

# **The Economics and Finance of Pension Scheme Design**

**David McCarthy**

# Introduction

- Occupational pensions are part of employment contracts
  - They compensate workers for effort...
  - ... and fulfil firm objectives
- Good pension scheme design takes account of both firm needs and employee preferences

# Scheme design

- Central issue is efficiency, or otherwise, of compensation
  - Taxation
  - Incentives
  - Portfolio issues
  - Corporate finance?

# ‘Efficient’ vs ‘inefficient’ compensation

- Tax efficient vs. tax inefficient
  - Government is a third party to all compensation contracts
  - Structure of the contract affects taxation liabilities and hence the net benefits to both parties
  - In the UK individuals and companies have the right to structure their legal interactions to minimise their tax liabilities
  - Pensions are tax-favoured

# ‘Efficient’ vs. ‘inefficient’ compensation

- Incentive efficient vs. incentive inefficient
  - Different compensation arrangements give workers (and firms!) different incentives
  - In general, most companies probably try to arrange compensation contracts to reflect the incentive effects of their compensation
    - promotion
    - dismissal
    - reward-based pay
  - Pensions have incentive effects

# 'Efficient' vs. 'inefficient' compensation

- Portfolio efficient vs. portfolio inefficient

- 'Cash is king'

- Movie tickets analogy

- 2 movie tickets a month are worth their cash value
    - 300 movie tickets a month are worth much less than their cash value

- Pensions have interesting portfolio effects

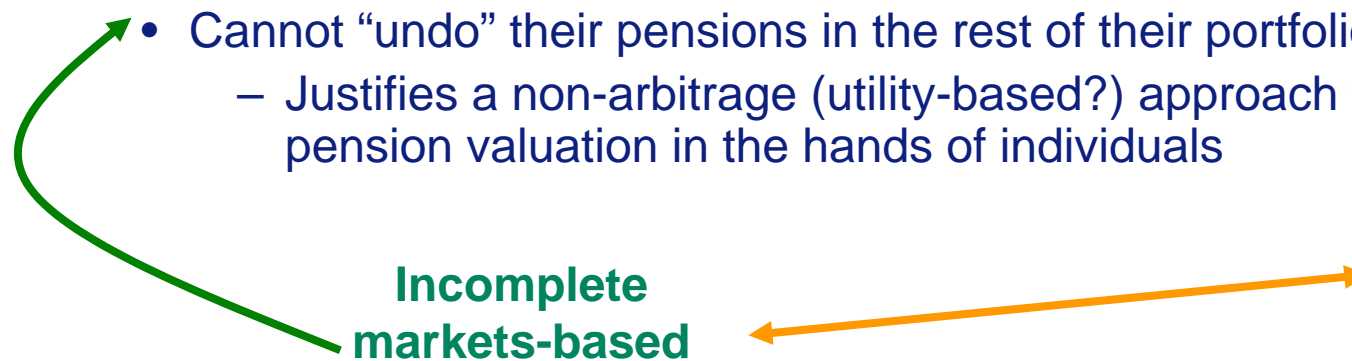
- Workers cannot sell their pension or borrow against it
    - Cannot "undo" their pensions in the rest of their portfolio
      - Justifies a non-arbitrage (utility-based?) approach to pension valuation in the hands of individuals

**Transaction costs-based argument**



**Selling individual movie tickets is a costly business**

**Incomplete markets-based argument**



# Three economic perspectives are relevant to determining occupational pension type

- Labour market
  - Pensions form part of employment contracts
  - Exert some influence on employee behaviour
- Portfolio theory
  - Pensions are an asset in the hands of the employee, with some special characteristics
- Corporate finance
  - DB Pensions are liabilities of the firm

# How might a firm choose a compensation contract?

- Firm maximises profit while keeping workers satisfied
  - Corporate finance issues important here (risks?)
- Profit = cost of compensation contract less output of the worker
  - Incentive effects important
- Worker satisfaction
  - Portfolio effects important
  - Workers cannot trade away pensions



# 1: Pensions and corporate finance

- DB liabilities are largely bond-like
  - Like bonds on firm balance sheets
  - Interest rate sensitivity like long bonds
    - Some unusual features
- Incomplete markets important
  - Mortality
  - LPI?
  - Salary linkage

**Diversifiable or not?**

## 2: Pensions in the labour market

- Sorting theory
- Incentives theory
- Bonding theory (wage-tilt)
- Retirement behaviour theory

## Sorting.....

- Workers have private information about their future performance
- This affects how workers value different compensation contracts
  - Pensions
  - Salary increases
  - Promotions
- Firms can design contracts to attract desirable workers

# Sorting.....

- Worker discount rates
  - Affects how workers value the future against the present
    - “delayed gratification”
  - Pensions are more attractive to low discounters
    - Low discounters may be better workers
- Likely quit rates
  - Some types of pension may be more attractive to workers who plan to stay rather than leave quickly

# Sorting.....

- Pension examples
  - Presence of a pension
  - Vesting requirements
  - Matching contributions

## Incentives.....

- Compensation changes worker incentives and hence worker effort
  - Performance-based pay
  - Seniority pay
  - Promotions
- Pensions also change worker incentives

## Bonding.....

- Pensions may bond workers to jobs
  - Reduces direct and indirect turnover costs
    - Recruitment costs
    - Direct and on-the-job training costs
    - Sociological costs
- Empirical evidence from the US suggests workers with pensions are less likely to leave jobs
  - Pension type doesn't seem to matter too much

## Bonding.....

- Can also induce longer tenure by ‘tilting’ wages
  - Form of seniority pay
  - Implies that workers at the end will be earning more than their marginal product
  - May therefore need to get them to leave
    - Mandatory retirement age
    - Pensions



# Retirement behaviour.....

- Pensions influence retirement behaviour
  - Strong retirement incentives in DB pensions
    - *Raison d'être* of DB corporate pensions?
    - Could use pensions to control age profile of workforce
  - DC pensions
    - Loss of employer control over retirement
    - Impact of age discrimination law?

## Pensions in the labour market

- Can be used as one of many tools to manage the workforce in a company

### 3: Pensions and portfolio theory

- Life cycle models (with pensions)
- DB pensions unsuitable for younger employees
  - Wage link undesirable
  - Human capital exposure large
  - Effect of lower adverse selection in annuity market less important
  - Mandated bond investment unattractive
- Better fit for older employees

# Use compensating variation of pensions contracts

- Cannot use no-arbitrage pricing!
  - Pensions cannot be traded, borrowed against
  - Need utility-based measure
- How much extra lifetime income is enough to compensate an individual for the loss of a given pensions contract?
- How does CV differ by pension type?
- How does CV compare to pension cost?

## **We use a calibrated model of employee preferences.....**

- Life-cycle model (65 periods)
- Wage uncertainty
- Exogenous retirement; no job switching
- Agent chooses
  - Consumption and saving
  - Asset mix each year
  - Annuitisation at retirement
- No Taxes

.....with these parameters.....

Assumption			
Risk aversion	5		
Time preference	4%		
Risk-free Interest rate	2%		
Equity risk premium	4%		
Equity uncertainty	$\sigma_{\eta} = 0.157$		
Permanent Income Profile	Polynomial profile		
Income Uncertainty	(College) $\theta = 1$ $\sigma_f = 0.130$ $\sigma_r = 0.121^{\circ}$	(High School) $\theta = 1$ $\sigma_f = 0.136$ $\sigma_r = 0.103^{\circ}$	(No High School) $\theta = 1$ $\sigma_f = 0.162$ $\sigma_r = 0.102^{\circ}$
Mortality	US Females <sup>d</sup>		
Equity / permanent wage error correlation	$\rho_{\eta\xi} = 0.15$	$\rho_{\eta\xi} = 0.10$	$\rho_{\eta\xi} = 0.10$
Liquidity Constraints	Directly Imposed		
Private Annuity Market	$\lambda = 10\%^{\circ}$		

## ..... to estimate CV of these three different pension contracts

- Final salary DB contract with a given replacement rate
  - Employer can diversify all wage fluctuations away
  - Assets and liabilities perfectly matched (i.e. bonds)
  - No employer default
  - Contributions a constant proportion of lifetime wages
- DC pension with full mandatory annuitisation
  - Contributions constant 10% of income
  - Mandatory investment mix (30%, 70%, 100% in equities)
  - No access to funds before retirement
  - Entire balance annuitised at retirement

# Two aspects of pension compensation

- Wage link (DB and DC)
- Pension illiquidity



# Compensating variation of DC Plan with full mandatory annuitisation

Table shows compensating variation of pension (no high school education case)

DC Investment mix	Age (retirement at 65)		
	30	40	50
30% Equity 70% Bonds	8.5%	9.2%	9.6%
70% Equity 30% Bonds	8.2%	9.0%	9.6%
100% Equity	7.8%	8.8%	9.5%

**CV around 1% greater than no mandatory annuitisation case**

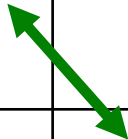
**Difference increases with age**

**Tax effects not in model**

# Compensating variation of DB Plan

Table shows compensating variation and costs of pension (no high school education case)

	Age (retirement at 65)		
DB replacement rate	30	40	50
50%	9.0% (12.5%)	17% (21%)	38% (41%)
25%	4.8% (6.3%)	8.8% (10%)	20% (21%)
10%	2.0% (2.5%)	3.6% (4.0%)	8.1% (8.2%)



Pension costs shown in brackets (tax effects not modelled)

DB pensions more efficient compensation as workers age

Tax effects not in model

# Welfare loss of different pension plans ....

Table shows pension costs less compensating variation as a percentage of pension cost (no high school education case)

	Age (retirement at 65)		
	30	40	50
Pension Cost = 10% for all plans			
DB plan	26% (40%)	12% (25%)	2% (12%)
DC plan (50%/50%), mand. ann.	18%	10%	4%
DC plan (50%/50%), no mand. ann.	24%	18%	13%

DB plan replacement rate shown in brackets

DB pensions more efficient compensation as workers age

Tax effects not modelled

## Putting it all together

- Efficiency of entire compensation contract made up of
  - Corporate finance efficiency
  - Labour market efficiency
  - Tax efficiency
  - Portfolio efficiency
- Compensation contracts trade these off against each other

## Further work

- Additions to portfolio theory model
  - Job changes
  - Sorting theory
- Empirical tests of the theory
  - Different pensions contracts observed where various trade-offs are different