Should Risky Firms Offer Risky DB Pensions?

David A. Love
Williams College
-
Paul A. Smith
Federal Reserve Board
-
David Wilcox
Federal Reserve Board
-
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Risky Firms and Risky Pensions

- Firms are risky because they can fail (default or go bankrupt)
- Accrued DB pensions are risky due to joint prob. of bankruptcy and underfunding
  - Pension insurance is incomplete and imperfect
- In this work, we study the effect of pension risk on firms and workers in a simple model of optimal behavior

Correlated Risks

- Risks of bankruptcy and underfunding can be correlated
- Stock price and interest rate decline of 2001-2002:
  - Top 100 DBs: \$200 billion surplus $\rightarrow$ \$163 billion deficit
  - Corporate default rate tripled
  - Claims to PBGC \$88 million $\rightarrow$ \$3.5 billion
  - Employer contributions tripled
  - “Perfect Storm” sounds exogenous...but no coincidence that bankruptcies rose at the same time funding levels dropped
- Risk exposure is chosen by firms and workers...does it make sense?

Asset Allocation

2007 Asset Allocation of the Largest 100 Plans

	Share in Risky Assets
Average (%)	69
# of Plans with Risky Asset Allocations:	
$>$70%	51
$<$50%	5

Source: Authors' calculations from Milliman Consultants and Actuaries.
*Risky assets defined as equities plus "other investments."

Recent Trends

	2001	2002	2003	2004	2005	2006	2007	08q1
Wilsh (% ch)	-12	-22	29	11	5	14	4	-10
AAA (bp ch)	-113	-34	-72	1	-4	57	-3	-24
Fund. Ratio (%)	102	83	89	90	91	100	106	99
# of Plans:								
$<$100%	51	74	79	75	81	59	42	–
$<$80%	13	44	26	22	21	11	4	–
Contribs ($B)	11	34	57	43	45	36	27	–
PBGC:								
Claims ($B)	1.2	3.7	6.4	3.2	11.5	0.3	–	–
Position ($B)	8	-4	-11	-23	-23	-18	–	–

Firms Choose Risky Positions

- Firms *could* eliminate risk (Bodie, 1990)
  - Fully fund accrued obligations every period
  - Discount using a term structure of riskless rates
  - Invest 100% in duration-matched fixed-income assets
  - Fund would be immune to financial market swings
- So is it optimal to introduce some risk into pension promise?

Is Risk Optimal?

- Conventional Answer: Yes
  - Equity risk premium allows lower contributions
  - Obligations are long-term, so risky investments are appropriate
  - Lower contributions maximize shareholder value
- Our Answer: No
  - In return for bearing risk, workers require risk premium
  - Cost of wage premium outweighs reduced pension costs
  - Shareholder value is maximized with riskless pensions

What About Pension Insurance?

- With no insurance, riskless pensions are optimal
- Effect of insurance depends on whether it is:
  - complete (i.e., covers all benefits)
  - fairly priced (i.e., premium equals FMV of insurance provided)
- We find that if insurance is sufficiently mispriced, a risky promise can be optimal

The Intuition from Previous Studies

- Bankruptcy gives firms a “put option” on underfunding
- But competitive labor market imposes discipline on the firm
- Employees demand wage premium for bearing pension risk
  - Employees are risk-averse
  - Bankruptcy risk is nondiversifiable to employees

Two-Period Model: Today and Tomorrow

- Begin by ignoring pension insurance
- Firm's and worker's choices are made today
- Tomorrow uncertainty is resolved and stuff just happens
- But the choices are made today understanding their implications for when stuff happens tomorrow

Two-Period Model: Today

- The firm pays the worker a wage today and promises a pension tomorrow
- The worker chooses:
  - how much of wage to consume today vs. save for tomorrow
  - how much of any savings to invest in the risky asset (market portfolio of stocks)
- The firm chooses:
  - how much to contribute to the pension trust
  - how much of trust to invest in the risky asset (market portfolio of stocks)

Two-Period Model: Tomorrow

- Returns on company stock and market portfolio are correlated
- Firm fails if its stock-market value is less than its debts (incl. pension shortfall)
- If firm fails, worker's pension is the min of the promised benefit and the trust fund
- If firm survives, it must make up any pension shortfall
- In any case the firm (not the worker) can claim any pension surplus

Firm's Costs

- These contingent claims on the firm can be viewed as options
- Define the firm's total compensation costs as:
  - wage
  - $+$ pension contribution
  - $+$ price of put option on pension shortfall, conditional on surviving
  - $-$ price of call option on pension surplus

Firm's Problem

- Firm wants to minimize compensation costs, subject to paying the worker enough to retain him/her
- Firm could choose to remove all risk by:
  - contributing the full PV of the pension promise (discounted at risk-free rate)
  - investing *none* of the fund in risky assets
  - In this case the options would both have zero value
- But would this strategy minimize costs?

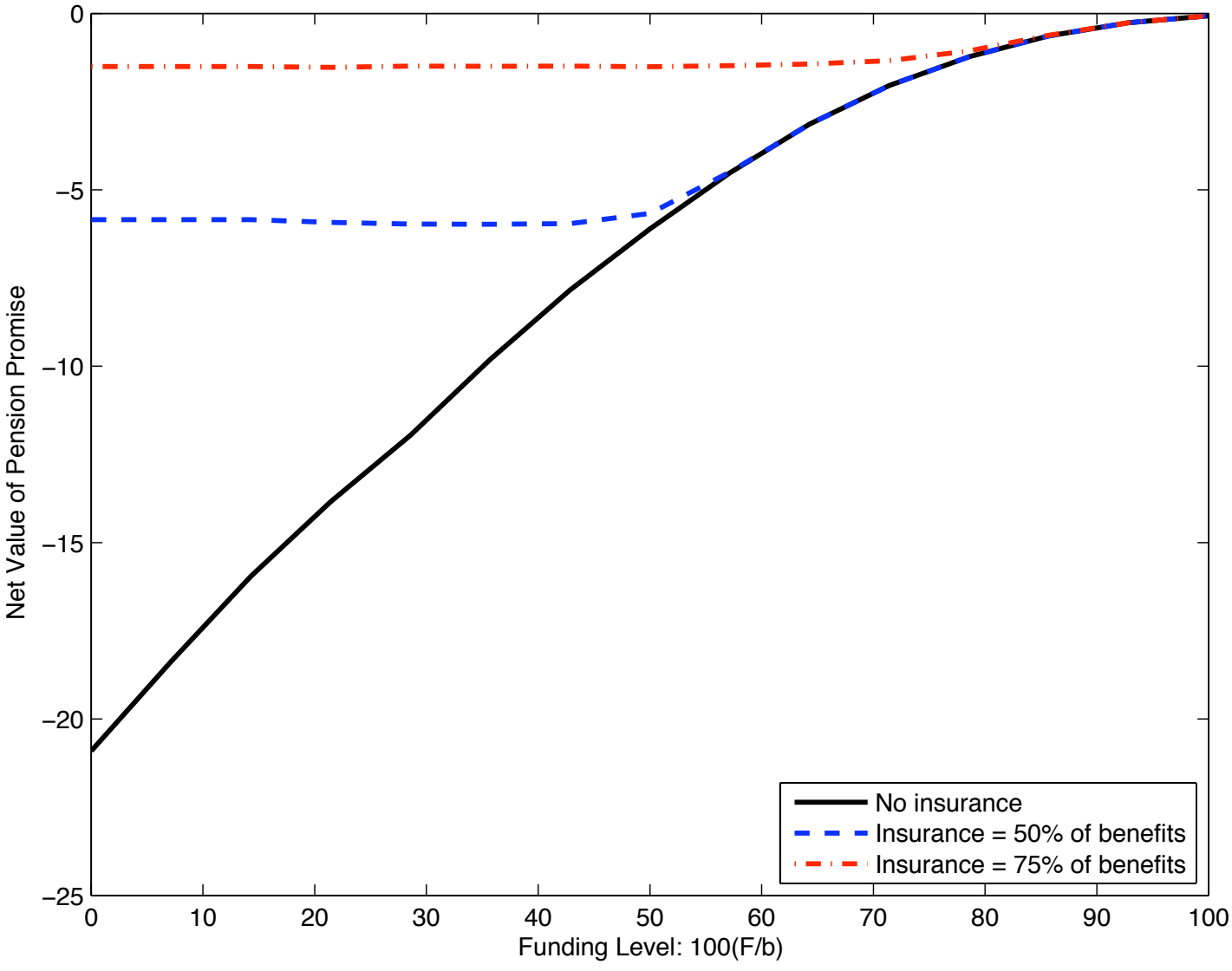
Worker's Problem

- Pension is risky from the worker's perspective:
  - worker gets promised benefit if firm survives
  - worker gets the lesser of the trust fund value and the promised benefit if the firm fails
- Tomorrow's income from savings is also risky:
  - depends on stochastic return on risky investments
- Worker wants to maximize expected utility of consumption, where consumption tomorrow is risky

Certainty Equivalent Approach

- Solve for the minimum required extra payment today that would equalize worker's utility from risky and safe pension
- Compare this with the cost advantage to the firm of offering a risky pension
- Define the "net value" to the firm of a risky pension strategy as the cost advantage less the extra required payment to the worker
- Result: max "net value" is zero...firm can never do better than a riskless pension promise

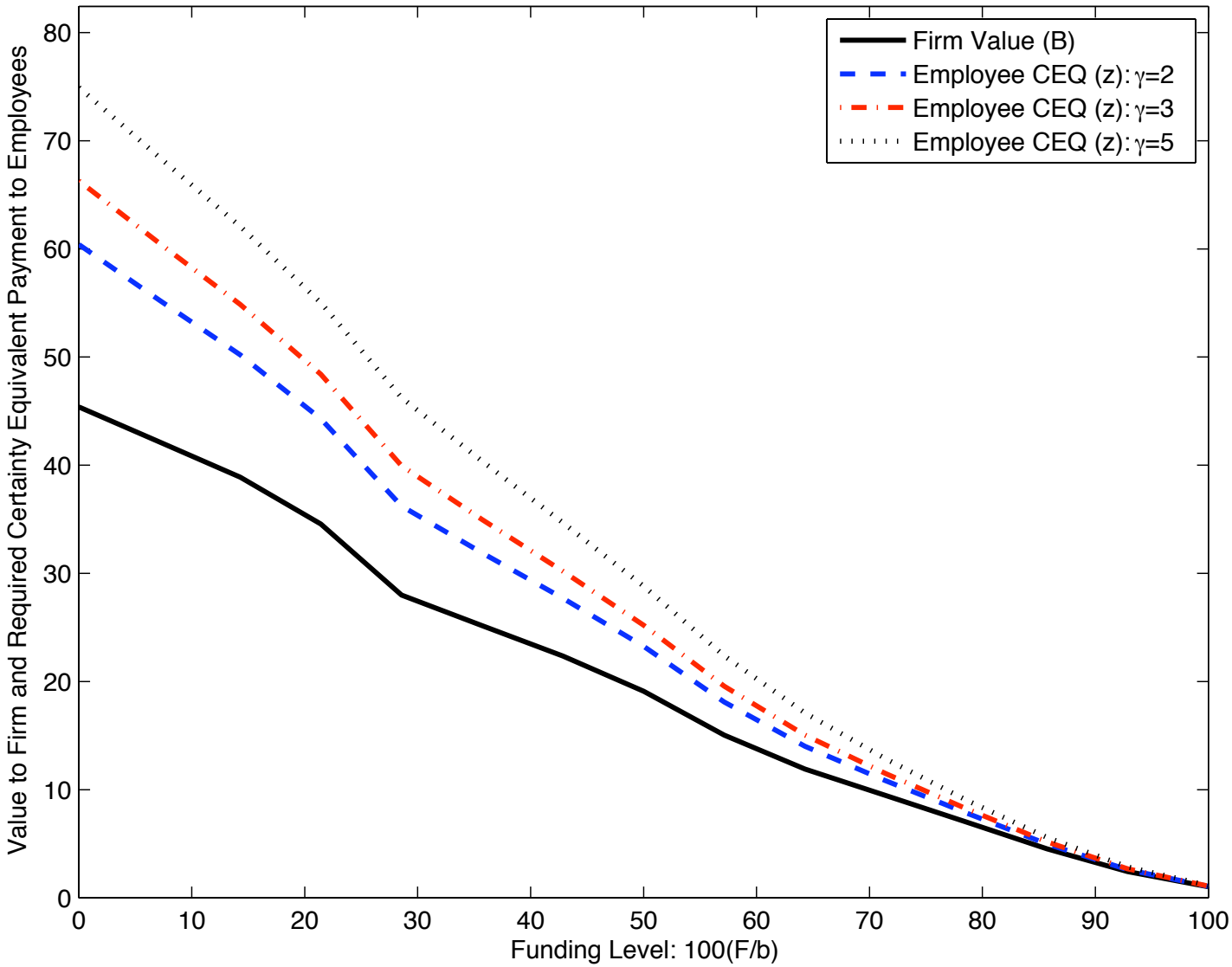
Net Values, by Insurance Coverage



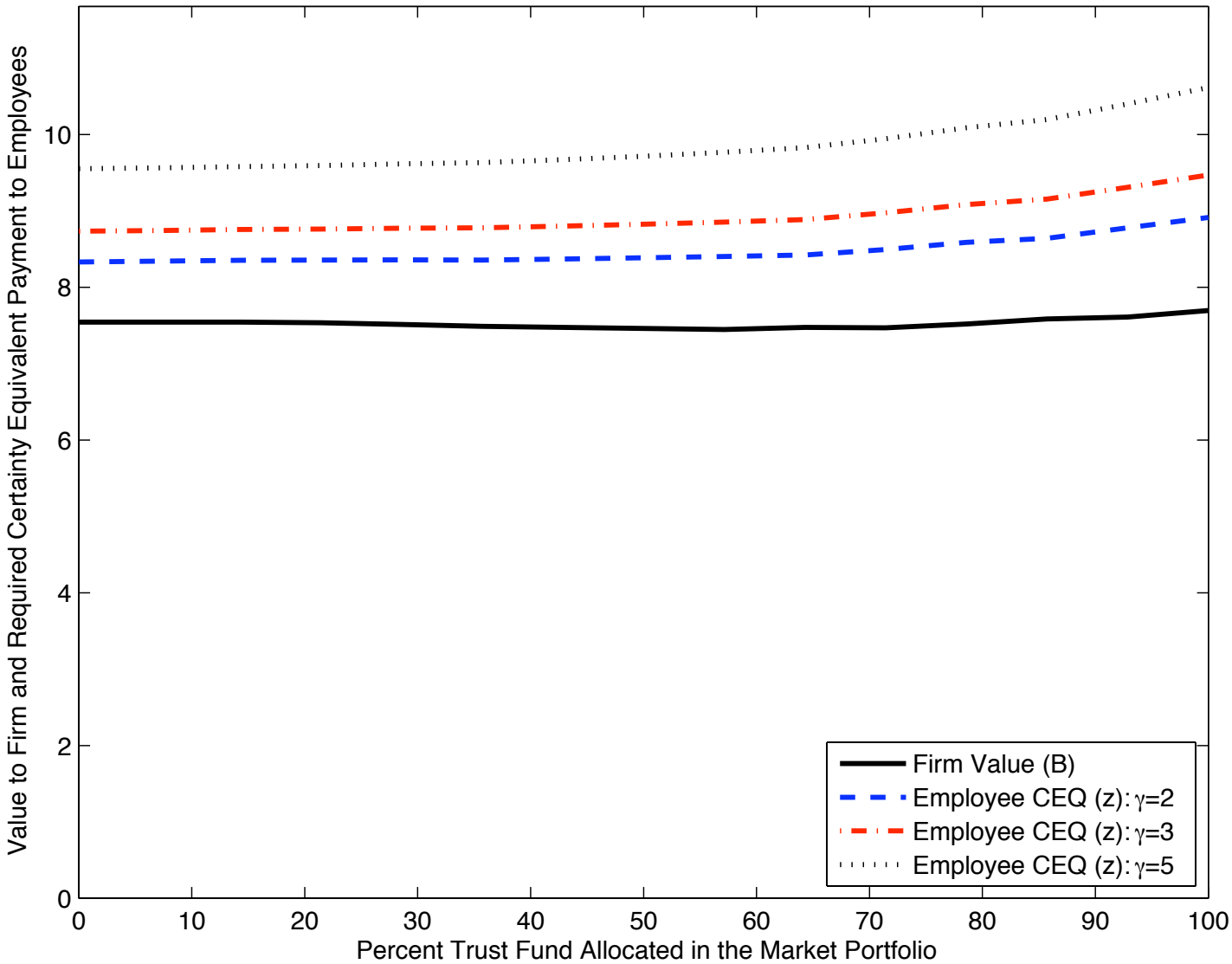
Intuition for Result

- The worker has to be compensated for a risky pension
- The cost of compensating the worker exceeds the savings to the firm
- This is true for all contributions below full fuding and all risky-investment allocations above zero
- It is also true for all correlations of the firm's stock returns with the market portfolio

Effect of Contribution Levels



Effect of Trust Fund Allocation



Effect of Correlation on "Net Value"

1st Period Funding %	$\gamma = 3$ $\lambda = 0.0$	.50	1.00
	$\rho = 0.0$		
50	-29.88	-30.09	-29.69
75	-4.38	-5.49	-8.63
90.5	-0.30	-0.81	-2.77
100	0.00	-0.16	-1.37
	$\rho = 0.5$		
50	-24.35	-23.56	-26.94
75	-3.80	-6.14	-7.21
90.5	-0.32	-1.54	-4.53
100	0.00	-0.30	-2.31
	$\rho = -0.5$		
50	-25.91	-27.73	-30.85
75	-3.80	-4.37	-5.11
90.5	-0.27	-0.25	-0.80
100	0.00	-0.01	-0.18

$\gamma =$ coefficient of relative risk aversion
$\lambda =$ pension's share in risky assets
$\rho =$ correlation between the market and the firm

Now Let's Add Pension Insurance

- Government insurance agency guarantees pension benefits up to some amount $g \leq b$
- Firm's costs now include an insurance premium
- Worker's problem now includes a minimum pension payment:
  - worker gets promised benefit if firm survives
  - worker gets no less than guaranteed amount, g, if the firm fails

Effect of Pension Insurance

- Effect depends on:
  - whether insurance is complete (i.e., $g = b$)
  - whether premium is fairly priced
- What is the fair premium?
  - Premium should equal the put value of the pension shortfall, conditional on bankruptcy
  - That is, how much would firm have to pay to dump the shortfall on some other private party?
  - Note this will be a function of the contribution and risky-asset allocation, *inter alia*
- We look at four cases: completeness X fairness

Case 1: Complete insurance; fair premium

- Worker is fully insured and faces no pension risk
- Thus the firm does not need to compensate worker for risk
- However firm pays higher premium for riskier pension promise
- Indeed, all funding and investment strategies cost the same
- Thus no unique solution in this case

Case 2: Complete insurance; mispriced premium

- Say premium is underpriced by some factor
- This reduces the cost of risk-taking to the firm
- Worker does not impose discipline due to full insurance
- Firm minimizes costs by:
  - contributing zero to the pension fund
  - if minimum contributions are required, firm should invest 100% in risky asset
- Thus, underpriced premium subsidizes firm's risk-taking

Case 3: Incomplete insurance; fair premium

- Incomplete insurance implies worker must be compensated for residual risk
- Partial insurance reduces the cost of the required risk compensation
- However, fair premium implies that firm costs do increase with pension risk
- Result: cost-minimizing strategy is to offer a risk-free pension in this case as well

Case 4: Incomplete insurance; mispriced premium

- Closest to reality
- With incomplete insurance, employee demands risk compensation from the firm
- But underpriced premium subsidizes risk-taking by firm
- Result: Below a threshold premium $p^* < p^{fair}$ the firm will offer a risky pension, above it will offer risk-free pension
- p^* depends on the net value of the risky pension

Other Real-World Factors

- Tax considerations
- Labor market frictions
- Accounting rules
- Internal versus external financing
- Informational barriers affecting employees, employers, shareholders, and taxpayers

Conclusions

- Main result: If insurance is nonexistent or fairly priced, firms optimally make pension promise risk-free
- If insurance is underpriced, firms might optimally offer risky pensions
- Policy implications: properly price insurance, tighten funding rules, restrict investments, improve accounting
- Will reforms further the decline of DB pensions?