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Health, Wealth & Workforce Exit:
Disability Insurance & Individual Accounts

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Abstract:

Historically "retirement" has been a condition which stems from the "disability" to continue work, thus the US developed an integrated set of social insurance programs, within OASDI. Current debate on the long-term finance of OASDI benefits includes proposals for private investment via Individual Accounts. The author first investigates what implications disability might have for equity account balances, simulating returns for cohorts retiring over the period of 1929 - 2003. In light of results, a behavioral model explores incentives to exit the workforce ahead of retirement age when one of two variants of a defined benefit Disability Insurance program continues to be available. Incentives are found to vary with specific program attributes.

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1.0 Introduction:

Since the late 1970's, both the Social Security Actuaries and the public at large have been

increasingly focused on the long-term solvency of Social Security Administration (SSA) trust

funds. The financial health of SSA's trust funds has been considered with various demographic

and productivity assumptions. Along with these measures of the funds' health, researchers have

employed alternate financing and benefit mechanisms for the SSA's main retirement trust fund,

the Old Age and Survivors Insurance (OASI) trust fund. One proposed design change involves

moving from a pooled OASI trust fund to a mandated system of Individual Accounts. Because

the design of SSA's Disability Insurance program is closely tied to the current OASI program,

and because the disabled exit the workforce ahead of retirement age any Individual Account-type

reform proposal has important ramifications for SSA's Disability Insurance as well as for other

federal and state benefit programs. This paper will consider the SSA's Disability Insurance (DI)

program in the context of Individual Accounts for retirement (IA) using a two part comparative

approach which begins by asking what implications disability might have for Individual Account

balances and then continues with consideration of two alternate designs for preserving and

integrating the current defined benefit DI program with a reformed Social Security system based

on Individual Accounts.

1. The individual forfeits their Individual Account to the DI trust fund, and receives continued

    benefits to the individual past retirement age.

2. The trust fund contributes to an individuals account while they are disabled, and the

    individual retires to their IA balance much like any other worker.

A behavioral model then considers worker application incentives under either design.

2.0   Background

Individual Accounts would allow the public pension system in the US to move retirement assets away from lower yield special issue Treasury instruments and toward assets with historically higher mean returns, while simultaneously providing beneficiaries with more direct authority over investment choices. The Individual Account framework thus allows for greater individual control of investment choices and related risk/return tradeoffs, while bypassing concerns regarding public sector investment strategies and their interaction with private sector finance.

The President's 2001 Commission, co-chaired by Moynihan and Parsons, looked at three alternate models for Individual Accounts. Each of the plans amount to a hybrid defined benefit / defined contribution program somewhat along the lines considered by Diamond (1996), thereby limiting risk exposure and, possibly improving political feasibility. More fundamentally the envisioned accounts are voluntary. In general the Commission's plans allows a small set of discrete worker investment choices which can be made to have lower transaction costs and a reduced risk profile when compared with plans in which workers are granted more choice.[1] One version allows larger accounts a greater amount of freedom of choice, an allowance tied to the decline in the ratio of transaction costs to account balance and basic economies of scale. The two most radical of the Commission's proposals increase the benefits of the long term working poor, and poorer surviving spouses as a way of addressing equity. All three of the Commission's proposals allow for inheritance of account balances, which could significantly improve

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[1] Some specific focus is granted to the Government's Thrift Savings Plan (TSP) as a model for the investment options.

intergenerational transfers, wealth accumulation, labor productivity, and the return from labor for

workers with traditionally low rates of savings, their families, and society overall.

Critics have expressed fundamental concern regarding the risk of arbitrarily poor equity market

outcomes for less fortunate retirement cohorts. [2] (It should be noted that these concerns are

prevalent for private defined contribution pension programs as well.) Critics also express

traditional and general concerns that workers may systematically overestimate their health, or

otherwise myopically overestimate their remaining years of labor force attachment in such a way

so as to choose high risk, high return strategies late in their careers when there is less opportunity

to recover from poor short-run market outcomes. As well concerns have been raised that even if

IA carve outs begin as small limited ratios within hybrid DB/DC structures, there is a long-term

political risk of allowing or even requiring an increasing ratio of individual public pension

assets/claims in to the DC component (Diamond 1998). Whatever the proportion devoted to a

DC-type public pension scheme, and regardless of the limits on investment type, etc. the risk of

poor individual returns is easily considered as having several components, including a cohort-

risk component, and individually heterogeneous components including decision-risk, lifetime

employment outcome-risk, and health-risk components.

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[2] More recently and specific to the idea of financing the creation of Individual Accounts, some critics have pointed out that moving from a system where each generation primarily pays the current period benefits of the generation before it ("pay-as-you-go" financing) to a system where each person saves for their own future benefit creates a transition state in which a single generation is required to both pay for the benefits of the generation before it, and to accumulate assets for their own retirement. .Since an extra burden is implicit as well for any tax increase that solves the current funding gap in order to preserve the pay-go system it is only the difference in burden of either approach which should be considered.

Because these risks interact, many of the above concerns are magnified for those who drop out of the labor force early because of a disability. In fact, the institutional interrelation between the programs makes any change in the OASI program more complex than otherwise. Specifically, current disability benefits are formulaically more generous than those provided under OASI for covered persons younger than the normal retirement age (NRA). As well, both benefit calculations and the financing of DI are defined in relation to the current OASI program. A final rationale for considering the DI trust fund within the current reform debate is the financial position of the DI trust fund. The OASI trust fund is in better shape than the DI trust fund and has been for several years. In its 2001 report on Social Security, the President's Commission did not develop a plan for DI, but recommended that the DI program be evaluated in a separate analytic process (pg. 149). Indeed, very little research has been done on the potential impact of Individual Accounts on the DI program. Research on DI has focused primarily on selection into the program and related behavioral incentives (Black, Daniel, and Sanders; Bound; Borsch-Supan; Diamond and Sheshinski). This literature has documented applicants' motives, and the acceptance pattern of disability programs in detail.[3] As will be shown in later sections of this paper, disabled workers should not be expected to apply in cases when expected benefits fail to outweigh costs of application, when they lack program information, or in cases when they are currently employed and are unwilling or unable to leave their job before applying to DI.

The goal of this paper is to consider DI in the context of Individual Accounts. As a simplification I consider a total transition to the DC-type public pension plan. I also dispatch

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[3] Much of the behavioral DI literature relies implicitly or otherwise on the existence of a stock of potential applicants who could successfully apply to the program but for some reason choose not to. Figure 4, gives some evidence that both applications and awards increase during periods of recession, in line with this assumption.

with the portfolio allocation and lifetime workforce outcome problems so as to focus only on

idiosyncratic health risks. To begin I estimate likely asset levels and compare returns from

Individual Accounts at various times of disability application relative to those from a traditional

forty-year career, using simulation techniques and assumptions described in detail below. This

allows for explicit consideration of a hypothetical fully funded IA public pension system's

ability to meet the needs of disabled workers. I then consider the current DI insurance program in

the context of an Individual Account program, providing a model for considering the interaction

of the current DI program with the just mentioned hypothetical fully funded IA public pension

system.

Section 3 simulates individual returns from individual equity accounts for disabled workers who

exit the workforce at three separate ages at or beyond the current average age of disability

application and award. Section 4 models the relative incentives to work or exit and apply for DI,

considering a system with an Individual Account pension program and the two variants of the

current DI program outlined in the introduction to this paper. Section 5 considers results from

this work. Concluding remarks follow as Section 6. Included tables and figures depict time

variation and summary statistics from estimation of returns for cohorts entering the workforce

between 1890 and 1964.

3.0   Simulated Wealth Accumulation and Individual Equity Accounts:

As mentioned just above, the approach here limits consideration to a program based in total on

an individual equity account. Specifically, the analysis limits worker investment to the Standard

& Poors 500 index with all dividends reinvested. In absence of disability, all workers are

assumed to work for forty years from age 22 to age 61, thus retiring on their 62nd birthday. The

analysis in this section simulates returns for workers who entered the workforce between 1890

and 1964 (retiring between 1929 and 2003). The goal is to generate worker returns from

individual equity accounts over this period, and then to compare those returns to the returns from

curtailed disabled worker careers.

Persons may reallocate portfolios away from stock to smooth returns in latter years of workforce

attachment by shifting balances towards a mixed portfolio which includes bonds or other

financial instruments. However the ability to enact this sort of strategy is likely to be limited by

disabled unexpectedly several years ahead of planned retirement. Thus estimated balances at

early disability (age 49) are likely to be better aligned with hypothetical realizations, while the

equity account balances from full work histories are likely to overstate the impact of equity

yields on total returns for any average IA participant. Because modeled accounts are invested

solely in equities the spectrum of returns is broader and more volatile than more balanced

accounts would be, however, by modeling the accounts in this way one may see the contribution

of equity market performance to potential savings yields most clearly, with out having to worry

about the impacts of unique and particular investment assumptions on results.

Workers are assumed to earn the average annual earnings in manufacturing as reported in the

Bureau of Census' *Historical Statistics of the United States* back to 1890.[4] To generate a real

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[4] A discussion of the relative virtues of this wages series and techniques for integration with the SSA average wage series along with alternate measures for robustness of utilized techniques can be found as Appendix A

price series, Robert Shiller's Producer Price Index (PPI) data is used to inflate worker wages to

current (1999) dollars. This data series extends back to 1871, and thus is easily long enough to

accommodate simulations here. Withholding tax rates of 10.6 percent, representing current

employer and employee contributions are used as the basis for initial contributions to Individual

Accounts

3.1   Simulated Returns:

Table 1 provides a threshold comparison of the yields of an individual equity account and a

traditional OASDI account. (The primary exercise reported on here assumes disabled workers

exit the workforce eleven years ahead of retirement, after working 29 years[5]).   The individual

equity account (IEA) is said to "Succeed" if its yield is greater than the yield offered by the pubic

program. Two methods are to calculate the current public pension return, one based on the

SSA's year 2000 program regulations, and one based on a proximate rule of thumb (44% of final

year wages).[6] Over the period of study, the estimated IEA outperforms the OASI program more

than 75 percent of the time.   However when the IEA is measured against DI at the average age

of disability, it outperforms DI less than 10 percent of the time.

Because under current law eligible disabled workers may exit and apply to DI any time before

reaching Normal Retirement Age, and for the sake of sensitivity analysis, Table 2a and 2b

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[5] SSA actuary estimates from Motsiopoulos and Zayatz, 2001 point to average award ages between 49 and 51 for the 1990's and through most of the next decade. Assuming a retirement age of 65 suggests that workers loose more than 11 years of labor force participation, however since a growing majority of beneficiaries actually exit the labor force closer to the early retirement age of 62, the loss of 11 years is taken as a conservative estimate, so as not to overstate a disabled workers missed participation.

[6] Appendix A gives a justification for the included rule of thumb approach. S figure 1 illustrates the results are similar using either approach.

present the distribution of estimated ratios of Individual Accounts at disability, and retirement, so

that the reader may better understand the link between early work force exit and IEA yields. In

addition, exercises involving workforce exit five, and three years ahead of retirement are also

reported. These additional values are picked to correspond to the early retirement age

differential as it exists for workers with a Normal Retirement Age of 65 (three years), and for

cohorts born later than 1960, with a Normal Retirement Age of 67 (five years). Under current

law, there is some evidence of induced disability application at Early Retirement Age.[7]

These tables show evidence that disability can significantly impact savings in an individual's

account because it curtails labor force participation. With early exit from the labor force, the

worker loses a great deal of his-or-her lifetime savings opportunity. Most obviously, the worker

loses accumulation of the withholding that would have occurred in the next eleven years. As

well however, the worker loses compounding on not only those years savings, but on savings in

early work years. Compounding on withholding from early years is substantial and thus, on

average, so is the opportunity cost of early exit in this regard. Table 2b reports summary

statistics on compound rates for each cohorts withholding in their first year. This table reports

several summary statistics, which help to give a picture of the range in returns for equities, and

include outcomes over a 40-year career for comparison with disability-curtailed careers.

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[7] One might wish to consider these additional estimates in the context of optimal retirement timing, and induced incentives. However even near the end of a "boom" it remains unclear to a workers (disabled or otherwise) whether fund balances are smaller, or larger than they might be eleven, five, or three years in the future, a continued boom, or new bull market may or may not emerge over the course of a decade. With rare large downward movements in equity markets, ex-post, there is always the question of whether investors properly assessed risk. In any implemented mandatory IA framework, there are likely to be cohorts who retire after market peaks, and who face returns below those expected a few years before retirement. Some of these labor force participants will find it relatively easy to stay in the workforce long enough to recover from sudden market declines while others may not. In any case, regardless of the perspective given to these comparisons, one should not easily be persuaded that workers are able to optimally time the market in the context of workforce exit.

Figure 1 provides a visual comparison of the relative returns from equity accounts at retirement and labor force exit due to disability across workforce cohorts. Figure 2 provides a closer look at estimated account balances at time of disability in constant (1999) dollars.[8]

4.0 The Current Disability Program and Individual Accounts:

Under the current IA proposals, the DI trust fund pays benefits to disabled workers up to normal retirement age, after which time the worker might either continue to receive the DI benefit or revert to the hybrid benefit tied to their IA allocation choice. It is not clear what schema will emerge at present. Within the framework provided here, one way to think of this option is to allow the current DI trust fund to pay benefits up to retirement age, after which the worker would retire with his-or-her account balance. This most nearly replicates the lifetime expense of individuals' DI benefits; which provides benefits from the DI fund for years up to normal retirement age with no obligation past this point, as well, it is the most feasible option for the DI Trust Fund. Assuming no behavioral changes within in the pool of potential applicants, this scheme could be expected to leave the date of fund exhaustion as it is currently, after which general funds would be required to keep the program solvent.

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[8] It has been suggested that workers might annuitize these lump-sum balances, and several proposals for DC-type accounts do expressly deal with annuitization. This is not pursued here because it is unclear that a market for annuity of disability benefits would exist, even when a robust retirement annuity market might. Disability affects mortality in widely varying ways. Some disabled persons can be expected to live long after onset, and others only very short periods. For those with very short time horizons annuitization would most probably not be attractive, whereas for those with very long life expectancies, annuitization of the smaller account balances associated with early exit might likewise be unattractive to either party. Given that the observed preference for annuity would seem to vary predictably with account balance and longevity, it is unclear what terms would be offered to those disabled persons who seek annuitization, and whether terms would vary substantially by cohort. Without a clear idea on pricing, it seems inappropriate to carry forward this exercise at present.

However, from the worker's perspective this program hybrid is quite different than current law.

Disabled workers in this type of system would potentially be likely to observe a change in their

benefit level upon reaching retirement age, as the basis for benefit shifted from the DI trust fund

to the individual's account. Assuming the account was not drawn against during disability it

would continue to accrue gains in valuation and dividend realizations until retirement. Account

growth would be stunted however as additions to the account thought the withholding tax would

cease at the time workers exit the labor force. For this reason, changes in the level of benefits at

Normal Retirement Age would likely amount to negative income shocks. This potentially has

implications for SSI, though not as large as might be considered in a strict IA environment (like

that analyzed in Section 3).[9] With some likelihood, and depending on market conditions, age of

disability onset, and the proportionate size of the IA carve out, the size of the negative income

shock at time of Normal Retirement Age, and/or the impact of the transition on Treasury's

General Fund would argue for a more continuous disability-retirement benefit structure (as

currently exists). In this spirit, the next two subsections consider design options 1, and 2 listed in

the introduction to this paper.

4.1   Design 1: Disability and Account Forfeiture- Program Substitution

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[9] The disabled in Section 3 exercises have account balances that vary greatly, many would wind up with monthly benefits below the cut off for SSI, a welfare program administered by the SSA, and various state governments, which is financed by Treasury's general fund as an on-going expense. At present, absent state subsidies, the Federal SSI program tops up individual payments to $750 per month. Summing this figure over 20 years yields an amount of $180,000. Absent SSA's Disability Insurance program the account balances described by Figure 3 suggest that many disability cohorts could easily place burdens of over half this sum, per capita on the general fund over 20 years through the SSI program. It is estimated that half of the disabled population survives at least this long, and that 40 percent survive 30 or more years[9], thus the fiscal burden implied for the federal government is significant. As well, some states increase federal SSI benefits for their residents; for these states, there is an additional fiscal burden implicit in any Federal disability program that relies primarily on the workers Individual Account[9].

Avoiding this discrete income shock, analysis in this subsection assumes that the individual

would forfeit their account balance to the DI trust fund which would then pay them a benefit for

the remainder of their life calculated using the current (2000) law.

Assuming that the SSA did not change account makeup, they would on average accumulate 11

years of accrual with which to finance the inflation indexed annuity offered by current OASI

benefit, alternatively they could sell the fund and invest in risk free US Treasury bonds[10]. In this

case, even assuming that applicant behavior was not affected, it is still not obvious how DI trust

fund solvency would be impacted- a lot would depend on market returns. Rational individuals

would be most likely to forfeit their accounts when the expected present value of the stream of

DI benefits to be greater than the current value of their account. By this logic, one might expect

any such DI trust fund to be systematically under funded in providing retirement benefits.

The distinguishing feature of this integration of the two programs is the DI trust fund's receipt of

the worker's Individual Account, in exchange for continued disabled worker benefits past

retirement age. Because the opportunity to make such a trade might affect disabled worker

behavior, a model incorporating this approach is developed below.

Starting from the current law, anyone considering exiting the labor force ahead of normal

retirement age should see the DI program as at least superficially alluring. Individuals who

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[10] Either scheme would not necessarily affect government's relation with private industry in a way that warrants the same degree of concern given to other scenarios in which the government manages a trust fund comprised in portion of private equities. This is especially true if the fund is handled in such a way that the government is unable to know it's composition, i.e., in cases where individuals are allowed significant portfolio choice, however this likely would complicate applicant behavior concerns.

choose OASI early retirement benefits receive a reduced percentage of the benefit they would

receive from Disability Insurance, under which they receive their full benefit- as calculated using

their workforce history. The current difference between the two types of payment increases by

5/9ths percent each month that an individual chooses to retire ahead of the NRA. By comparison

with the Individual Account, the value of what is forfeited is less well known. This is especially

true for younger workers who face uncertainty in both the trajectory of market returns, and the

potential trajectory of their own careers. As workers approach the age at which the plan anyway

to retire however, the traditional DI benefit is more easily compared to their portfolio balances

and labor market outcomes are better known.

Besides the difference in monthly income, there is another difference between continuing labor

force attachment and the DI program, the availability of Medicare. Current DI recipients are

eligible for Medicare two years after successfully applying to DI (Medicare eligibility generally

occurs at age 65[11]). Thus successful application to DI occurring anytime up to two years before

age 65 therefore includes the added benefit of extended Medicare coverage.

In the model below, workers consider exiting the labor force and compare the expected value of

application to the DI program with the expected value of continuing labor force attachment,

including the expected value of continued retirement account accumulations. After considering

the expected value of each option the work rationally makes application to DI whenever it yields

the highest expected return. In a discrete framework this is akin to simultaneously comparing

options for exit to the option of continued work force attachment in each period.   If the

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[11] The Medicare eligibility age is not set to increase with the NRA at present.

individual options for exit compare unfavorably with work in the model, then the individual fails

to exit the labor force in the current period.

Differences in across individuals lead to heterogeneous outcomes. In this model there are a few

main points of variation across individuals in this model. In evaluating DI, the most significant

are the persons expected probability of acceptance, the time remaining to the Medicare-eligible

age, and the individual's estimate of life expectancy[12]. Let:

φ = Pr (eligible | health)

θ = remaining life expectancy | age & health, or age & self assessment

$\wp$ = discount rate

ξ = expected cost of obtaining medical evidence

μ = expected value of 1 months Medicare coverage.

α = (NRA – current age in months)

age   = age of individual considering exiting the labor force = NRA - α

PV   = present value as a function of θ, $\wp$.

PIA   = the SSA primary insurance amount at Normal Retirement Age[13]

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[12] Life expectancy is a function of disability as well as other potentially unrelated things such as consumption of cigarettes, alcohol, and other inputs that vary within categories and intensities of disability as experienced. The individual may have unique information on these additional factors.

[13] This is the benefit amount received in the case of a successful application to DI.

With these components in place we can begin to give a formal structure to the relative benefits

and cost of application. Given an average waiting period of 5 months, the expected value of an

application to DI in the current period can be expressed as:

1. $E(DI) = \varphi\, PV[(PIA(\theta-5) + (\max\{0, (\alpha-24)-age\}\mu)] - \xi$

Where $((\alpha-24)-age)\mu$ adds the value of Medicare benefits.   This exposition is written generally,

for the specific case of disability eleven year ahead of normal retirement, the value is readily

derived as 132μ

Allowing individuals a choice to remain in the labor force requires that we model the expected

value of work. The expected value of work to an individual is the pay received from work,

minus the disutility of working, plus the expected increase in the individuals retirement account

balance from further workforce participation. Assuming wages constant, the marginal change in

the PIA for any extra month of work is the value of that months withholding, and the probable

compound. Let:

w = monthly wage and benefits

τ = the withholding rate assigned to employers – assumed to be ½ total withholding.

λ = disutility of working one additional month

π = market valuation of retirement account at end of period.

Then the expected value of working an additional month is:

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2.　　　$E(W_t) = w(1+\tau) - \lambda + \delta(E(\pi_{t+1})/\delta(age) + \delta(E(DI))/\delta(age)$

Where:

3.　　　$\pi = 2\tau w + \delta\pi_{t-1}/\delta t$　　　　　and,

4.　　　$\delta(E(DI))/\delta(age) = \varphi PV(-\mu)$　　for individuals with extended Medicare, else $= 0$.

5.　　　$\delta(W_t)/\delta(age)$ is a function of average real wage growth for the cohort- tied to productivity, labor's share of profits, and the experience weighted age profile for relevant worker type.

Of note, are the different signs for the changes in work and DI award with respect to age. Working an additional month has positive effects on retirement savings in most periods, it's expected contribution declining in line with remaining compound periods, and the individuals degree of pessimism regarding likely financial market performance. However, working an additional month has a strictly non-positive effect on expected DI award. The effect is negative each month before the last 24 of work and zero thereafter, as a function of μ.

Given these options, an agent can compare E (W) and E (DI) and make a forward-looking choice in the current period about working, or applying to Disability Insurance. The worker should be indifferent if the valuations of each option are equal. There is a third option too, which is to exit the labor force and to let the account balance in the retirement account continue to accrue.

Current consumption must then be financed out of savings. This is akin to letting w=0 and $\lambda=0$[14]

in the formulation above.

Considering this third option is relevant for the predicament in which a worker is unexpectedly

let go and does not expect to find work easily. The sudden change in $E(W_t)$ that accompanies

such action changes the valuation of labor force participation as follows-

6. $E(W_t \mid w=0, \lambda=0) = \delta(E(\pi_{t+1})/\delta(age) + \delta(E(DI))/\delta(age)$

Thus only when savings are sufficient to allow current consumption, and

7. $\delta(E(\pi_{t+1})/\delta(age) > \delta(E(DI))/\delta(age)$

is remaining in the workforce both attractive and feasible.

Two very interesting and important results follow directly. First, without sufficient savings

continued labor force participation may actually be attractive, without being feasible. Second,

even with sufficient savings, a worker may wish to convert their retirement account balance into

a DI balance whenever the inequality is reversed. Thus much depends on a workers contingent

savings, and on expectations for $E(\pi_{t+1})$, where π_{t+1} is now only a function of market

performance.

In economic downturns there is often a simultaneous increase in unemployment and a decline in

equity market performance, thus using the model above we should expect increased application

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[14] Actually if the disutility of work is derived form being in the workforce then some or all of the value of λ should remain- this is akin to what Black, etal. found for coal towns with high layoffs- that there was a disutility attached to remaining in the labor force and being without work in the current period. However simplifying to allow $\lambda=0$ should make staying in the labor force more attractive than otherwise, and thus errs on the side of making DI application less attractive.

in downturns. This is not unique to the equity financed Individual Account retirement savings

structure analyzed here[15]; what is unique, however, is the degree of uncertainty in the valuation

of continued work and retirement benefits, which now more closely ties the workers decision to

remain in the workforce with equity market performance through the defined contribution

retirement program, and the workers expectation $E(\pi_{t+1})$. The concern is that some individuals

who might otherwise remain in the workforce holding retirement benefits nearly constant in a

recession, now exit and apply for DI in order to trade their uncertain account balance for a more

certain stream of payments in later years.

In order to avoid the perverse incentive described above, which may encourage current DI

program uptake in the context of Individual Accounts whenever market returns decline

precipitously, one might wish to reintegrate persons and their accounts at Normal retirement age,

perhaps with accommodation for loss of contributing years. The next section considers this

alternate approach.

4.2   Design 2: Disability and Integrated Accounts –Serial Participation

This approach to integrating DI in a system of Individual Accounts for retirement would preserve

the individual's account and have the DI trust fund continue to make contributions toward

disabled individual's retirement. As such the DI trust fund would experience an additional

burden through the requirement that it finance both current benefits and contributions to the

Individual Account on behalf of the disabled worker. The DI trust fund would fail to acquire the

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[15] Included Figures 4a, and 4b show historic trends in application and award with respect to recessions.

assets of the workers account and would no longer be burdened with benefit payments past

retirement age. There may still be discrete jumps in benefits when the funding basis changed at

retirement age, however it would no longer be the case that the disabled faced a greater

probability of being poor in retirement due to the loss of withholding contributions in periods of

disability. The disabled would retire to the market situation faced by their birth-cohort[16].

Behaviorally, the agents described above could be expected to evaluate this sort of program

differently. Remaining in the workforce while out of work, i.e. when w=0 and λ=0, now

imposes greater opportunity cost, because $E(\pi_{t+1})$ is now always greater within the disability

program, than outside of it, by the amount of withholding contribution put aside on behalf of the

worker, 2τ, this clearly motivates application and workforce exit[17].

Replacing the guaranteed stream of payments past retirement age with individual access to their

account can either increase or decrease application motive, and so is less clear-cut. In cases

where the agent expects the present value of current SSA retirement benefits to be less than that

of the account, the agent now has comparatively more incentive to apply. Alternatively, in cases

where the expected present value of the account, including contributions, is less than the SSA

benefit the incentive to apply is comparatively reduced, though observed behavior may be less

affected in this group. This is because in cases where the worker has significant account

balances and high wages, the ability to keep their account, and the contribution stream might

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[16] This statement assumes that those participating in the labor force do not forestall exit when private market returns are relatively low.

[17] If workers kept their portfolios unchanged, such continued withholding could add significant support to markets during downturns. Since however it is unlikely that workers would keep fund allocations constant, it is unclear how large any such stabilizing affect might be.

actually remove a barrier to application to DI, while for workers with small accounts and low

contributions, the lack of ability to trade their account for a higher valued annuity will reduce

incentive. Since small-account workers among the most likely to have lower contingency

savings and thus few alternatives to applying, behavior may be more similar for this group under

either structure. For the less affluent individual application behavior may be dictated by savings.

This design however does avoid the perverse incentive found in section 3.4.1, for individuals that

would successfully apply to DI simply to avoid uncertain market outcomes, the new program is

no longer attractive. There is no ability to trade away from the account, and no contingent

minimum benefit for retirement of the type referred to by Smetters in the literature review above.

Because proposing that the DI trust fund pay surrogate withholding taxes to individual funds

entails added expense it is useful to try to anticipate costs. In order to ascertain that, one must

first specify how much the fund should contribute, on behalf of the worker. To give one answer,

the contributions might be expected to continue at the level that the disabled worker had

followed before becoming disabled, however, this would likely under-fund young disabled

workers unless it incorporates an experience path, which inflates contributions in later years.

Such calibration within industry and job classification should be seen as relatively feasible,

though simple approaches are likely to overstate wage growth if they consider only surviving

workers. More general series may thus do a better job as they capture a larger cross-section of

workers, regardless of career path across industry and job classification. For this effort, a rough

estimate of this spirit is calculated as the number disabled times the withholding tax on the

experience adjusted manufacturing wage series[18], for the average period of disability. For one of the more recent retirement cohorts (entering the workforce in 1960, expected retirement in 1999), an 11-year disability would cost the trust fund roughly $40,300 in withholding tax over an equal period. Inflation adjusted per worker costs in future periods could be expected to rise in line with real wage increase, and thus would be tied to productivity. Figure 4a gives a historic trend in the number of awards through 2001. Taking the average annual number of awards in recent years yields an estimate of 625,800 awards and a total increased trust fund exposure of roughly $25.2 billion over the course of a single cohort's disability.

Applying this estimate across future cohorts, the program variant described above is likely to due significant further damage to the DI trust fund. Additional withholding would thus be required to support it. However, SSI burden should not be affected in this variant of the DI program, either in years of disability or later, through retirement, at least not beyond changes in burden associated with an Individual Account reform of OASI.

In terms of worker incentives, this type of program does do a better job of insulating the program against equity market shocks, however it may not improve upon employment shock outcomes. Of course, as figures 2a and 2b illustrate, the current program shows evidence of response to labor market shocks caused by recession, so this type of responsiveness may be more in line with current program policy and expectations.

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[18] A better wages series can be derived from observed wages of disabled applicants, or awardees in years prior to application, and the experience weighting the contributions based on age of onset. A current sample of this type exists as the SSA earnings history attached to the restricted access HRS data.

5.0   Summary of Results

The work here has focused on an Individual Account made up completely of the S&P 500. Of course workers might insure themselves with portfolios that lean toward less volatile assets. Also while the focus here is clearly on DI, analysis has been carried out which may be considered relevant to a retirement system based on Individual Accounts. Because these results may also be of interest and because they support disability analysis herein, the results of this wealth accumulation simulation are depicted in Figure 1. This figure should serve to orient the reader with some fundamental impressions before carrying forward the papers main body of work. While individual equity accounts do much better than the US public retirement program on average, they fare far worse when compared to the US public disability program. This is troubling because historically US retirement and disability programs have been closely linked. Table 1 gives a summary of discrete binary comparisons of the programs. Figure 1 and Table 1 together suggests that stock market based Individual Accounts alone would not be likely to afford disability benefits comparable to those provided by the current public defined benefit plan.

In another comparison, Figure 2 gives readers an idea of how large Individual Accounts are likely to be eleven years ahead of retirement, at the average age of disability award. A bottom panel provides the reader a look at the ratio of expected awards at disability, and retirement for each cohort. In these figures, the volatility in account balances based solely on cohort is striking and significant at all withholding levels. It is worth highlighting the large standard deviations in Table 2, which suggest that a great deal of uncertainty remains regarding the adequacy of Individual Account savings for disability.

Figure 3 looks at the benefit provided by a DI system based solely on Individual Accounts once more; this time in comparison with account balances after a full 40 years of workforce participation and contribution. Results are reported for an average worker's account 11 years out from retirement as well as for 5 years out from retirement and 3 years out from retirement. In all three cases the degree of deviation by cohort is again striking. There are quite a few years where missing even 3 years of returns significantly reduces Individual Account yield when compared to the counterfactual of remaining in the workforce. Perhaps not surprisingly the opposite is true as well. In the context of retirement this volatility may further induce early retirement for all covered workers when markets give strong returns, and discourage any exit in the wake of poor market performance poorly[19]. An increased link between labor and financial markets for elder workers is of concern because the ability to delay retirement depends quite a lot on the condition of the individual and on the condition of the labor market during these periods. Financial market volatility may be of concern as well if workers are not be able to appreciate historically high valuations as they are realized, or are tempted to switch to high risk high return strategies late in their careers, when they are least likely to be able to recover from any realized losses.

Since workers do not really know what kind of returns to expect from the market over the course of several years; Figure 3 is not intended to suggest that a worker has sufficient information to time exit optimally.   It is important to note as well that some of the return ratios across time here look rather low not because returns were abnormally low for early exits, but rather because the

---

[19] This is particularly concerning if a wage response follows since, in boom years experienced workers would be more scarce, and in recession years more plentiful.

market continued to gain or showed accelerated gains, as was the case in the later 1990's. In this light, the bottom panel of Table 2 gives results on account ratios and compounding for 1st year investments- the investment with longest opportunity to compound. Thus Table 2 gives a more absolute take on time based variation in outcomes and should work to enhance appreciation of market outcomes beyond what Figure 4 would alone provide.

Considerations of likely worker response to program changes is concerning. In hybrid programs which fuse a public disability insurance program to system of mandated Individual Accounts, incentives to exit early and claim disability insurance are found to be greater than those under the current program rules. Lest one consider that the required condition of "Disability" should limit behavioral changes, Figures 4a and 4b apprise the reader of trends in application and award for the current Disability Insurance program. Here one can see in increase in both application and award of DI under adverse conditions. With further appeal to a behavioral approach to application, the model developed in Section 4 of this paper suggests that stronger counter-cyclical application patterns should emerge if the current DI program is left in place while mandated Individual Accounts comprise retirement savings either in response to negative equity market shocks, or negative labor market shocks, or both. One formulation described in Section 4.2 does a good job of theoretically insulating the program from equity market shocks, but increases program expense and thus may actually increase some labor market distortions when compared to either the current program, or other hybrid designs described here. Taken along with the results of Table 1, it seems unlikely that Individual Account balances would afford to afford equal or better protection for workers than the current disability program. Thus there is strong reason to believe any integration of a defined contribution retirement system based on

Individual Account with a defined benefit system like the current DI system would see an

increase in counter-cyclical application to the defined benefit disability program.

6.0 Summary Conclusions:

Analysis here has used as its kernel a rather extreme position regarding Social Security program

design, in which the OASI program is entirely scrapped and replaced with a mandated system of

Individual Accounts invested in a single equity index. Results thus should be considered in light

of this assumption.

In such a system, DI benefits are considered first in the context of an individual's account for

retirement. There is nothing very special about looking at fund balances ahead of retirement,

however putting these results in the context of disabled populations, is important because

disability, by it's very nature limits options for continuing work force participation, so for very

many disabled persons there is no near substitute for application. The Individual Account

structure modeled here in Section 3 is exceptionally extreme, amounting to a program where

workers self-insure against disability, but since bad outcomes maybe outside of the workers

control, such acts of nature are usually provided for with pooled insurance designs. Inclusion of

a workers SSI disability award shows that in lieu of a pooled insurance approach to disability,

the general position of federal and state finances would likely be worsened.

Next a continued defined benefit pooled insurance approach to DI in which workers forfeit their

accounts to receive DI is considered and shown to likely reduce workforce participation when

either equity markets or labor markets perform poorly. A third alternative explored here allows

workers to keep their accounts, and increases the burden on the current DI trust fund though it

does a better job of insulating DI against poor equity market performance, but may increase

uptake when poor labor market outcomes occur. Either defined benefit approach to disability

benefits in an Individual Account context substantially reduces the displacement associated with

SSI and other federal and state specific programs.

While the simple exercises here have not focused on cross-section variance in earnings or the

impact of wage inequality on accounts (except as enters through increases in productivity in the

included historic wage series), the volatility in returns across time as depicted is strong enough to

cause some concerns about equity along the lines of those raised by authors who have focused

more on these topics, some of whom are included in the literature review above. Further in this

regard, work here has shown that even for persons who exit the workforce very near to

retirement, that there can be great swings and reversals of fortune such that early workforce exit

may be desirable, or may turn out to have been desirable after the fact. This is significant for

Individual Accounts both in the context of retirement and disability. Several current proposals

attempt to limit worker investment choices to reduce risk. The comparisons of outcomes near to

the end of standard careers suggest that a tapering down of account holder choices in later years

may be particularly beneficial in reducing the volatility of returns, however such tapering

presents it's own cross-cohort challenges and are beyond the scope of this work.

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Table 1: Direct Simple Comparisons of Accounts by Type

OASI, DI, and Individual Equity Account Returns Compared by Retirement Cohort
For retirement cohorts 1929 - 2003 (75 age cohorts)

	IEA > SSA	SSA > IEA	Total	% Success IEA [a]
Social Security Regulation, Year 2000 Methodology: [b]				
OASI	56	19	75	75%
DI	4	71	75	5%
44% Replacement Rate Methodology: [c]				
OASI	61	14	75	81%
DI	6	69	75	8%

Notes:
-a-: Individual Equity Account represents investment of 10.6% of labor income in S&P 500 with
      reinvestment of all returns. Final balance is divided across 20 remaining years of life.
-b-: OASI and DI returns are for single claimants with no survivors
-c-: Public Pension Benefit is calculated to be 44% of final year earnings

Table 1a illustrates the effect different withholding tax assumptions and methodologies can have on outcomes. (See Figure 1.) Using a constant 44% replacement rate, and the current withholding tax assumptions an Individual Account invested in the S&P500 yielded greater retirement returns 75 percent of the time.

Table 1b suggests the same pattern would not hold for single disabled beneficiaries, who file and claim disability at the current average age of 49, 11 years before the SSA benchmark early retirement age.

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Table 2a and 2b:

Table 2a:
Individual Account ratios DI(IA):OASI(IA)

Years Before Retirement at Time of Exit	3	5	11
Average	83.7%	41.8%	**45.0%**
Median	76.2%	33.0%	**31.1%**
Std. Deviation	30.2%	27.8%	**30.8%**
Maximum	183.4%	131.8%	**123.4%**
Minimum	44.7%	7.7%	**10.7%**

Table 2b:
Number of Times Worker's First Year Contributions Compound Before Withdrawl

Years Before Retirement Age at Time of Exit	0	3	5	11
Number of Years of Compounding	**40**	37	35	**29**
Average	**16.1**	12.8	10.8	**6.8**
Median	**13.0**	11.4	9.3	**5.9**
Std. Deviation	**8.7**	6.1	4.7	**3.1**
Maximum	**44.3**	31.8	26.0	**15.5**
Minimum	**5.4**	4.6	4.2	**2.3**

Tables 2a and 2b depict summary statistics in two important dimensions for Individual Account holders.

Table 2a gives much the same information as is illustrated in Figure 4, in table format.

Table 2b describes average compounding and associated variability for workers first year contributions to Individual Accounts, for the same three relative early exit dates associated with disability, and including the calculation for a full 40-year work history. Of interest, the minimum compounding outcomes are larger for longer work histories. The range of outcomes is large with maximum compounds over six times as large as minimums in each exit case.

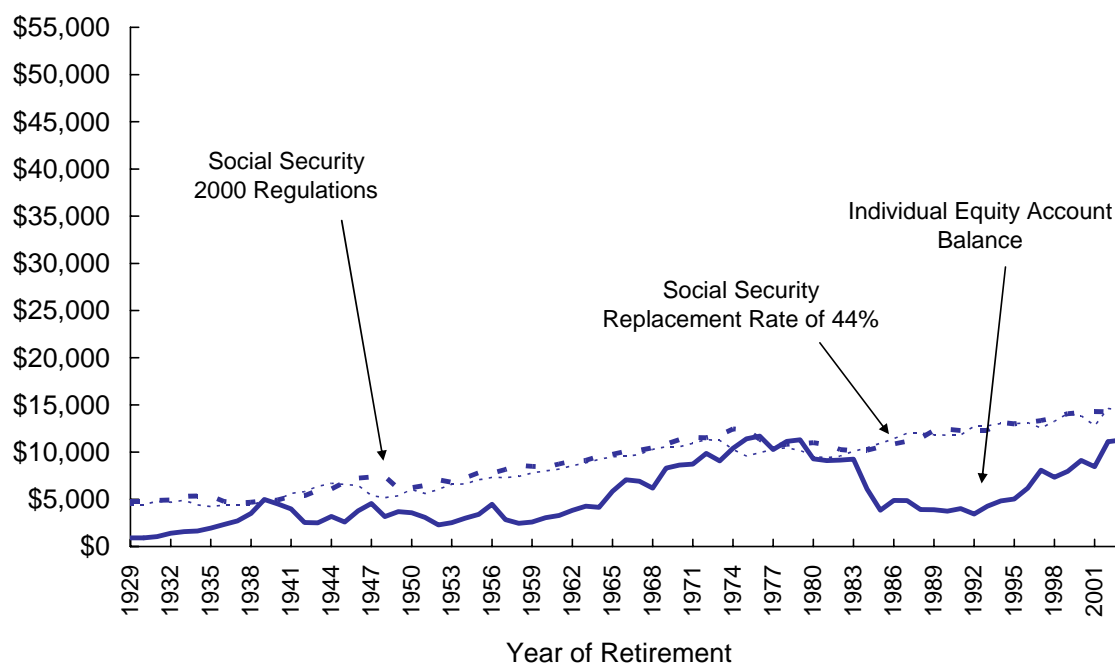## Figure 1: Hypothetical IEA balances compared to OASDI returns

Individual Equity Account Balance at Retirement
for retirement cohorts 1929 - 2003 (1999 Dollars)
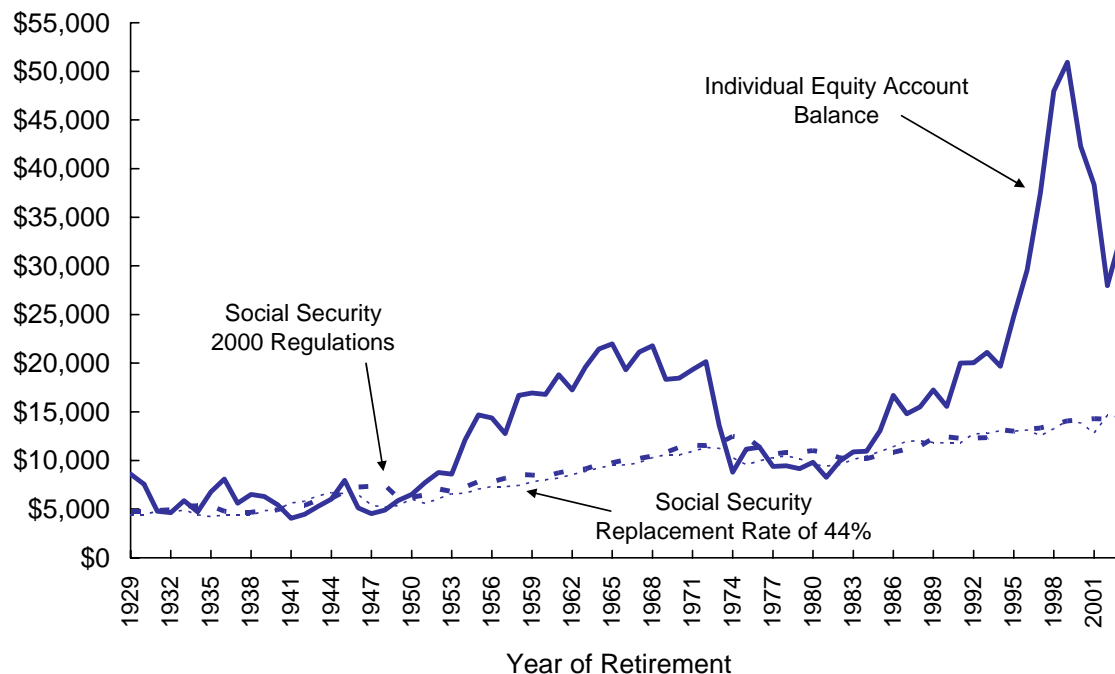
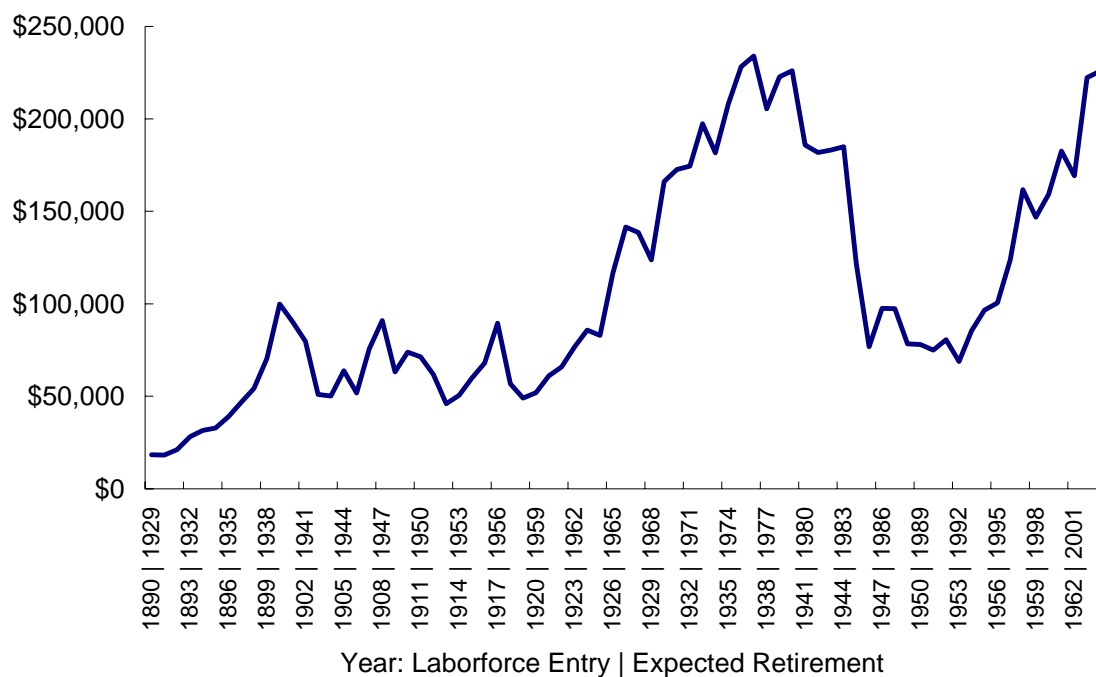**Individual Equity Account Balance - with Disability 11 Years before Retirement**
for retirement cohorts 1929 - 2003 (1999 Dollars)

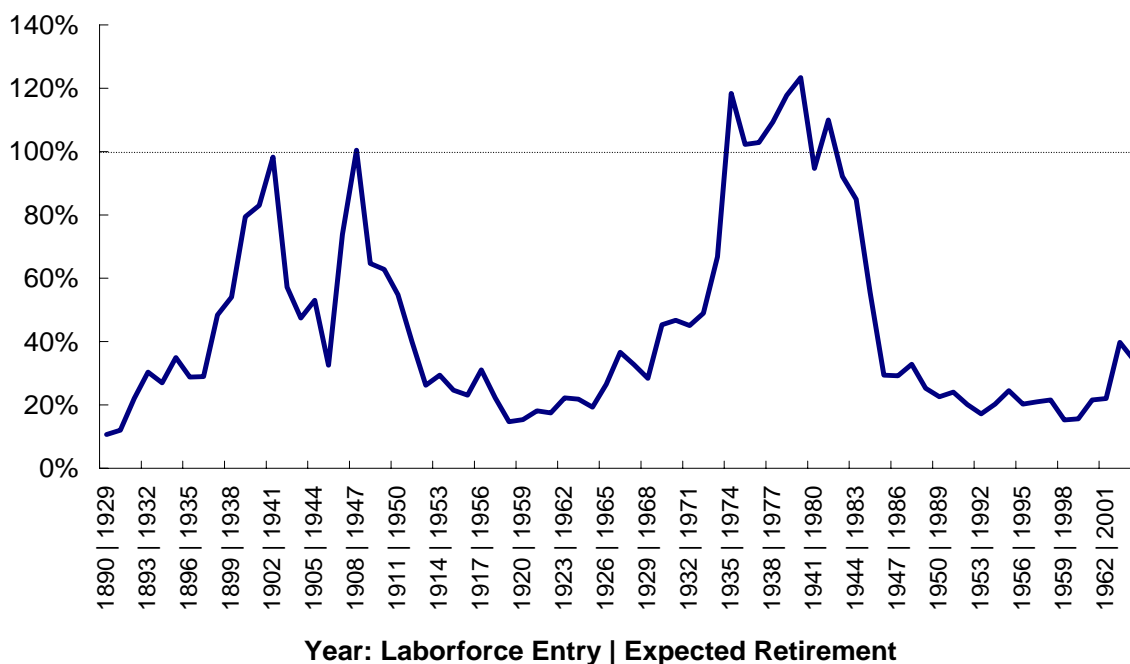## Figure 2: Measures of individual equity account balances

Individual Equity Account Balance 11 Years Before Retirement
for retirement cohorts 1929 - 2003 (1999 Dollars)

Year: Laborforce Entry | Expected Retirement

Individual Equity Account Balance Ratio
for retirement cohorts 1929 - 2003

Year: Laborforce Entry | Expected Retirement

Figure 3: Account Balance Ratios at different Disability Exit Points

Three Measures of an Individual Equity Account Balance Ratio
for retirement cohorts 1929 - 2003

Year: Laborforce Entry | Expected Retirement
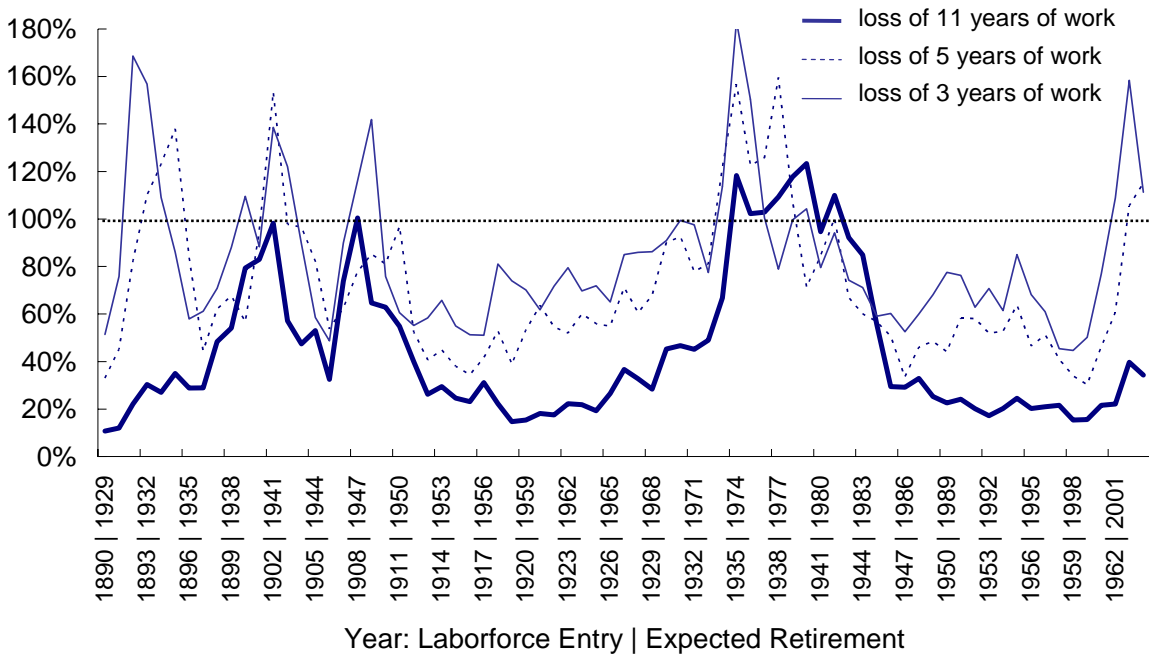
Account Balance Ratio is defined as (Disability:Retirement) Assuming Intended 40-Year LFP

Figure 4: DI application & award over the business cycle & across time

Figure 4a:

Social Security Disability Insurance Applications and Awards
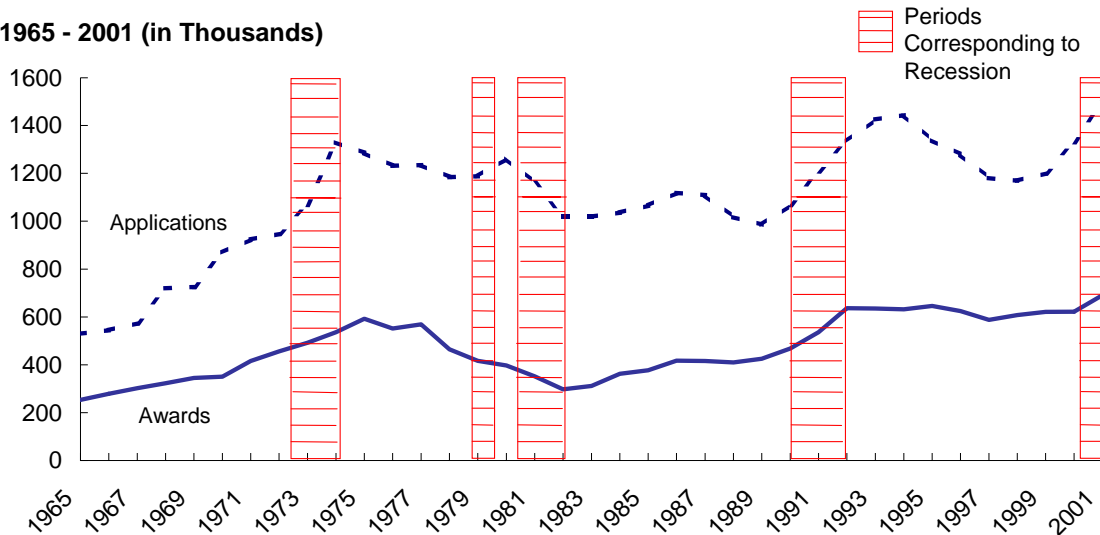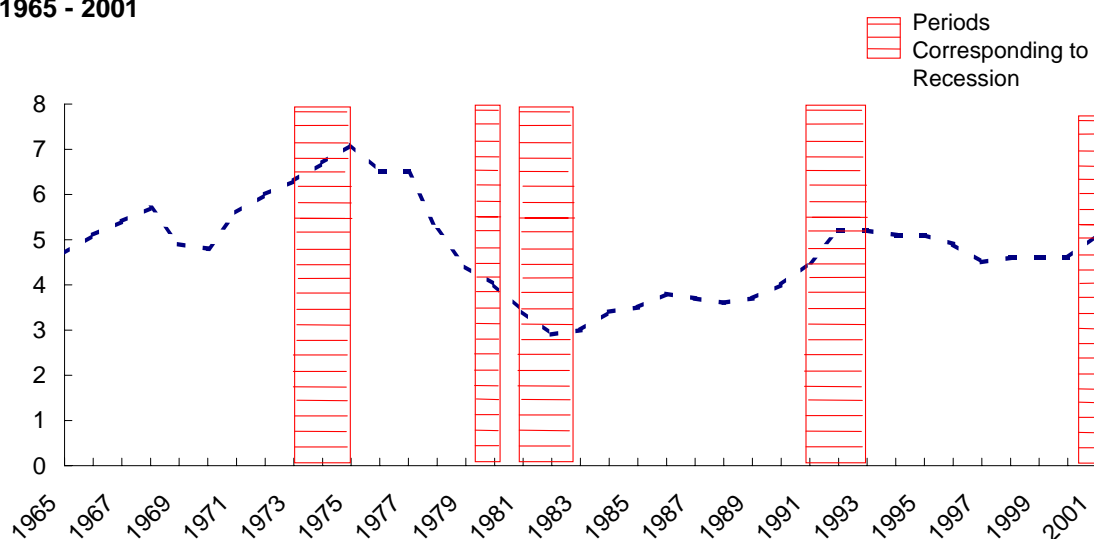
1965 - 2001 (in Thousands)

Figure 4b:

**Social Security Disability Insurance Awards per 1,000 Insured Workers**

1965 - 2001

Both applications and trust fund burden tend to increase during recession, with the recession(s) of the early 1980s being a notable exception.

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Figure 5:

Age Earnings Profile of Wage or Salary Income
Conditional on Working at least 35 hours a Week, and 39 Weeks a Year
Census 2000 Suplementary Survey (1999 data)

Plotted data

Fitted Quadratic: $y = -36.846x^2 + 2114.7x + 16500$

Age
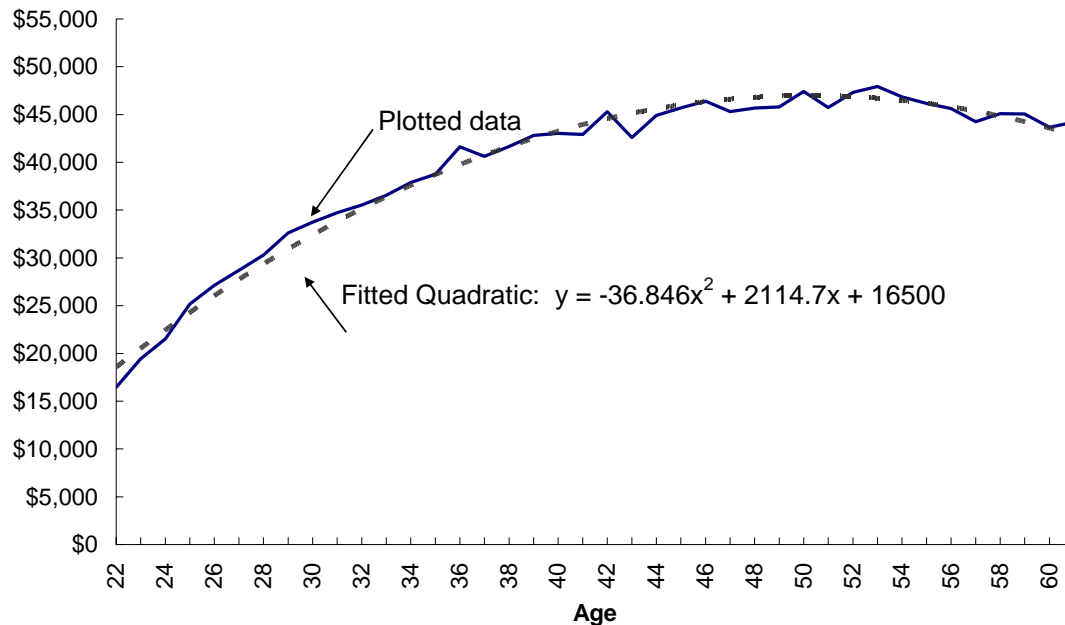
Data from the Census 2000 Supplementary Survey used to experience weight the earnings of
workers in each cohort, by age for their period of labor force participation, up to 40 years
between ages 22 and 61. The fitted earnings peak for workers included in the estimation occurs
at age 51. Fitted Data are used to synthesize the effect of experience on worker wages, applied
as a percent of wages for the average aged worker in the data, age 41. By age 61, the experience
weight has declined to 99 percent of the median age wage. Age 61 is the first age for which the
experience factor is lower than 100 percent beyond median age 41.

Appendix A: Historic Wage Series Construction

For the exercises in Section 3, Workers are assumed to earn the average annual earnings in manufacturing as reported in the Bureau of Census' *Historical Statistics of the United States* (which encompass the period of study). In comparison with either the SSA's median wages across all industries (which extend back to 1950)[20], or historic wages across all industries from the *Historical Statistics* (which extend back to 1900), the manufacturing series yields larger earnings (roughly 9.4 percent higher than the all-industry series, and 36.9 percent higher than the constructed SSA average wage series, on average), and hence larger investments. Use of the manufacturing series tends to overstate lifetime IA yields when compared with SSA's median wages or the all industries series from the *Historical Statistics*, but it has the advantage of being a continuous data series.

In order to compute SSA benefits it is necessary to extend the SSA average wage series from 1890 to 1949. This is accomplished using both the all-category and manufacturing category wages series described just above. Because the all-category series only extends back as far as 1900, a first effort must be made to integrate this series with that for manufacturing employees. This is accomplished utilizing the difference between the two series for years 1900 – 1905. The average ratio of the two series is then used to extend the all-category series back to 1890. From here the composite all-category series is smoothed to the SSA series as follows. A ratio is calculated for the historic series and the SSA series for the 10-year period 1951 to 1960. The maximum and minimum years of deviation are discarded and the resulting eight-year series of

---

[20] The SSA average wage series was constructed as part of the 1977 Amendments in order to calculate worker Primary Insurance Amount based on a formula that compares yearly worker wages to the average series.

deviations used to derive a conversion ratio[21]. The conversion ratio is applied to the historic

series to create a synthetic SSA-like historical series. This series is checked against two other

sources, the Current Population Series for years 1947 forward, and the historic manufacturing

wage category back to 1890 to ensure consistency with these reference wage series. As a test of

sensitivity to the constructed smooth splined series for calculating the SSA benefit, a rough 44

percent replacement rate (based on the last year of earned manufacturing wage for each cohort)

is included in both Table 1 and Figure 1. While there is some variation between the two results,

they are remarkably similar of the bulk of the period of investigation.

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[21] A larger series is used for conversion in this second step because of the length of sample to be spliced (1890 to 1950), however there are limits to how long the series used for this purpose should be. Specific to this exercise, as standards of living rose and covered worker categories of employment increased throughout the 1950's and 1960's, using longer samples to compute the conversion ratio changes the compared populations and tends to inflate the historic series. The choice of eight years attempts to balance the tension between using too few observations, and too may later observations, however, the choice is somewhat arbitrary.