

# Interpreting Social Security as a DC System

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# Imagine the Following Headline

## Congressional Leaders Propose New Personal Account Plan

Features include:

- Protection against low income
- Protection against inflation
- Protection against outliving your resources
- Risk sharing of aggregate shocks
- Private ownership of account assets
- Market valuation of account balances
- Government matching of contributions
- Self-balancing aggregate finances

# We're almost there now!

- Many of these features are already built into the current system ...
- But they need to be translated from the language of DB into the language of DC ...
- And the rest could then be added

# Democrats versus Republicans?

- Democrats committed to keeping DB (redistribution and risk sharing)
- Republicans committed to shifting to DC (private ownership and market prices)
- One could have a system which meets both of their needs:
  - an individual account (DC) system with the same features and payouts as the current (DB) system
- Might provide common ground for Democrats and Republicans

# Outline (including work in progress)

- Create an individual account (DC) system with the same features and payouts as the current (DB) system
  - Describe benefits using new securities that share aggregate risks: PAAWS
  - Achieve redistribution by making accrual of PAAWs a function of contributions and accumulated balances
- Estimate price of a PAAW (under risk neutrality and risk aversion) to
  - Decompose increment to accrued balances into contribution + government match / tax
  - Enable individual to value accumulated balances
  - Help measure assets and liabilities of Social Security system
- Consider alternative self-balancing rules
- Create new tradable securities to implement market-based pricing and self-balancing

# Related Literature

- Implicit marginal tax rate / matching in current system
  - Feldstein and Samwick
  - Cushing
  - Feldstein and Liebman
- Self-balancing / Notional DC systems
  - Valdes-Prieto
  - Borsch-Supan
  - Bohn
- New financial securities
  - Goetzmann (wage bonds)
  - Shiller (GDP bonds)
  - Blake (longevity bonds)

# Mechanics of Current OASDI System

## Contributions / Taxes

Contributions = tax rate x covered earnings

Covered earnings = min (earnings, cap)  
(cap currently \$90,000)

# Mechanics of Current OASDI System

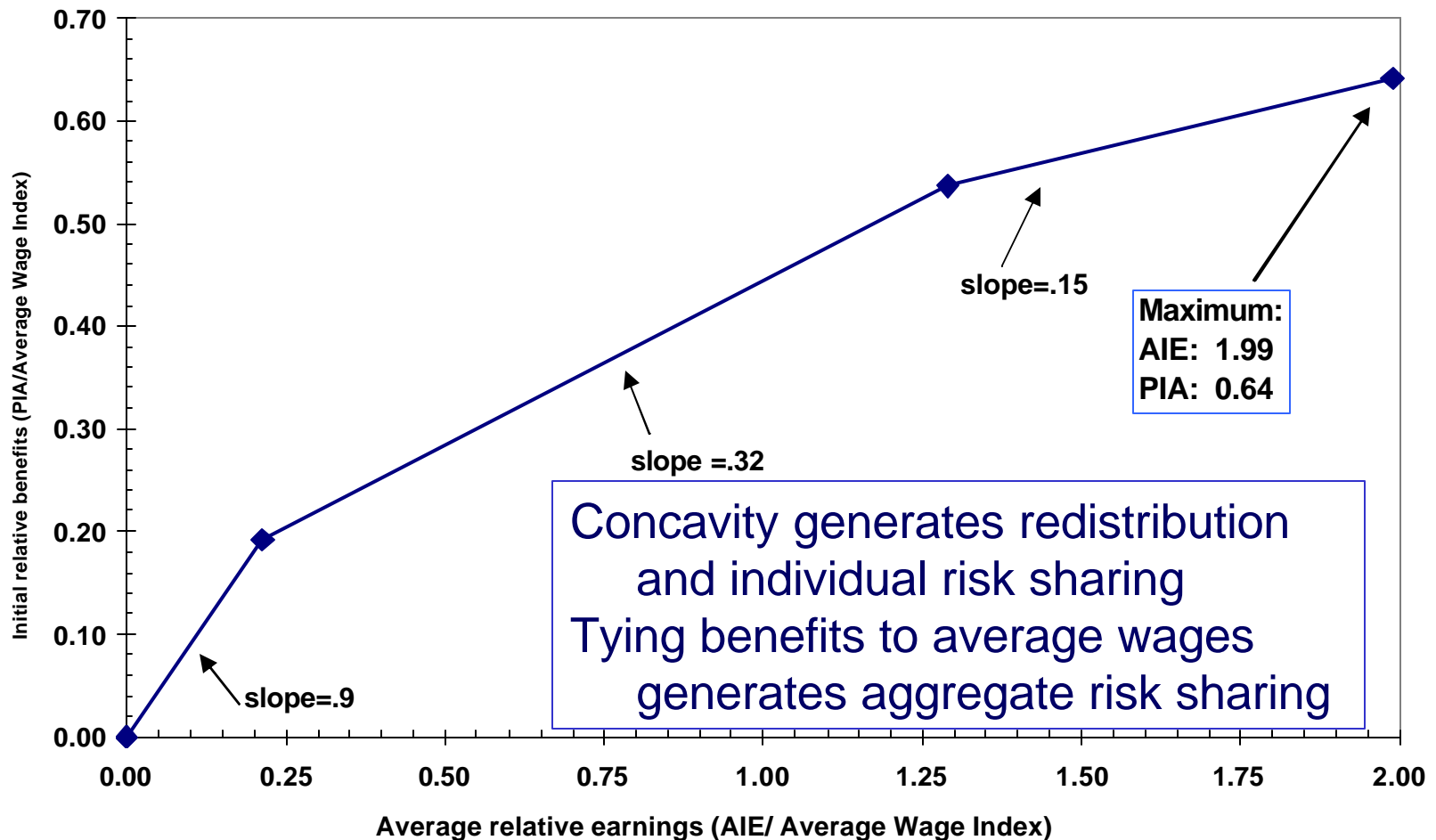
## Calculation of Benefits

- 1) Calculate relative earnings (ratio of individual covered earnings to average economy-wide earnings)
- 2) Average worker's relative earnings across highest 35 years
- 3) Compute PIA (in average wage units) as concave function of average relative earnings
- 4) Benefit in first year = PIA (in average wage units) x average wage index  
Benefit in future years (each remaining year of life) indexed to CPI



# Mechanics of Current OASDI System

## Calculation of Primary Insurance Amount (PIA)



# The current system is not “self-balancing”

- No aggregate adjustment mechanism to tie promised benefits to revenues
  - Total revenues / total expenses:
    - 1.3 currently (i.e. surplus)
    - .75 projected for 2042 (i.e. deficit)
  - Actuarial balance (75 years)
    - = PV future revenues - PV future benefits
    - = - \$ 3.7 trillion
- To rewrite the current system as an individual account system, need to take a stand on how future balancing would occur
  - We start by assuming all balancing occurs via changes in future taxes or future benefit accrual rules

# Translating DB into DC

<b>Current “Defined Benefit” System</b>	<b>Translated “Defined Contribution” System</b>
Benefits depend on individual earnings	Balances accumulate yearly based on individual contributions and variable government match
Progressive redistribution based on lifetime earnings	Variable government match rate based on accrued balances
Benefits depend on growth rate of average wages	Accounts hold assets with payoffs that depend on average wage index ...
Benefits received as an annuity	and individual longevity
Annual statement lists earnings history and projected future benefits	Annual statement lists contribution history and accumulated account balances

# Personal accounts hold PAAWs: Personal Annuitized Average Wage Security

- Each PAAW pays
  - Economy-wide average wage index in the year of retirement (conditional on living that long)
  - Same number of inflation-adjusted dollars for as long as the individual lives

# PAAW is a composite of two securities

- Average Wage Security
  - Pays average economy-wide earnings in a given year (like a futures contract)
- Personal Annuity Unit (PANT)
  - Pays \$1 (real) for as long as the individual lives
- PAAW: composite security that pays off an uncertain number (security 1 above) of a one inflation-adjusted dollar life annuity (security 2 above)

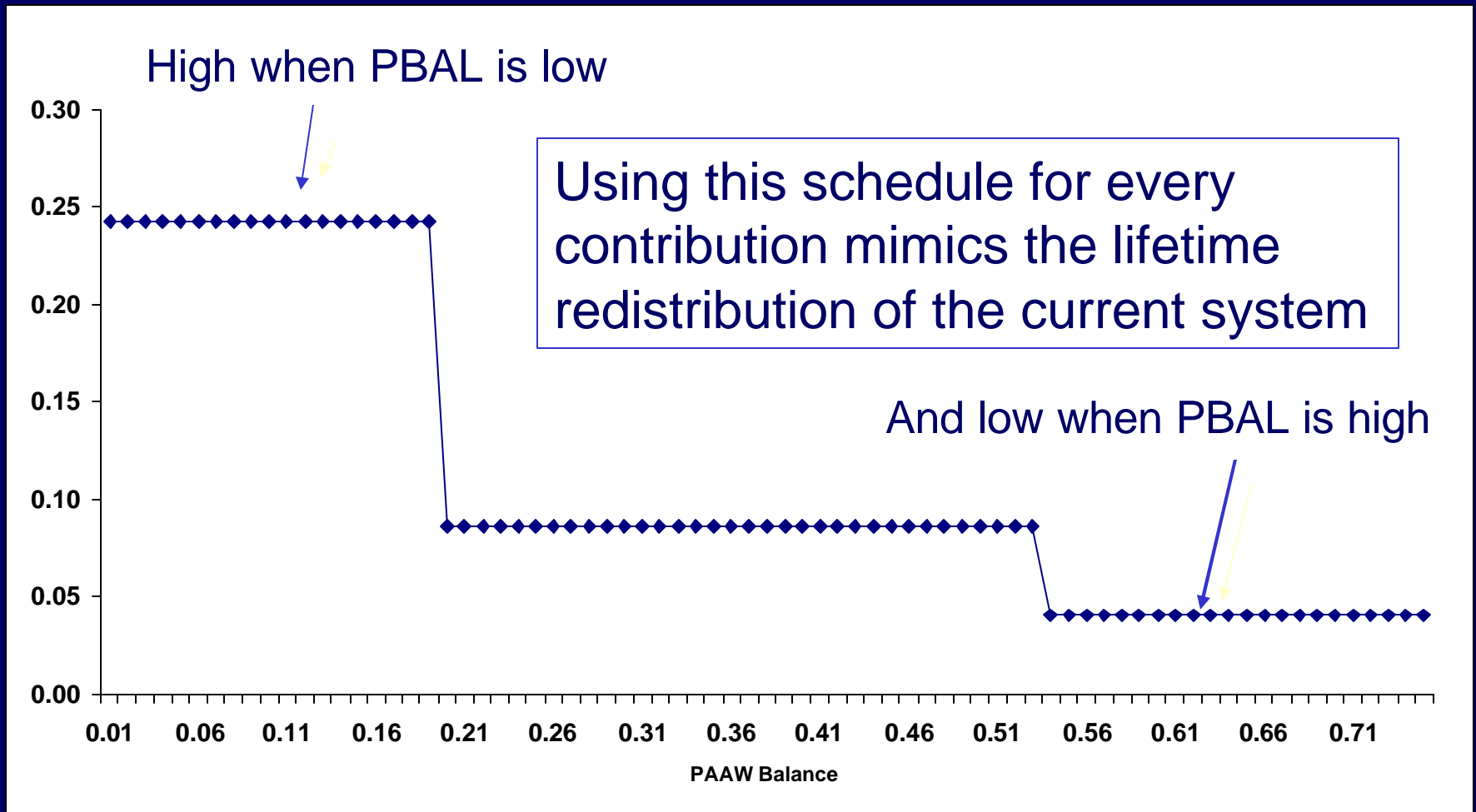
# How are PAAWs accrued?

- Define  $PBAL_{it}$  = number of units of PAAWs accrued by worker  $i$  as of year  $t$
- PBAL represents benefits a worker would be entitled to under the current system if all future earnings were = 0
- PBAL can rise, but can never fall
  - Note: Other definitions of accrual exist (that end with same amount at retirement and never fall), but our definition accumulates balances most rapidly
- Writing accrued balances in this way could be a step toward establishing property rights for benefits

# PAAW accrual replicates redistribution in current system

- PAAW accrual is a function of
  - New contributions
  - Accumulated balances (PBAL)
- Additional PAAWs per additional contribution (measured in relative wages units) is a decreasing function of PBAL
  - Note: If a contribution comes after the first 35 years, only the excess of that contribution over the 35th highest relative contribution to date counts toward PAAW accrual

# Additional PAAWs Per Additional Contribution (measured in average wage units)





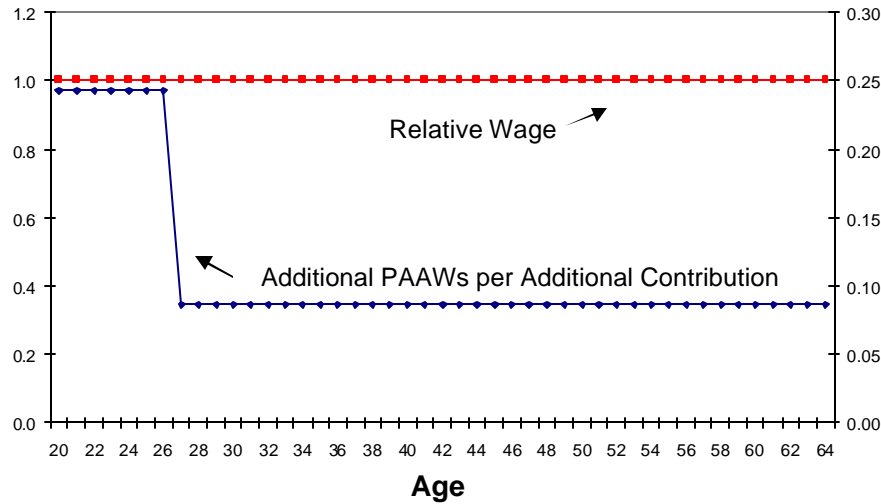
# Simple Numerical Examples

- Worker 1: Relative earnings = 1  
(earnings = average economy-wide earnings in every year)
- Worker 2: Relative earnings = average relative earnings for cohort born in 1938
- Worker 3: Earnings =  $\frac{1}{2}$  earnings of Worker 2
- Worker 4: Earnings = 1.5 earnings of Worker 2
- Future work: examine realizations of stochastic earnings process

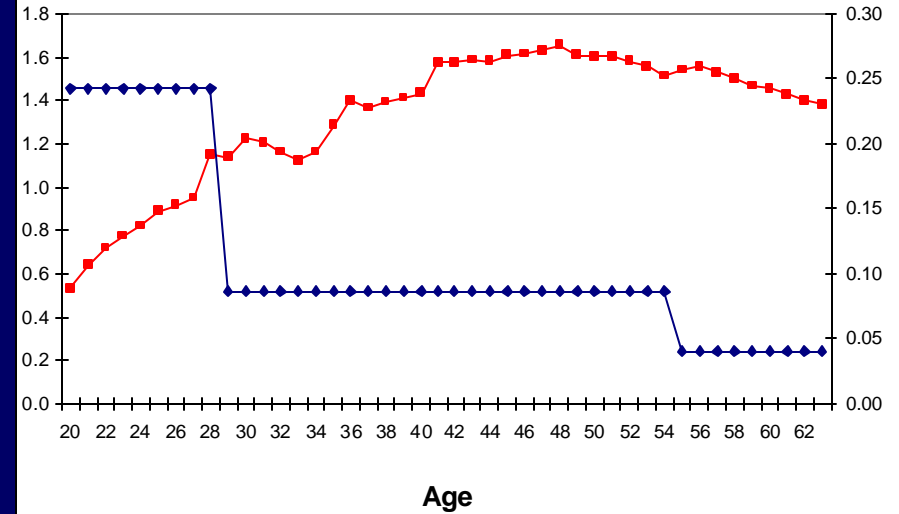


# Additional PAAWs Per Additional Contribution (measured in average wage units)

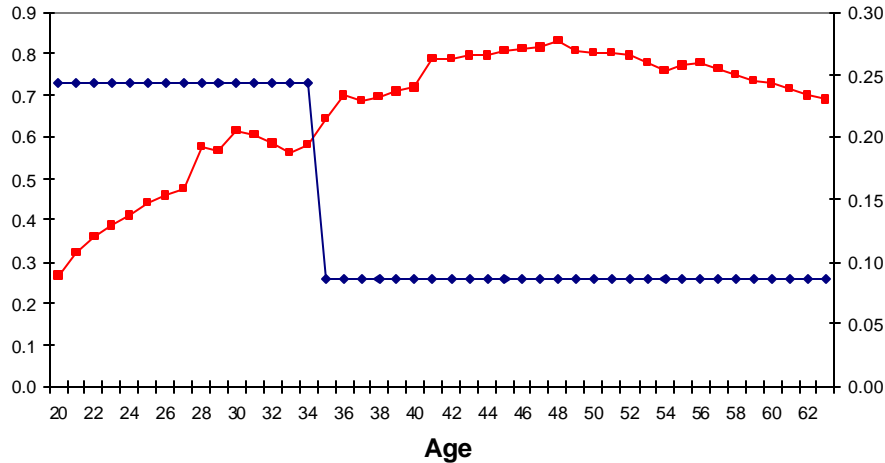
Worker 1: Economy Average



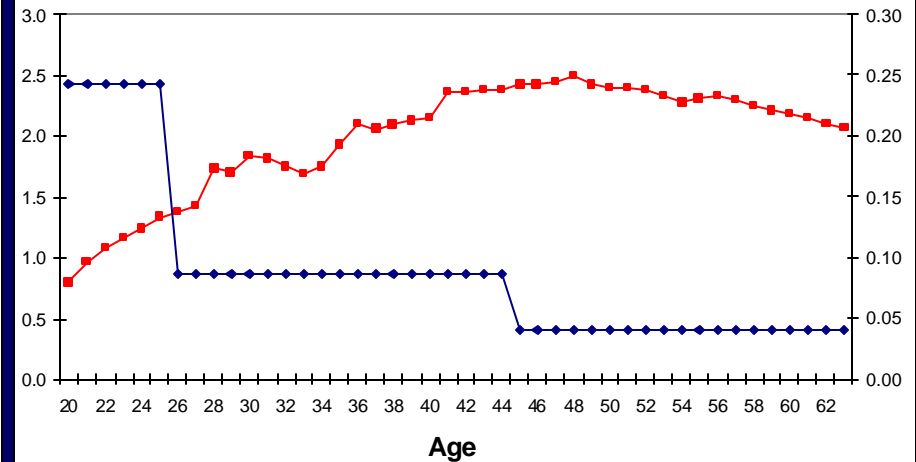
Worker 2: Cohort Average



Worker 3: 0.5 Cohort Average



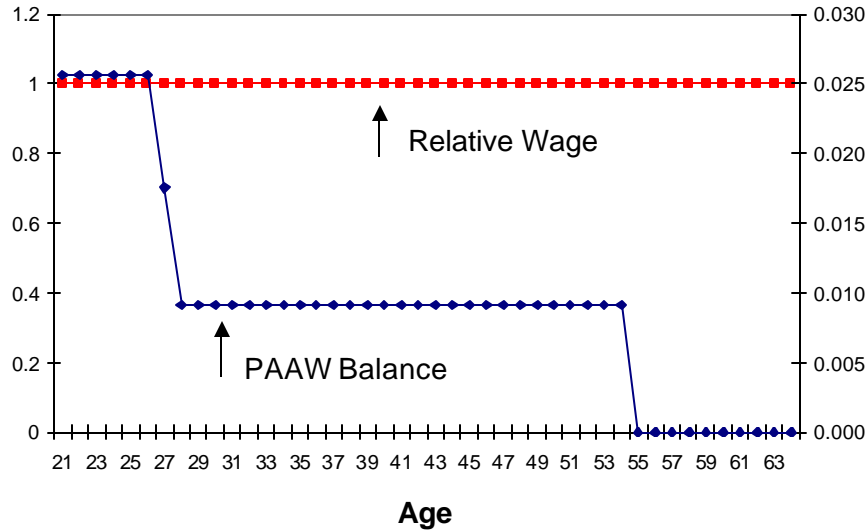
Worker 4: 1.5 Cohort Average



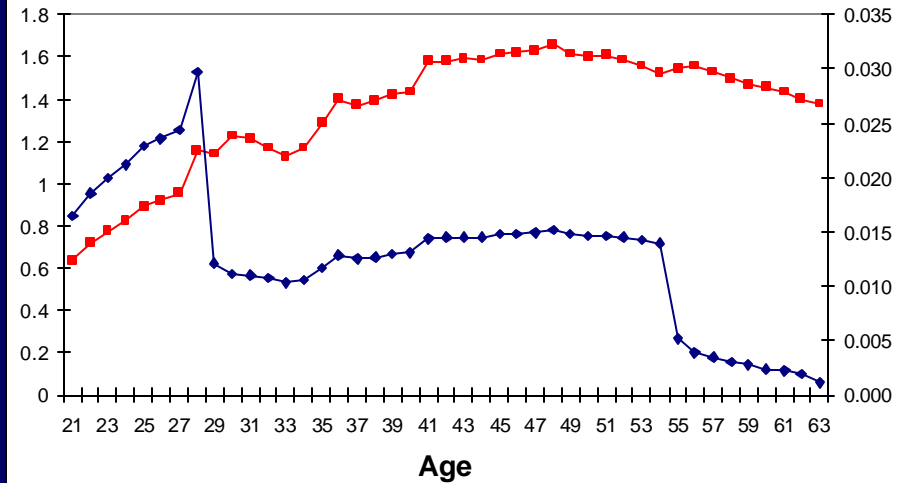


# Change in PAAW Balances

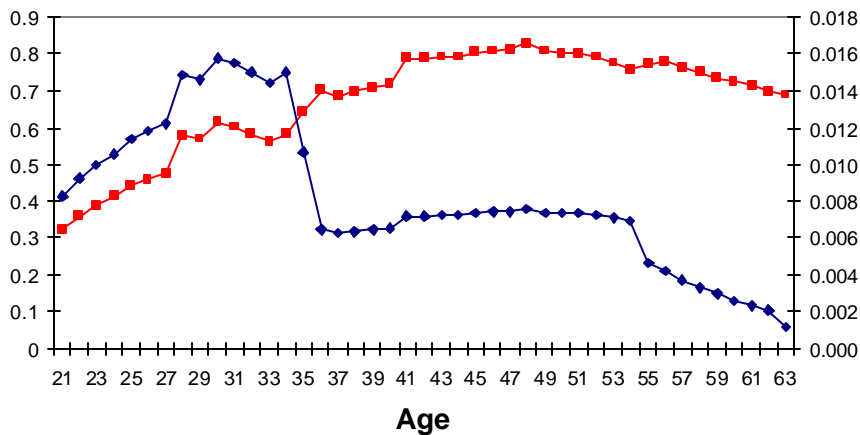
### Worker 1: Economy Average



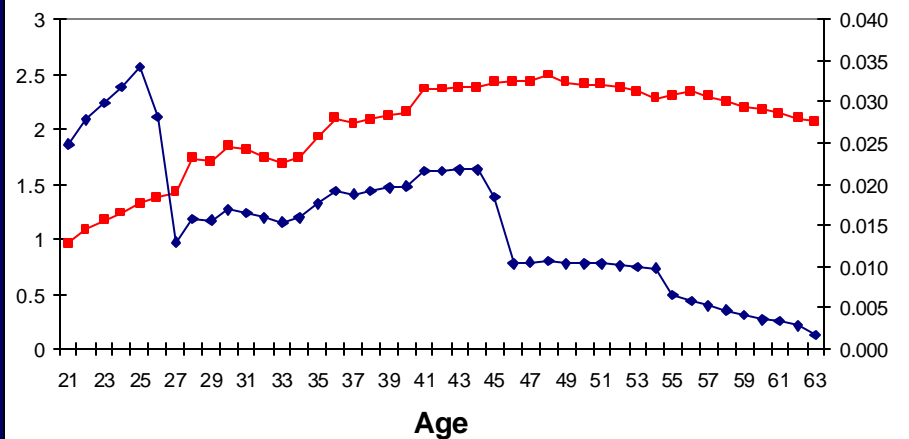
### Worker 2: Cohort Average



### Worker 3: 0.5 Cohort Average

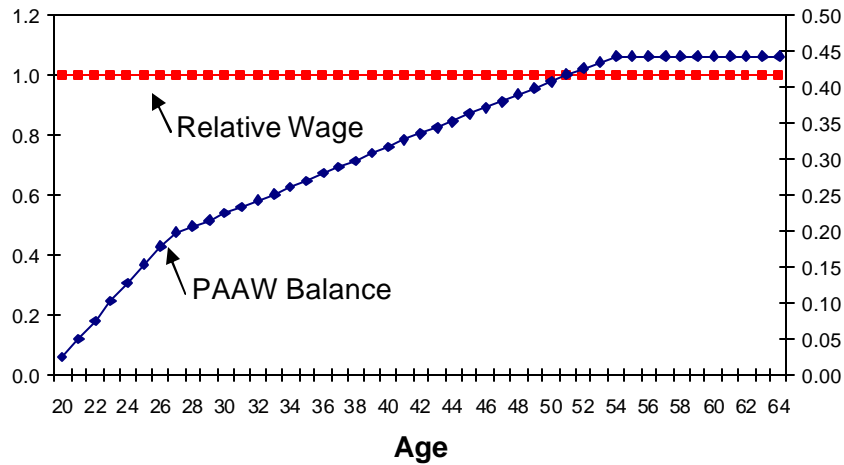


### Worker 4: 1.5 Cohort Average

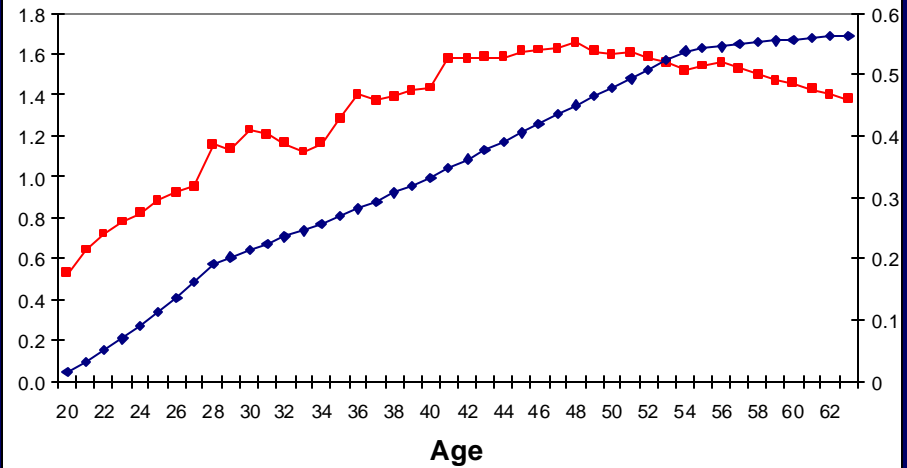


# PAAW Balances (PBAL)

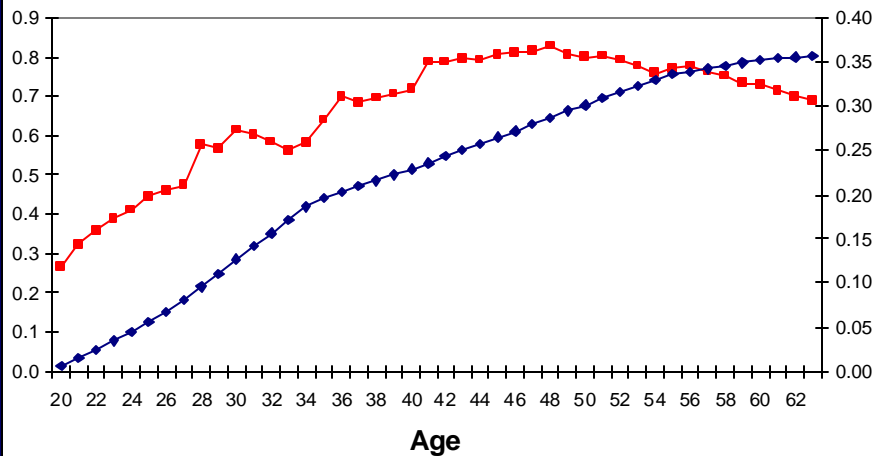
### Worker 1: Economy Average



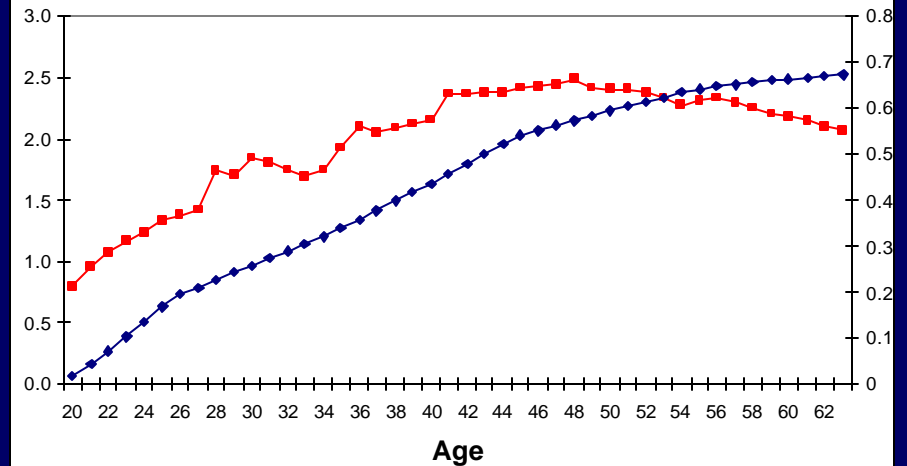
### Worker 2: Cohort Average



### Worker 3: 0.5 Cohort Average



### Worker 4: 1.5 Cohort Average



# Extensions (future work)

- Spousal benefits
  - Separate spousal account, with vesting after 10 years of marriage
- Survivors benefits (children/spouses)
  - Can be handled as well

# Pricing PAAWs

- Allows individuals to observe
  - value of account
  - value of contribution – value of additional PAAWs
- Useful later for
  - valuing aggregate assets and liabilities,
  - making system self-balancing
  - allowing for the possibility of trade within accounts

# Alternative approaches to pricing PAAWs

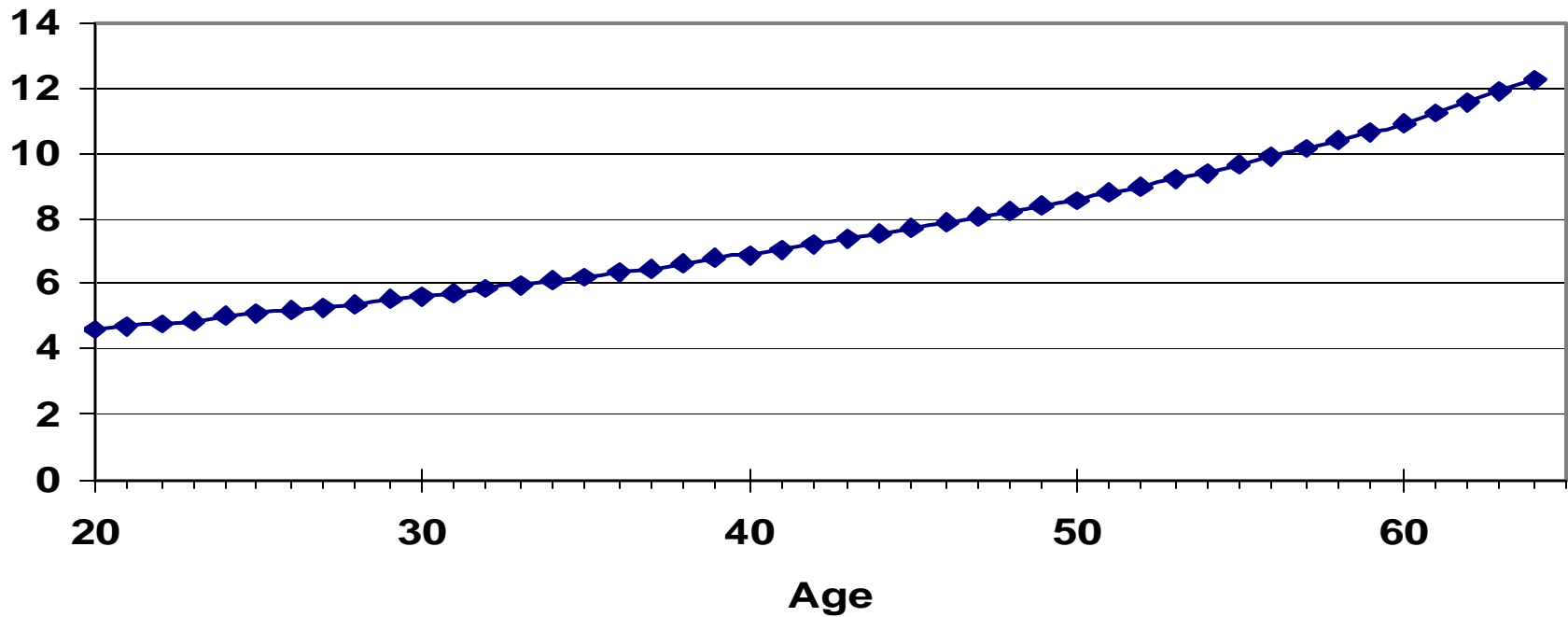
- Model based
  - Assume risk neutrality or
  - Allow for risk aversion and construct portfolio of marketed securities that best replicates PAAWs payouts
- Market based
  - Introduce new securities and observe market prices

# Pricing PAAWs under risk neutrality

- Value of individual PAAW depends on assessments of
  - Growth in average wages
  - Future path of interest rates
  - Individual mortality



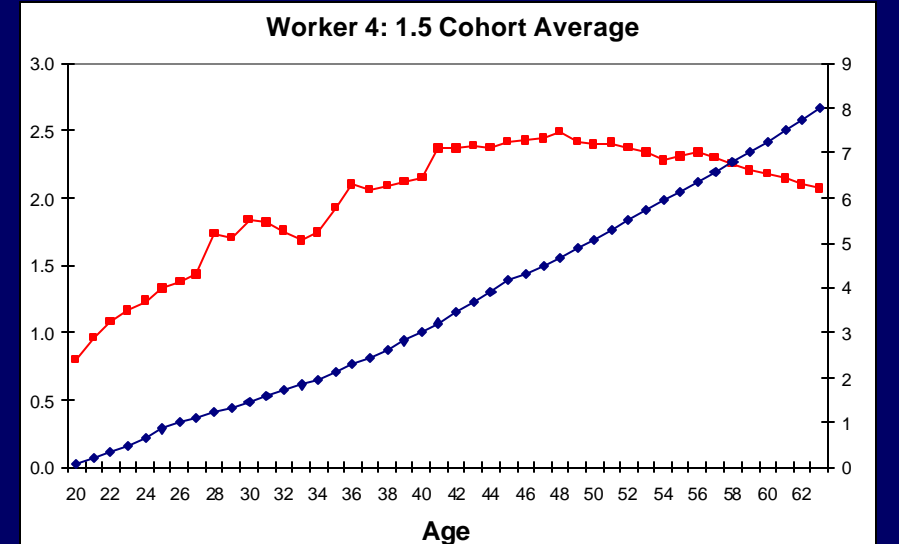
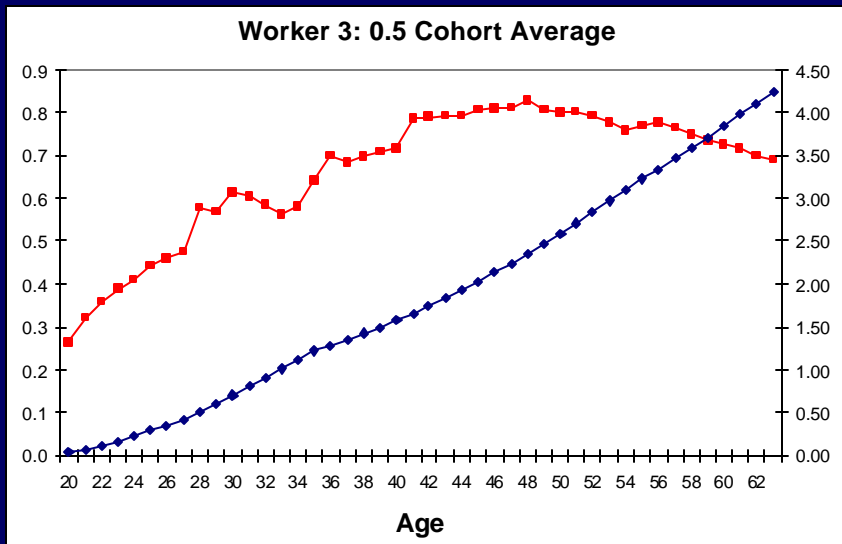
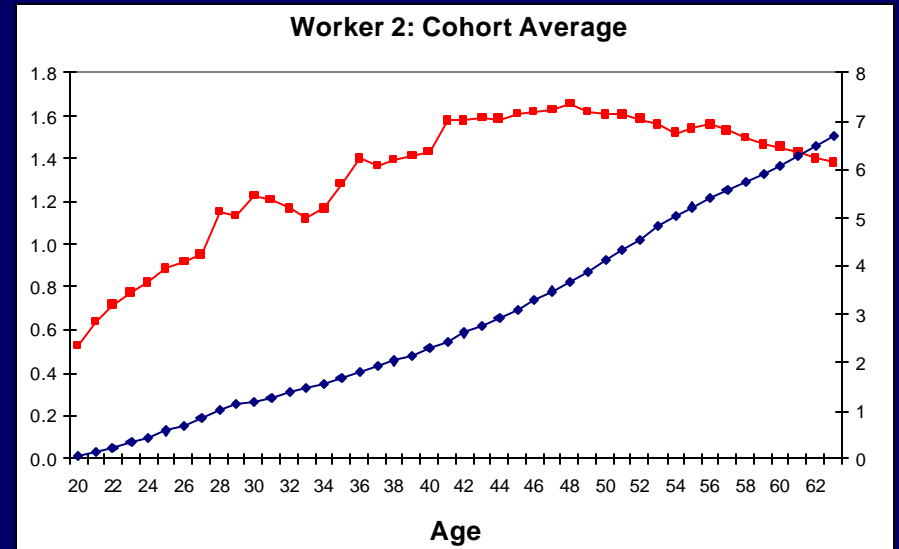
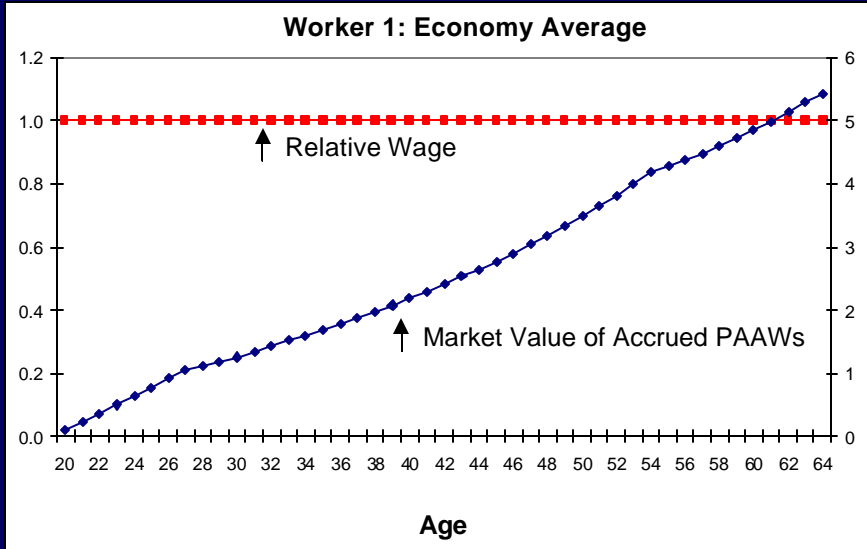
# Projected market price of one PAAW (under risk neutrality, measured in average wage units)



Price rises with age because:

- $r >$  growth of average wages
- probability of survival to retirement rises with age

# Projected Market Value of Accrued PAAWs (measured in average wage units)



## Defining the match

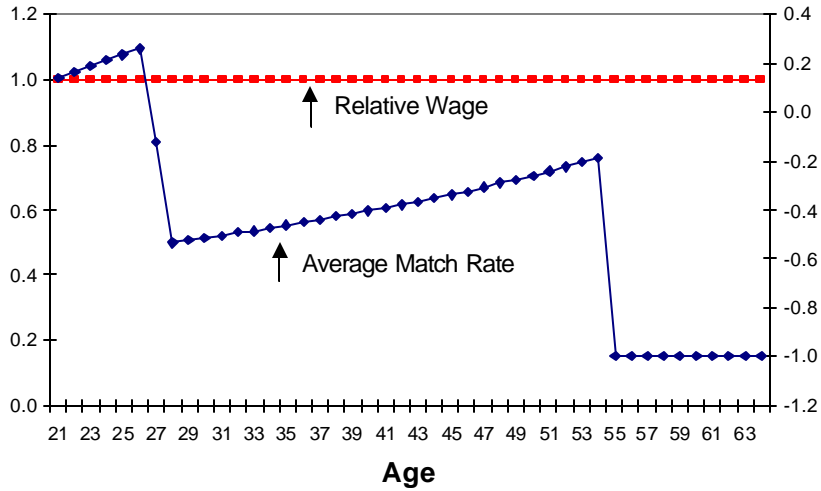
- Match (tax/subsidy) = value of extra PAAWs - value of contribution
- Average match rate
  - $[P_{PAAW} * (? PBAL) / \text{Annual contribution}] - 1$
- Marginal match rate
  - $[P_{PAAW} * (\text{increment to PBAL per additional dollar of contribution})] - 1$

# Properties of the Match

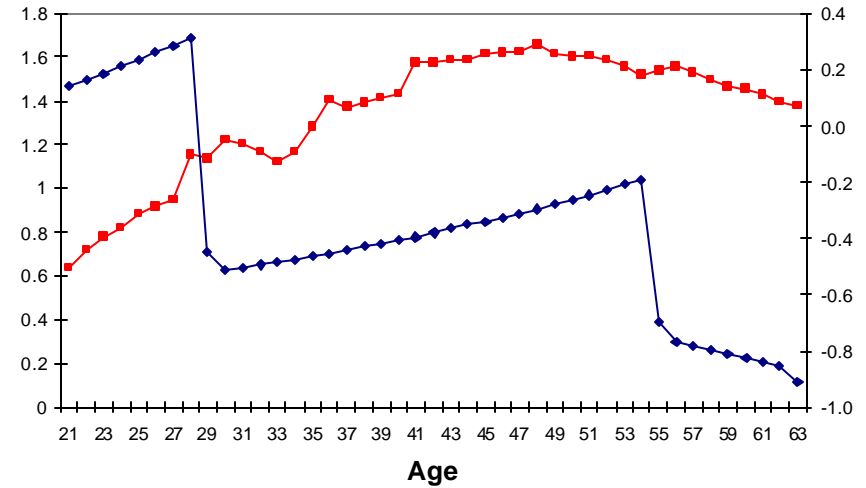
- Match rate can be + or –
- Match rate cannot be  $< -100\%$ 
  - balances cannot be taken away
  - all redistribution occurs on the way in, none on the way out
- Unlike simple DC plans, match rate not constant across people or time
  - Depends on PBAL, price of PAAWs, and fraction of contribution that “counts”

# Average Match Rate

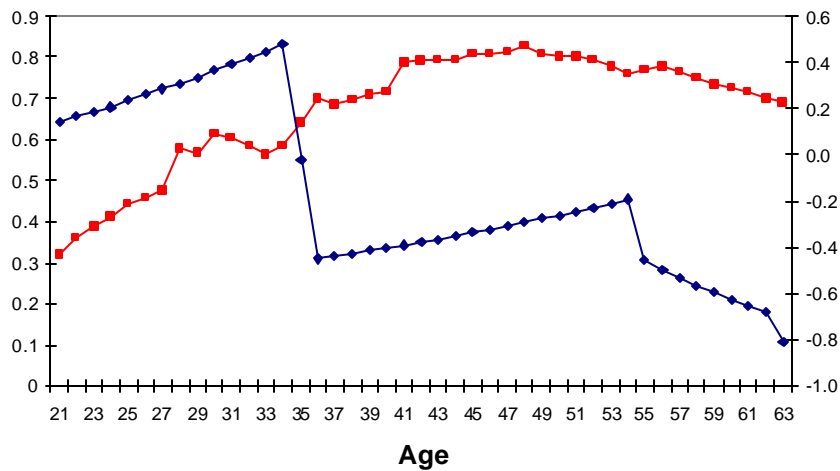
### Worker 1: Economy Average



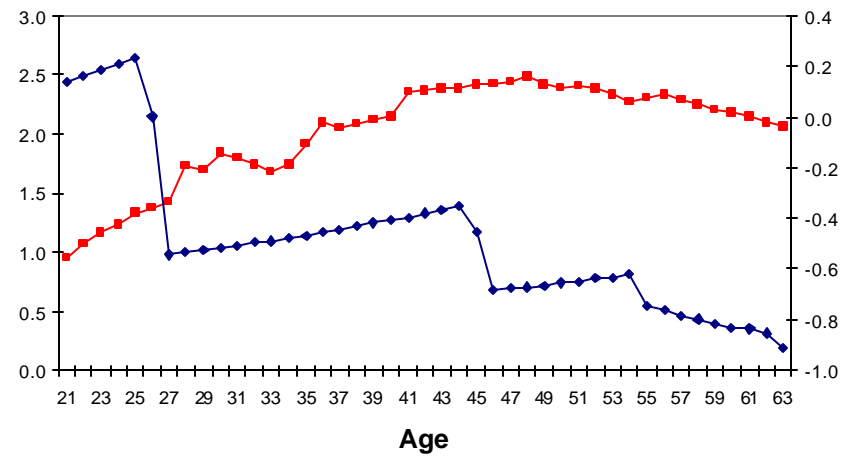
### Worker 2: Cohort Average



### Worker 3: 0.5 Cohort Average

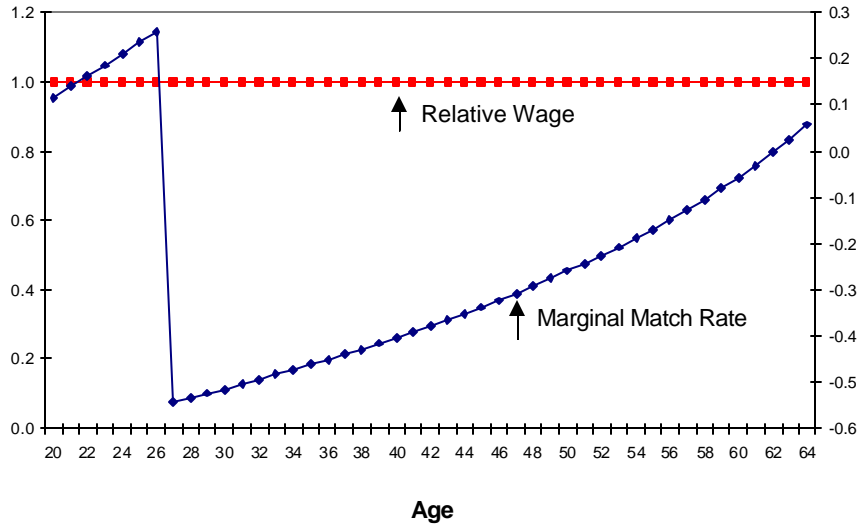


### Worker 4: 1.5 Cohort Average

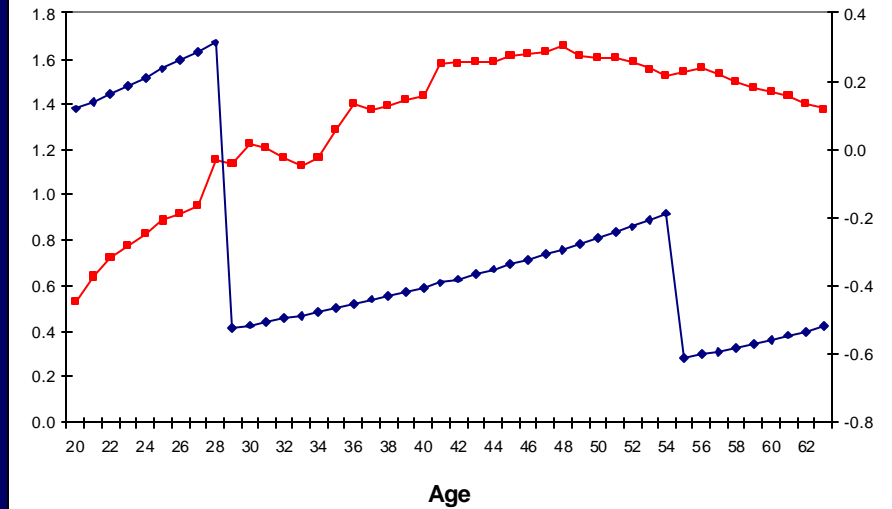


# Marginal Match Rate

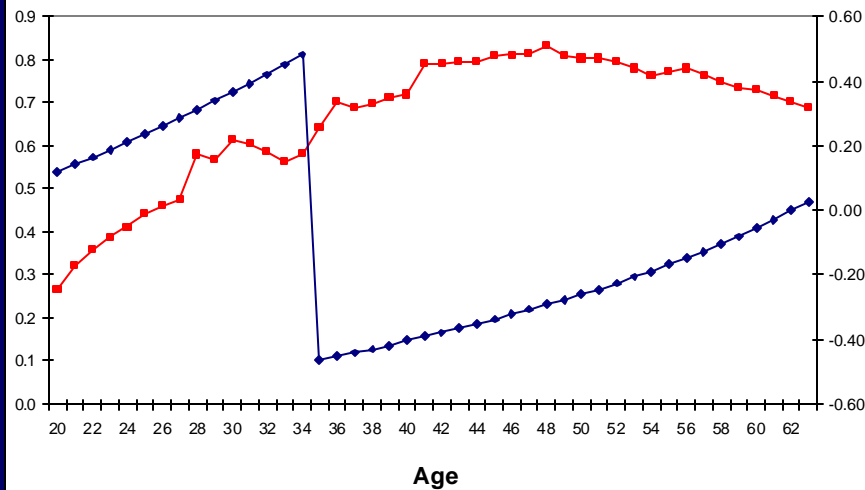
Worker 1: Economy Average



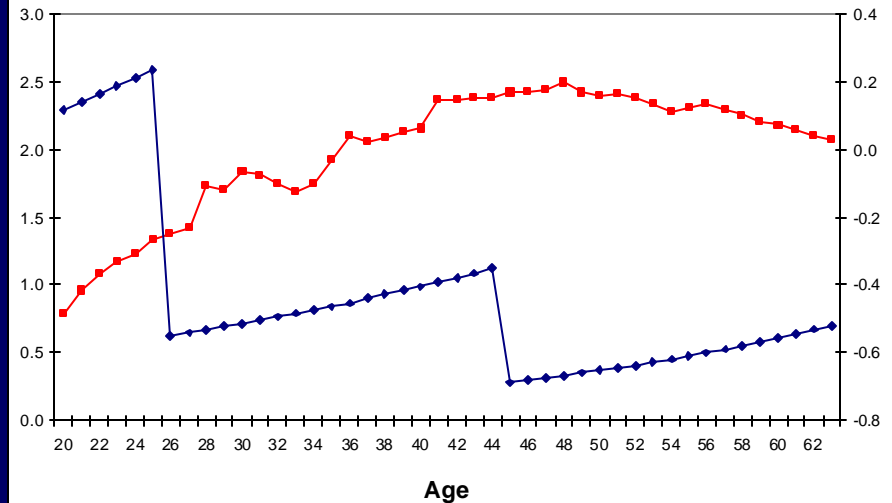
Worker 2: Cohort Average



Worker 3: 0.5 Cohort Average



Worker 4: 1.5 Cohort Average



# On net, match rate is positive for young and negative for old

- Match lower for old because
  - **Progressivity** means that a given relative wage contribution generates more PAAWs when young (when PBAL is low )
  - **35-year averaging formula** means that earnings in 36<sup>th</sup> year and beyond only increase PBAL by the amount they exceed the 35<sup>th</sup> highest relative wage to date
- Although this is partially offset by
  - **Price of PAAW rises with age** [and holding PBAL constant, increment to PBAL due to additional contribution (measured in average wage units) is constant with age]
- Match rate concept differs from incentive to work (i.e. implicit marginal tax rate computed by Feldstein/Samwick and others), because working today also affects future match rates

# Work in Progress

- Model-based pricing allowing for risk aversion
  - Examine replicating portfolio
  - Complicated by serial correlation in wage growth
  - Social Security liabilities may be less than typical estimates
- Create new tradable securities
  - Pools of PANTS and PAAWS (similar to pools of mortgages)
  - Average wage bonds
  - Social Security revenue bonds
- Implementing a self-balancing system with marketable securities



# Conclusions

- Translate DB into the language of DC, to facilitate debate over individual accounts
- Preserves redistribution and risk sharing of the current system
- Clarifies the link between contributions and benefits
- Enhances property rights of the system
- Might lead to a political compromise between Democrats and Republicans

# Conclusions

- It should be possible to create and trade pools of PAAWs
  - providing an estimate of the market value of each individual's account
  - providing an estimate of market value of system liabilities
  - opening up the possibility of allowing (limited) trade in these accounts

# Conclusions

- We conjecture that we could use these and other new securities to create a self-balancing DC system
- Still very preliminary – much more to be done!

**END**



# Talking Points (1)

- Economy average worker
  - Starts at .9 tier, then to .32 tier
- .5\*Average cohort worker
  - Same, but takes longer to get to .32 tier
- Average cohort worker and 1.5 average
  - Drops to .15 tier (1.5 worker faster)
- No drop after 35 years b/c earnings late in life always = 35<sup>th</sup> highest

## Talking Points (2)



- Similar to previous slides, but take into account varying contributions due to age profile of relative earnings
- After year 35, a large fraction of each contribution does not count toward accrual



## Talking points (3)

- Product of PAAW balances and price of PAAW
- Value at retirement:
  - .5 worker: 4.3
  - avg worker: 6.7
  - 1.5 avg worker: 8.0
- Illustrates redistribution