Do Firms Set Pension Discount Rates Strategically?

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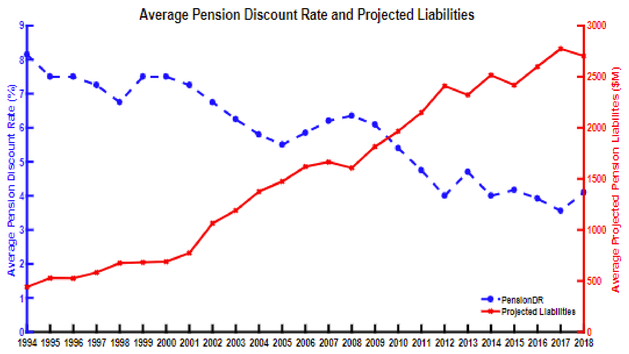
Abstract

Corporations reduce the magnitude of pension contributions through the choices of pension liability discount rates, and do so asymmetrically: firms are slow to drop the rates when corporate bond rates drop, but raise them rapidly when rates rise. Cross-sectionally, firms with greater investment productivity and facing more financial difficulty set higher pension discount rates. Consistently, we find that firms setting high pension discount rates tend to have higher funding ratios and that setting high pension discount rates allow more productive firms to invest more and become more profitable when they face a lower level of insolvency risk. Imperfect elasticity of pension discount rates to market interest rates offers firms leeway to alleviate the constraints from defined benefit pension plans.

Motivation



- Firms are more likely to inflation pension discount rate during large interest rate drop period
- Firms with better investment opportunity are more likely to set higher pension discount rates
  - The positive relationship intensified for for low financial risk firms
- A higher pension discount rate increases firms pension funding
- A higher pension discount rate increases firms investment and improves operating performance

Conceptual Framework

Objective function:

$$v_t = p_t * [\underbrace{(f(i_t) - i_t) + (h(c_t) - c_t)}_{\text{profit in year t}} + \underbrace{\beta v_{t+1}}_{\text{PV}(v_{t+1})}]$$

Setting $v_t^* = (f(i_t) - i_t) + (h(c_t) - c_t) + \beta v_{t+1}$, we have

$$\frac{\partial v_t}{\partial c_t} = \frac{\partial p_t}{\partial c_t} v_t^* + \frac{\partial v_t^*}{\partial c_t} p_t = 0$$

Three scenarios: 1) $\frac{\partial p_t}{\partial c_t} = 0$; 2) $\frac{\partial p_t}{\partial c_t} < 0$; 3) $\frac{\partial p_t}{\partial c_t} > 0$.

p_t is independent of c_t; that is $\frac{\partial p_t}{\partial c_t} = 0$.

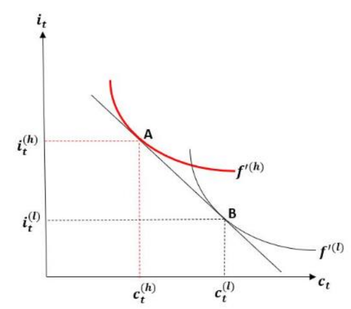
The first order condition is $\frac{\partial v_t^*}{\partial c_t} = 0$.
With pension funding constraint and time consistent relation $\frac{\partial v_t}{\partial c_t} = \frac{\partial v_{t+1}}{\partial c_{t+1}}$

$$\frac{\partial v_t^*}{\partial c_t} = \frac{[f'(i_t) - 1]\frac{\partial i_t}{\partial c_t} + [h'(c_t) - 1]}{1 + \beta r_p} = 0$$

Then,

$$\frac{\partial i_t}{\partial c_t} = -\frac{h'(c_t) - 1}{f'(i_t) - 1}$$

Tradeoff and Hypotheses



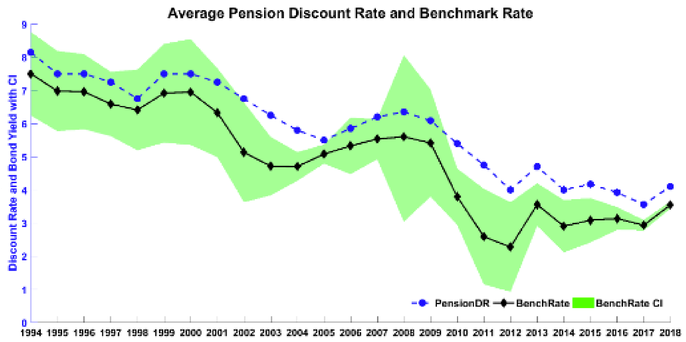
- Firms with a higher investment productivity invest more and contribute less to pension
- That is, $i^{(h)} > i^{(l)}; c^{(h)} < c^{(l)}$

- H1 (Pension Discount Rates over Time): Corporates are more likely to set higher pension discount rates when interest rates **significantly drop**.
- H2 (Investment Productivity and Pension Discount Rates): **Highly productive firms** are more likely to set higher pension discount rates. The effect is stronger among **low financial risk** firms.
- H3 (Corporate Default and Pension Discount Rates): **Higher financial risk** firms set greater pension discount rates.
- H4 (Pension Discount Rates and Funding and investment): All others being equal, pension funding is higher for firms setting **higher pension discount rates**.
- H5 (Pension Discount Rates and profitability): Firm **investments and profitability** are higher for firms setting higher pension discount rates. This effect is stronger among firms with **lower financial risk**.

Data

- Data
  - Compustat and CRSP
  - Bond prices & yields from Enhanced TRACE
  - Other bond information from Mergent FISD
- Sample
  - 1994-2018
  - Firms having defined benefit pensions (i.e., pension assets and liabilities are available)
  - Having pension discount rate data

Empirical Finding



$$\text{Pension Discount Rate}_{i,t} = \beta_1 \text{Benchmark Rate}_t + \beta_2 \text{Pension Discount Rate}_{i,t-1}$$
$$\Delta\text{Pension Discount Rate}_{i,t} = \beta_1 \Delta\text{Benchmark Rate}_t + \beta_2 \Delta\text{Benchmark Rate}_t^-$$

	Pension Discount Rate		ΔPension Discount Rate	
Benchmark Rate	0.82***	0.52***		
	(35.76)	(20.82)		
Pension Discount Rate$_{t-1}$		0.43***		
		(12.90)		
ΔBenchmark Rate			0.44***	0.64***
			(19.95)	(10.85)
ΔBenchmark Rate$^-$				0.31***
				(-5.15)
Industry FE	Yes	Yes	Yes	Yes
Adj R^2	0.77	0.88	0.13	0.14
N	45,447	40,511	40,511	40,511

- Prior pension discount rates have a **strong** effect on the pension discount rate in the current period
- Benchmark rates have an **asymmetric** effect on firm choices of pension discount rates (Hypo. 1)

Stage 1 : $\text{EDR}_{i,t} = \beta \text{EDR}_{ind,t} + \text{Control}_{i,t}$
Stage 2 : $\text{Funding}_{i,t} = \beta \widehat{\text{EDR}}_{i,t-1} + +\text{Control}_{i,t-1}$

$$\text{EDR}_{i,t} = \beta_1 \text{MPK}_{i,t-1} + \beta_2 \text{SOL}_{i,t-1} + \beta_3 \text{MPK}_{i,t-1} \text{SOL}_{i,t-1} + \textit{Control}_{i,t-1}$$

SOL Proxy:		Rating	Z-Score	DD	Rating	Z-Score	DD
MPK	0.65***				0.33*	0.31	0.36*
	(3.48)				(1.71)	(1.48)	(1.82)
SOL		-0.15***	-0.14***	-0.13***	-0.14***	-0.13***	-0.13***
		(-3.57)	(-3.18)	(-2.97)	(-3.21)	(-2.96)	(-3.07)
MPK*SOL					0.69***	0.62***	0.68***
					(3.34)	(3.02)	(3.28)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj R^2	0.46	0.46	0.46	0.49	0.46	0.46	0.49
N	41,703	45,447	45,447	32,013	41,703	41,703	31,236

- Highly productive firms are more likely to set higher EDR
- The positive association between EDR and investment productivity intensifies among **solvent firms** (Hypo. 2)
- Highly defaultable firms set high pension discount rates (Hypo. 3)

	Funding Ratio		Funding Rank	
$\widehat{\text{EDR}}$	0.15***	0.13***	2.03***	1.80***
	(5.32)	(5.94)	(6.13)	(6.03)
SIZE		0.03***		0.37***
		(3.15)		(3.66)
PenLiab		0.33***		3.11***
		(3.98)		(3.25)
TAX		0.11***		1.71***
		(4.05)		(3.85)
PRET		0.39***		6.03***
		(3.88)		(4.06)
Time FE	Yes	Yes	Yes	Yes
Adj R^2	0.16	0.25	0.06	0.14
N	48,343	46,924	48,343	46,924

- We use industry average EDR as the proxy for individual firm EDR
- Firms with higher discount rate has better pension funding (Hypo. 4)

$$X_{i,t} = \beta_1 \widehat{\text{EDR}}_{i,t-1} + \beta_2 \text{SOL}_{i,t-1} + \beta_3 \widehat{\text{EDR}}_{i,t-1} * \text{SOL}_{i,t-1} + \textit{Control}_{i,t-1}$$

Solvency Proxy:	Rating		Z-Score		DD	
	I/K	IG	I/K	IG	I/K	IG
$\widehat{\text{EDR}}$	0.64*	0.79	0.58*	0.61	0.58*	0.64
	(1.90)	(1.51)	(1.75)	(1.03)	(1.81)	(1.19)
SOL	2.04***	3.02***	1.84***	3.52***	3.08***	4.56***
	(3.29)	(5.59)	(2.98)	(6.81)	(4.14)	(7.97)
$\widehat{\text{EDR}} * \text{SOL}$	1.73***	2.08***	1.67***	1.94***	1.61***	1.87***
	(4.51)	(3.69)	(4.37)	(3.48)	(4.19)	(3.40)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Adj R^2	0.04	0.05	0.07	0.05	0.06	0.06
N	42,207	41,574	42,207	41,574	30,604	30,210

- I/K: capital expenditure/lagged fixed assets
- IG: capital expenditure growth rate
- Setting higher pension discount rates improves investment of **high solvent** firms

$$R_{i,t} = \beta_1 \widehat{\text{EDR}}_{i,t-1} + \beta_2 \text{SOL}_{i,t-1} + \beta_3 \widehat{\text{EDR}}_{i,t-1} * \text{SOL}_{i,t-1} + \textit{Control}_{i,t-1}$$

Solvency Proxy:	Rating		Z-Score		DD	
	ROA	ROE	ROA	ROE	ROA	ROE
$\widehat{\text{EDR}}$	0.38**	0.75**	0.29*	0.78**	0.31**	0.74**
	(2.11)	(2.35)	(1.81)	(2.46)	(2.03)	(2.20)
SOL	2.84***	5.09***	3.96***	5.79***	3.89***	6.49***
	(5.64)	(5.54)	(7.15)	(6.21)	(6.89)	(7.32)
$\widehat{\text{EDR}} * \text{SOL}$	0.45***	1.28***	0.41***	1.06***	0.40***	1.08***
	(3.19)	(3.90)	(2.89)	(3.17)	(2.81)	(3.29)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Adj R^2	0.09	0.06	0.19	0.09	0.16	0.10
N	44,395	44,389	44,395	44,389	31,977	31,976

- Setting higher pension discount rates improves profitability of **high solvent** firms (Hypo. 5)

Conclusion Remarks

- Can firms discretionarily set pension discount rates (within some bounds) -- YES
- Do firms strategically manage their pension discount rates -- YES
- Are discount rate management effective to firm operating performance -- YES