How Do Pensions Affect Household Wealth Accumulation?

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Preliminary and Incomplete

Introduction

- Public and private pensions are the main source of retirement income for most households
- An important question in the design of pension programs and evaluation of their welfare effects is how pensions affect household saving behavior
- Pensions are “backloaded compensation,” or forced saving
- The life cycle framework suggests that workers will respond to forced saving in a pension plan by saving less in other forms
  - Thus pensions may “crowd out” household saving.

- Intuition about the effects of pensions on saving is based on a simple version of the life cycle framework
  - Fixed retirement age
  - Little or no uncertainty
  - Perfect capital market
  - Save while employed, dis-save during retirement

- This simple model =>100% crowdout over the life cycle:
  - An additional dollar of pension wealth (PDV of future benefits) causes PDV of consumption to increase by a dollar

- Intuition about the extent of crowd out by pensions may not hold when these assumptions are relaxed:
  - Pensions could induce earlier retirement, which could result in *increased* saving (Feldstein, 1974; Crawford and Lillien, 1981)
  - “Pension wealth” may not be well defined for illiquid pensions, and not comparable across pensions with different liquidity (Rust, 1998)
  - A precautionary saving motive, asset tests in public assistance programs, bequest motive, etc. can affect extent of crowd out (Gale, 1998; Hubbard, Skinner, Zeldes, 1995)

- Empirical estimates of crowd out use specifications that are based on the simple stylized version of the life cycle model: (regardless of source of identification)

  – Assume that age of retirement is fixed and known

  – Assume that the value to a household of an illiquid pension can be measured by its expected present discounted value => no liquidity constraint

  – Assume perfect foresight about future earnings, medical expenditure, and everything else except date of death

- Virtues of the very simple life cycle approach:
  - Analytic solution for saving and wealth
  - Strong testable hypothesis: complete crowd out
  - Implied empirical specification is linear

- Drawbacks of the approach:
  - Imposes strong restrictions
  - The model is misspecified under the alternative hypothesis of less than complete crowd out
  - Not clear whether regression estimates measure the extent of crowd out in this case

Contribution of this paper

- Specify a richer and more realistic version of a life cycle model of saving and retirement

- Estimate some parameters, set others arbitrarily, and “calibrate” others. Solve the model numerically.

- Simulate the model to investigate the effects of pensions on wealth accumulation without imposing the strong assumptions used in empirical work

Use the results to address three issues:

- In a model with choice of retirement, a liquidity constraint, uncertainty, and the institutional features of pensions in the U.S., how much saving is crowded out by pensions? The "truth"

- How valuable are pensions of different types to households in the model? Calculate welfare effects of pensions.
  - Can then derive substitution effects (not yet done)

- Can linear regression models of household wealth estimated on simulated data reproduce the "truth?"
  - Measurement and specification based on assumptions of the simple model, but data generated from a model in which these assumptions are false

Summary of preliminary results

- Employer-based Defined Benefit (DB) and Defined Contribution (DC) pensions have modest crowd out effects on household wealth in the simulations: -11 to -15%.

- Social Security (public pension) has an even smaller crowd out effect: -4%

- DB and DC pensions have large welfare effects, but less than EPDV of benefits: Compensating Variation (CV) = 65% of EPDV (DB), 94% (DC)

- In the absence of private pensions, Social Security has a very large welfare effect: CV = 370% of EPDV of SS benefits

- Regression models have mixed success in measuring crowd out; usually overestimate the extent of crowd out

Outline

- Description of the model
- Calibration, solution, and simulation
- Results
- Summary and ongoing work
- See the paper for description of basic life cycle model and summary of previous empirical results

A rich life cycle model of pensions, saving and retirement

- Similar to Van der Klaauw and Wolpin (2008); adds pensions
- Discrete time, annual periods, ages 51-100
- Unmarried individual
- Choices: employment, consumption, SS claiming, DC pension claiming
- Borrowing constraint, consumption floor (public assistance)
- Reasonably accurate tax treatment of pensions
- Institutional restrictions on pension
- Several sources of uncertainty
- No bequest motive

Choice variables each period

- Employment: (0) non-employment, (1) new job [offer always available], (2) current job; no work after 75
- Consumption, net of out-of-pocket medical expenditure
- Whether to claim SS benefit (irreversible decision)
- Whether to claim DC account balance. Can delay claiming after leaving pension job (irreversible decision)

Constraints

- Stochastic AR(1) log wage offer process
- Stochastic AR(1) log out-of-pocket medical expenditure process
- Health status: good, bad, dead. Markov transition model
- Layoff risk
- Stochastic mean-reverting interest rate process
- Borrowing constraint: assets >= 0 $\bar{c}$ in each period
- Consumption floor: consumption >=
- Taxes, SS rules, pension rules

Key features of pensions in the model

- DB pension:
  - benefit = f(age at exit from firm, tenure at exit, earning history at exit); f() is plan-specific
  - No claiming decision: determined by employment choice
  - nominal lifetime annuity
- DC pension (e.g. 401(k)):
  - employer and worker contributions to worker's account plus interest accumulate tax-free until claimed
  - Can delay claiming after leaving pension job
  - Received as a lump sum; no annuity or installment option
  - 10% tax penalty if claim before age 59.5; must claim

Social Security (public pension)

- Benefit = F(age at claiming, average indexed lifetime earnings)
- Provided as a real annuity
- Earliest claiming age = 62; approximately actuarially fair increase in benefit for later claiming, until age 70; must claim by 70
- Claiming decision is independent of employment decision
- Earnings test if work after claiming; lose benefit now, gain later
- Financed by payroll tax on employee and employer
- SS Disability Insurance (SSDI) available before age 62. Approximate application and acceptance process; no decision

Utility function

- $u_t = [c^{1-\alpha}/(1-\alpha)]exp\{\varepsilon_{ct}\} \quad + \quad (\gamma_1 + \gamma_2 a_t)W_t \quad + \quad \gamma_3(1-W_{t-1})W_t$
  $+ \gamma_4 W_{t-1} NJ_t \quad + \quad H_t \varepsilon_{\ell t}$

- CRRA in consumption; separable in consumption & leisure
- W = 1 if employed, 0 otherwise
- H=0 if W=0, 1 if PT, *2* if FT
- NJ = 1 if a new job is chosen, and zero otherwise;
- ε_{ct} is an *iid* shock to the utility of consumption ~ Normal
- $\varepsilon_{\ell t}$ is an *iid* shock to the utility of leisure ~ Normal
- $\gamma_1 + \gamma_2 a_t$ = utility from employment at age *a*
- γ_3 = additional utility from employment if not employed in the previous period,
- γ_4 = additional utility of employment if change jobs

Numerical Solution

- Formulate as a dynamic program; solve by backward recursion on the value function, using monte carlo integration over the continuous random variables (50 draws)

- Solve for a randomly selected set of points in the state space each period; estimate polynomial spline regression of value function (VF) on state variables (sample size = 2000)

- Approximate $E(VF_{t+1} | S_t, D_t)$ for any point in period-t state space and period-t decisions by interpolation from t+1 regression function (Keane & Wolpin; Van der Klaauw & Wolpin) [S = state, D = decisions]

Pensions

- Use a set of DB pension plans from the Health and Retirement Study (HRS), with known benefit formulas and eligibility rules
- Use a plan-specific regression approximation to the plan rules
- Use HRS respondent-reported employer and employee contribution rates for DC plans
- Pension coverage, pension type, and specific plan are state variables

Estimation and Calibration

- Use data from the HRS to estimate:
  - Wage offer function
  - Out of pocket medical expenditure function
  - layoff process
  - health transition functions and mortality risk
  - SSDI acceptance probability, conditional on application

- Select arbitrary values of risk aversion, consumption floor, mean interest rate, rate of time preference, variances of interest rate shock, wage shock, and medical expenditure shock

- "Calibrate" the disutility of work parameters to give a reasonable employment pattern

Key parameter values

- Chosen arbitrarily:
  - CRRA = 2.5
  - Cbar = 3 (thousands of 1992 $)
  - Mean real interest rate = 0.02
  - Rate of time preference = 0.03
- Estimated:
  - Serial correlation in earnings = .85
  - Serial correlation in medical expenditure = .55
- Calibrated:
  - Variance of utility of leisure shock = .00012
  - Variance of utility of consumption shock = .01
  - Disutility of work (gammas) = (1) -.003 (2) -.0004 (3) -.35 (4) -.08
  - Variance of log wage shock = .030
  - Variance of log medical expenditure shock = 1.0

Simulation

- "Typical" single man, born 1941, age 51 in first period; high school education, white, in good health & employed at 51

- Endowed with mean or median sample characteristics of single men ages 51-53 in the 1992 HRS with earnings > 10K

- Simulate behavior for four scenarios: (1) no pension (NP), (2) a DB pension, (3) a DC pension; SS available in all three cases. (4) No pension and no SS (NPNSS)

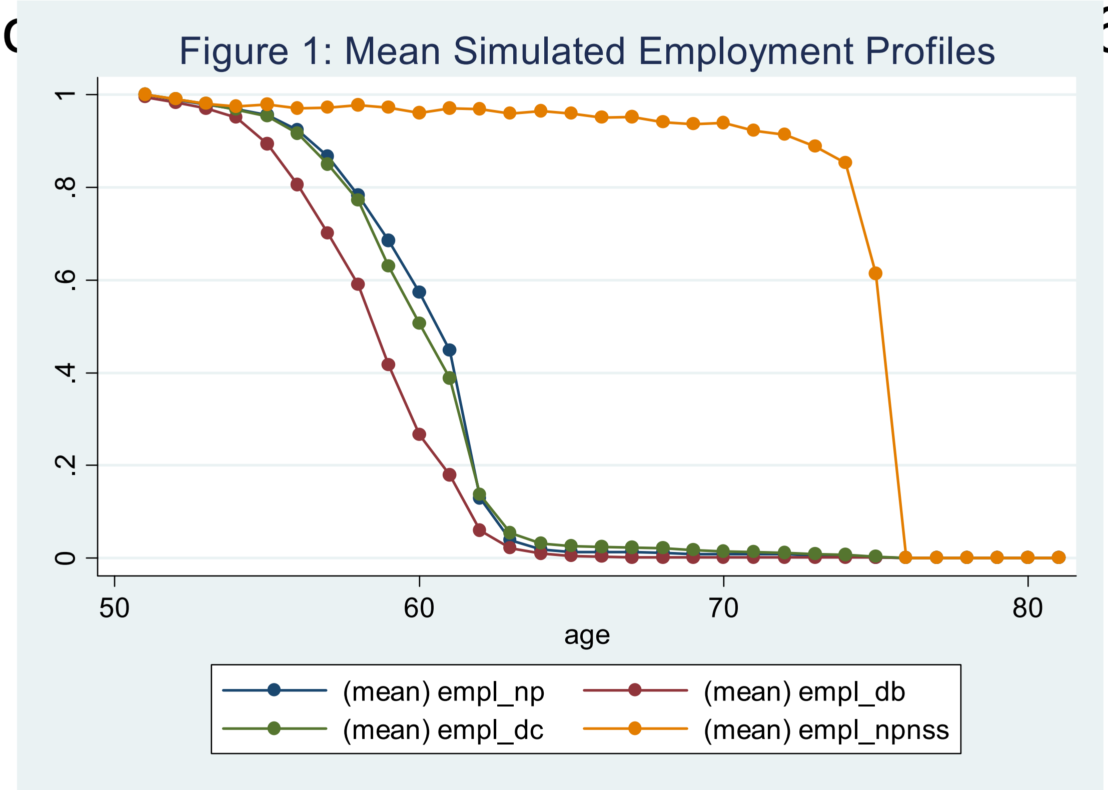
- Simulate for each plan in HRS data base and average over plans
  - 834 DB plans 1,410 DC plans

Initial conditions

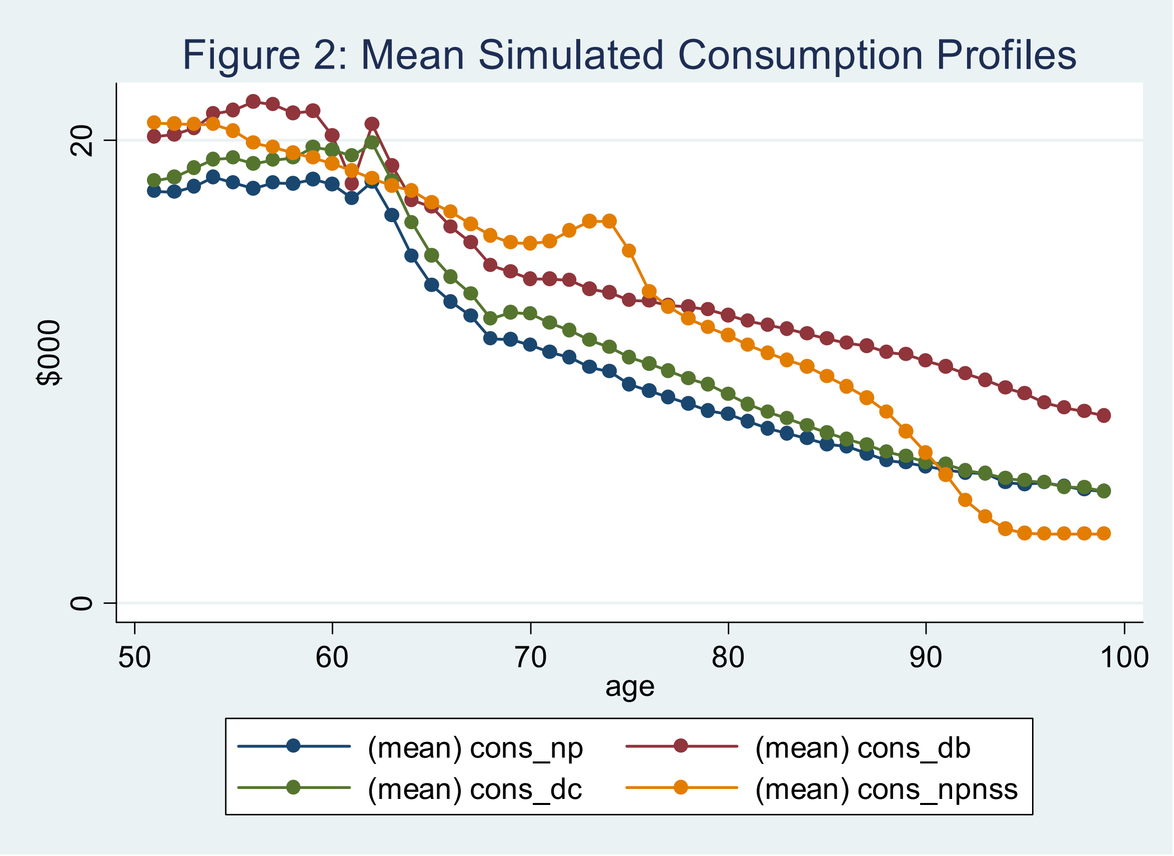
- Age: 51
- Joined pension plan at age: 30
- Experience: 22
- Tenure: 20
- previous period earnings: 35
- AIME*12 (SS average earnings): 30
- initial assets: 41
- initial DC balance: 17
- (all monetary amounts are in $000 1992 dollars; multiply by 1.46 to convert to 2008 dollars)

Overview of simulation results

- Employment declines rapidly in all three scenarios with SS coverage; remains very high in the no-SS (NPNSS) case
  - Emplo 62 effect (SS)

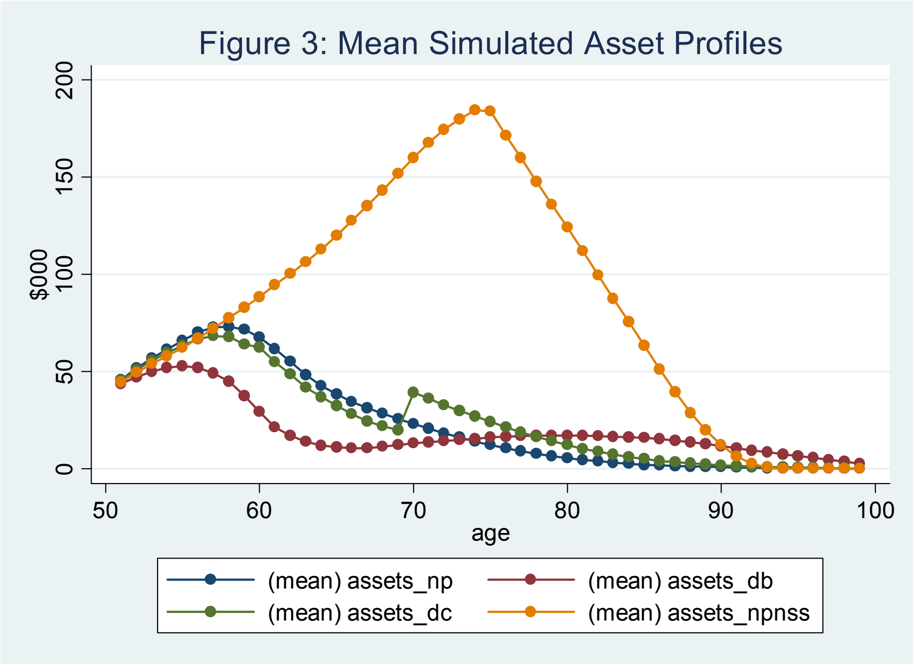


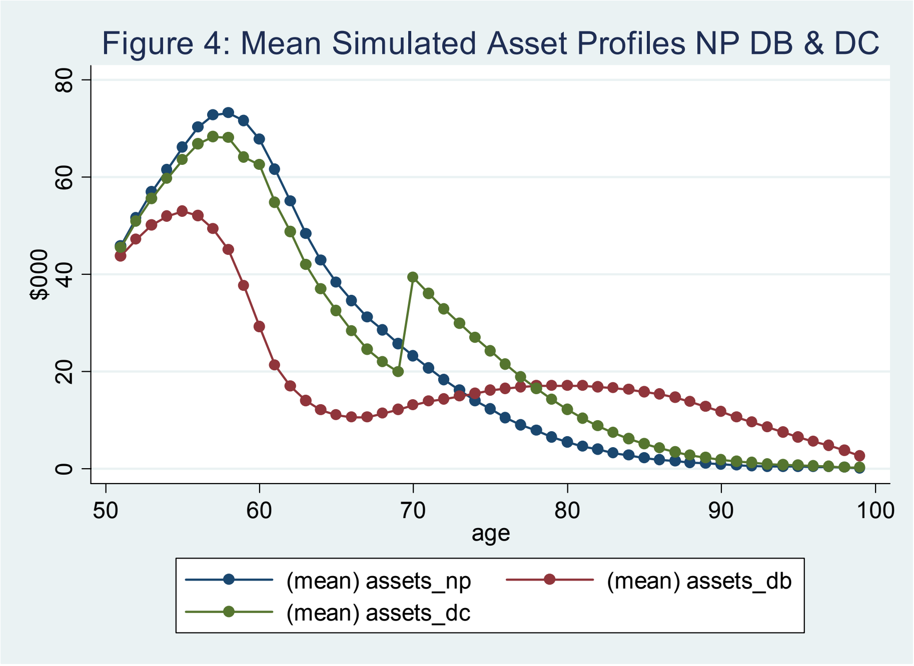
- Consumption declines with age
- Remains relatively high in DB and NPNSS cases



Crowd out

- Assets rise until around the age of retirement, then decline, with a couple of exceptions
- DB crowd out is moderate; DC small; SS ~ 0 before 60





Crowd out

- Compare assets in DB and NP cases to measure crowd out by DB pensions. DB_crowd out = DB assets minus NP assets
- Scale by the EPDV of future DB benefits (DB “pension wealth”)
- DB crowd out = -40 at age 61; DB pension wealth=118 at 61

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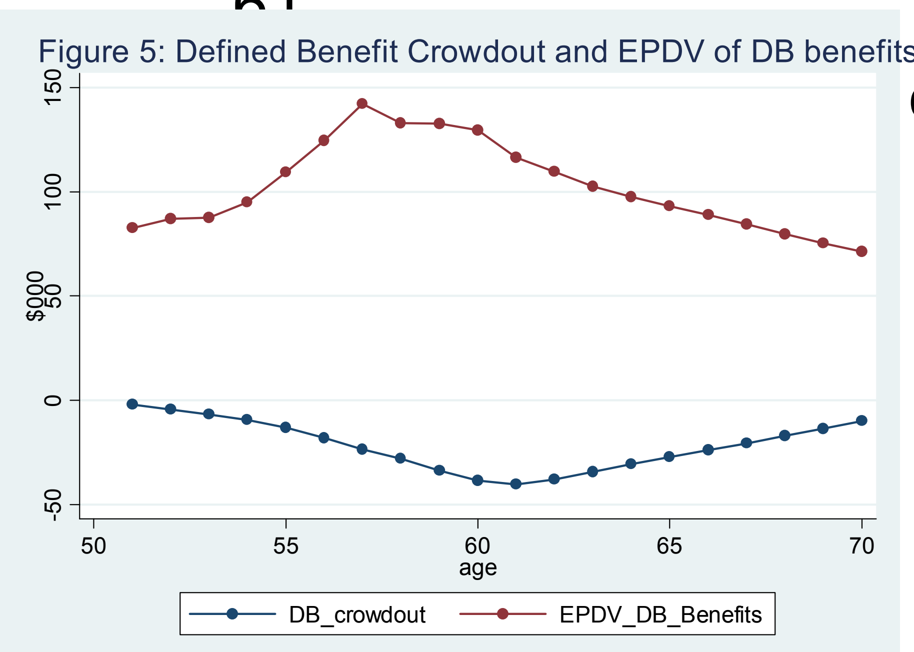


Figure 5: Defined Benefit Crowdout and EPDV of DB benefits

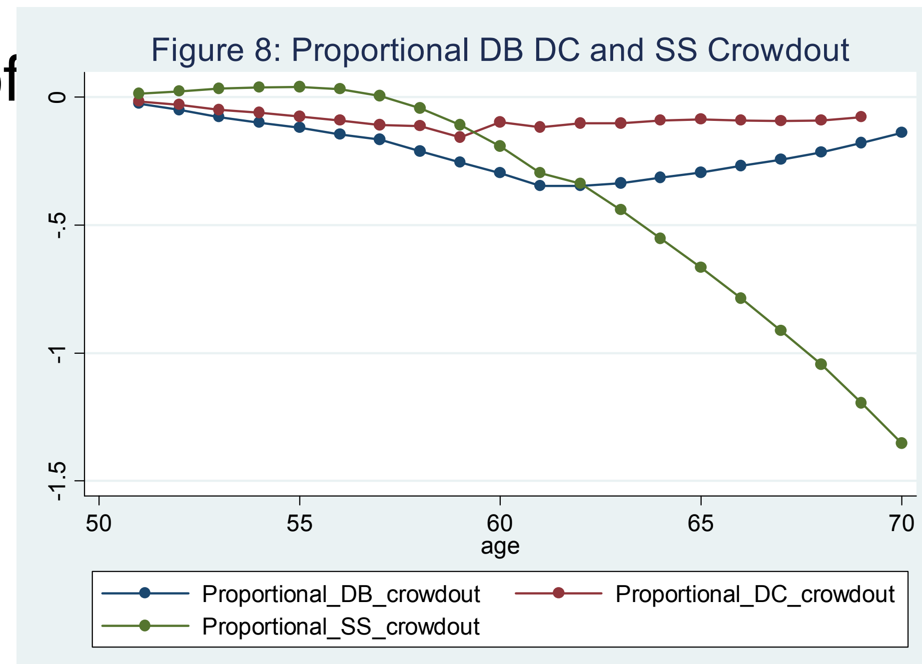
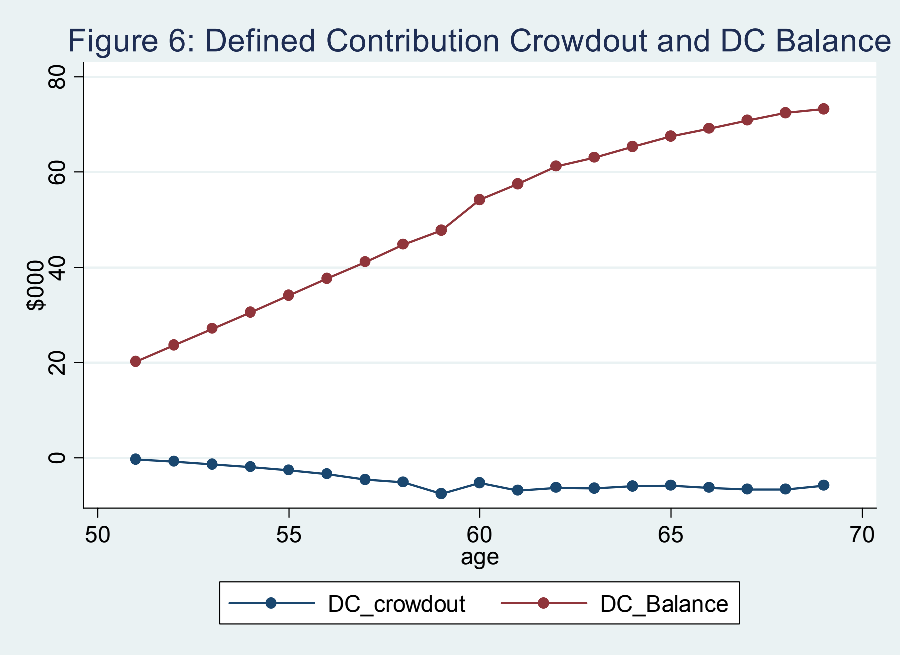
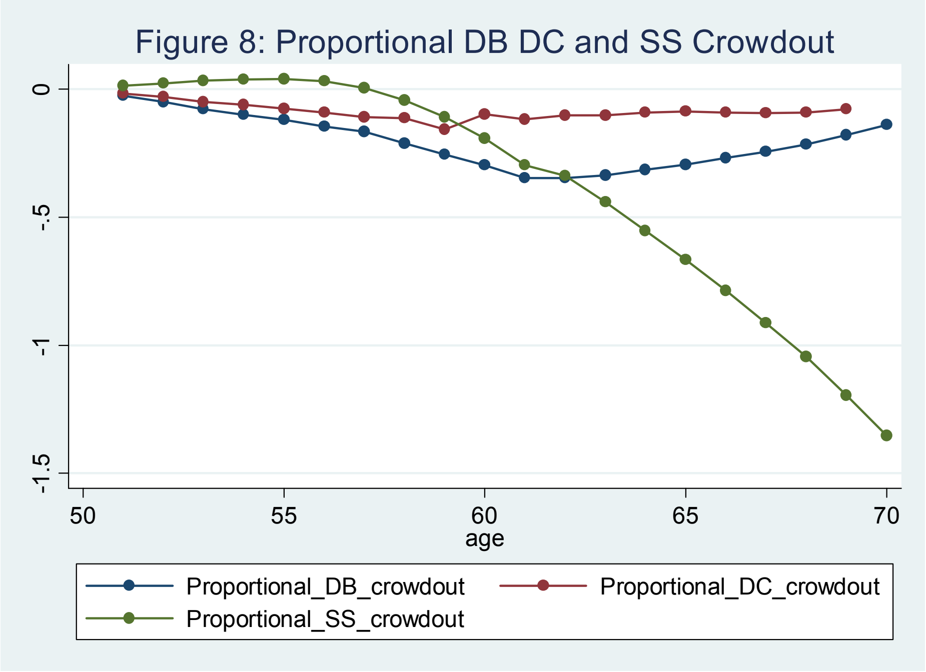


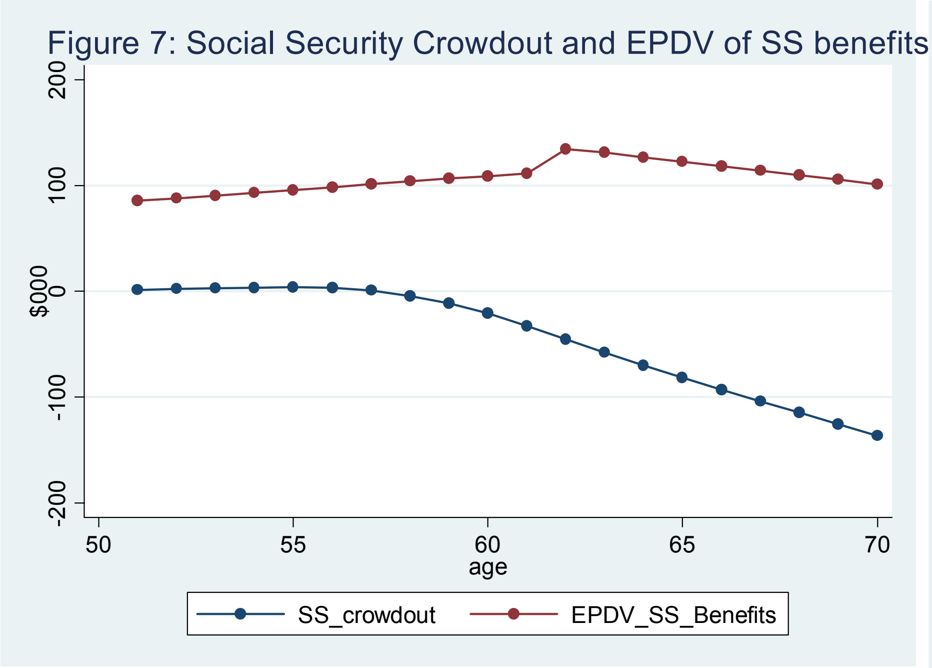
Figure 8: Proportional DB DC and SS Crowdout

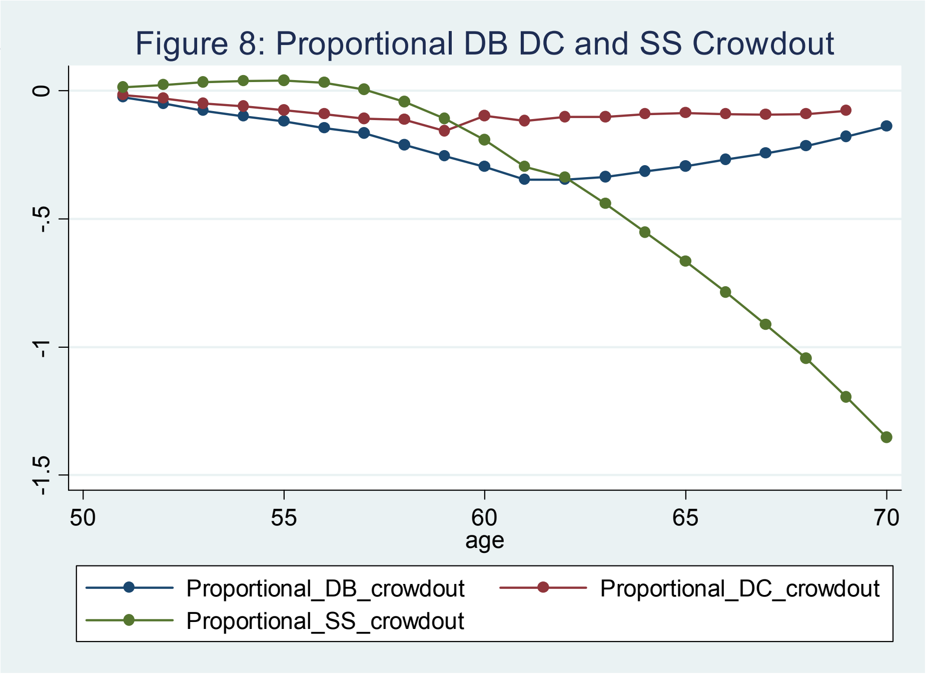
- DC_crowd out = DC assets minus NP assets => crowd out of up to -20, -0.16 or less as a proportion of DC balance





- SS_crowd out = NP assets minus NPNSS assets
- SS crowd out is very small early
- Rises to -0.40 at age 62





At which age should crowd out be measured?

- Initial assets are equal, by construction, so should let behavior play out for several years
- But should measure crowd out before pension claiming
  - Comparable to the empirical literature
  - Crowd out has different meaning after claiming
- Use last age at which at least 75% of simulated cases have not yet claimed. Arbitrary, but results are not very sensitive
- Yields crowd out of: -0.15 DB, -0.11 DC, -0.04 SS. **SMALL**

Why is crowd out small?

- Low initial assets?
  - Higher value results in somewhat larger crowd out
- Liquidity constraint? Relax it:
  - Not much effect.
  - Maybe due to consumption floor and uncertainty
- Relax LC and eliminate all uncertainty:
  - Surprisingly, little effect
- Eliminate or reduce consumption floor
  - Solution goes wild
- Eliminate employment choice:
  - In progress; no reliable results yet

Welfare effects: Compensating Variation

- Adjust initial assets to equate EPDV of optimized lifetime utility in first period with pension and without pension
  - DB: CV = 54, 65% of initial pension wealth. DC: CV = 16, 94% of DC bal.
- Equate EPDV of optimized lifetime utility for NP and NPNSS
  - CV = 319, 370% of initial SS wealth

	Initial assets	CV	Initial pension/ SS	CV/(Pen/SS wealth)
NP	41		0	
DB	-13	54	83	0.65
DC	25	16	17	0.94
NPNSS	360		0	
NP	41	319	86	3.70

Now, let's run some wealth regressions

- Use linear specifications like those in the literature

- Compute pension wealth two ways:
  - Correctly, given the assumptions of the model (except liquidity constr.)
  - Incorrectly, assuming fixed retirement and claiming age, no uncertainty, no liquidity constraint, etc. Use actual claiming age

- Sample = periods in which pension has not yet been claimed
  - Aggregate data by age and pension/SS scenario
- Compute age adjustment factor using a continuous time approximation from Gale (1998)
- Three control variables implied by the theory:
  - Lagged wealth, EPDV of remaining lifetime earnings, current

Wealth Regression Results: is crowd out=-1?

- Incorrect pension wealth measure comes closer to the "truth" for DB
- DC balance does not require any assumptions; both regression estimates are much higher than crowd out calculated directly
- Correct SS wealth measure performs much better in the regressions for SS

	Correct pension/SS wealth measure	Incorrect pension/SS wealth measure	"Truth"
EPDV of DB benefits	0.05	-0.21	-0.15
DC Balance	-0.76	-0.93	-0.11
EPDV of SS benefits	-0.00	-0.62	-0.04
R-squared (n)	0.93 (88)	0.93 (88)	

Summary

- Crowd out of household wealth by pensions and Social Security is small in simulations of a life cycle model with employment and claiming choices, liquidity constraint, and uncertainty

- Conditional on SS availability, pensions are valued less by households than the EPDV of their benefits. Without pensions, Social Security is valued at more than three times its EPDV

- Regression estimates have mixed success in reproducing crowd out measures

Ongoing work

- Explore why crowd out is small in this model:
  - Impose fixed retirement age, and no hours or job choice
  - Impose perfect foresight
  - Relax liquidity constraint: allow negative net worth
  - Eliminate or reduce consumption floor

- Sensitivity to alternative values of key parameters

- Simulations for single women and married couples

- Structurally estimate the model, using a method of simulated moments, in order to reduce arbitrariness of parameter values