression

	OLS		Fixed effects	
	1	2	3	4
$\text{funding}_{j,t}$	41.9403***		33.8682***	
$\text{funding}^{+}_{j,t}$		33.0988***		17.1562*
$\text{funding}^{-}_{j,t}$		-74.2335***		-90.1387***
N	2797	2797	2797	2797
R^2	0.0484	0.0515	0.0282	0.0424

Funding levels, discount rates and credit risk

Evidence from second-stage regression: robustness

	Small Plan		Large Plan	
	Low leverage	High leverage	Low leverage	High leverage
$\text{funding}^{+}_{j,t}$	8.1255	19.5761+	57.6997***	72.0698***
$\text{funding}^{-}_{j,t}$	-96.9193***	-63.3550*	-88.5583**	-30.2456
N	818	581	581	817
R^2	0.0351	0.033	0.0962	0.0767

Effect persists again among small plans with low leverage

Intermediate summary

- Plans use legal gray-zone when left with choice
- Future regulation should take this into account
- Use MAP-21 to illustrate recent events
  - PPA of 2006 removed co-existence of AL and CL
  - MAP-21 allows DB plans to use higher discount rate
  - Gave plans option to be early adopter of legislation
  - Underfunded plans should be early adopters

Overview of MAP-21

- U.S. government signed MAP-21 into law in 2012
- Allows DB sponsors to increase discount rates as of 2012
- Based on 5,218 plans in 2012
  - 4,239 were early adopters
  - Discount rates increased by 213 basis points
  - Mandatory pension contributions decreased by 37%

The impact of funding levels to adapt the MAP-21 bill

$$update_{i,t} = \alpha + \theta^{P}\text{funding}^{+}_{i,t-1} + \theta^{N}\text{funding}^{-}_{i,t-1} + \delta X_{i,t} + \gamma_k + \eta_t + \epsilon_{i,t}$$

	Logit	
	(1)	(2)
$\text{funding}^{+}_{i,t-1}$	-2.7220***	-2.3143***
$\text{funding}^{-}_{i,t-1}$	3.2821***	3.8820***
$\text{size}_{i,t}$		0.2345***
$\text{duration}_{i,t}$		0.5618*
$\text{risky}_{i,t}$		0.5684***
industry dummies	no	yes
N	5218	5218
$PseudoR^2$	0.06	0.11

Summing up...

- We study details of pension funding law
- Investigate competing liability concepts
- On average, CL exceeds AL by 10%
- Difference increases in the level of plan underfunding
- Results are not explained by credit risk
- Suggest that pension plans use legal gray-zone