Mortality and Disability Risk Sharing under the OASDI Program in a Stochastic Overlapping Generations Framework[1]

by
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Summary

Individuals develop adverse health conditions as they get older, which limit their earnings, resources, and wellbeing. Workers also face uncertainty about their life spans, which affect their savings and consumption decisions. Many well-known economic characteristics of these risks prevent private markets to pool these risks adequately. The OASDI program plays a role of these missing markets. Workers, who earn the insured status by working and contributing to the OASDI program a certain minimum amount of time, are eligible to get annuity and survivors benefits from the OASI program, and disability benefits from the DI program. The paper addresses the following issues:

- What is the value of the OASDI program to individuals from the perspective of sharing these two types of risks? That is, what is the size of the welfare gains the program brings to individuals?
- How does the OASDI program affect aggregate capital stock, average consumption and the elderly poverty rate?
- How much are individuals willing to pay for the type of protections they get against these risks?

This paper uses a stochastic overlapping generations model, calibrated to the US economy to examine the above issues. The paper studies the long-run equilibrium and takes as benchmark an economy in which individuals self-insure themselves against these risks by adjusting their own savings and labor supplies without access to an OASDI program or private markets for sharing these risks. The main findings of the paper are that the OASI and DI programs together improve lifetime welfare of workers, reduce variations of consumption and asset holdings over their life cycles, and virtually eliminate elderly poverty. The value of the OASDI program to a representative worker is as high as if he has an extra 13.72 percent higher consumption at all ages of his life at the benchmark equilibrium. The value is even higher for the DI program. For the OASI program, however, disregarding the survivor's benefit component of the program, and without incorporating dependence of individual wellbeing on the wellbeing of others, the actuarially fair pay-as-you-go (PAYGO) financed annuity component of the program does not improve individual lifetime wellbeing. Since the OASDI program mitigates the precautionary motives for savings, the macroeconomic costs of the program are that it reduces the aggregate capital stock and per capita consumption and income. The paper uses a notion of replacement rate as the percentage of the working population's average yearly wage (AWI) that the program will pay out to an individual in case the risky event covered by the program occurs. The replacement rate that maximizes the lifetime wellbeing of an individual turns out to be zero percent for the OASI program without the survivor's benefits component, and 90 percent for the DI program.

[1]Draft prepared for presentation at the Western Economic Association Meeting, June 29-July 3, 2007, Seattle.

Abstract

This paper uses a stochastic overlapping generations model, calibrated to the US economy to examine the above issues. The paper studies the long-run equilibrium and takes as benchmark an economy in which individuals self-insure themselves against these risks by adjusting their own savings and labor supplies without access to an OASDI program or private markets for sharing these risks. The main findings of the paper are that the OASI and DI programs together improve lifetime welfare of workers, reduce variations of consumption and asset holdings over their life cycles, and virtually eliminate elderly poverty. The value of the OASDI program to a representative worker is as high as if he has an extra 13.72 percent higher consumption at all ages of his life at the benchmark equilibrium. The value is even higher for the DI program. For the OASI program, however, disregarding the survivor's benefit component of the program, and without incorporating dependence of individual wellbeing on the wellbeing of others, the actuarially fair pay-as-you-go (PAYGO) financed annuity component of the program does not improve individual lifetime wellbeing. Since the OASDI program mitigates the precautionary motives for savings, the macroeconomic costs of the program are that it reduces the aggregate capital stock and per capita consumption and income. The paper uses a notion of replacement rate as the percentage of the working population's average yearly wage (AWI) that the program will pay out to an individual in case the risky event covered by the program occurs. The replacement rate that maximizes the lifetime wellbeing of an individual turns out to be zero percent for the OASI program without the survivor's benefits component, and 90 percent for the DI program.

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1. Introduction

In this paper, I use a calibrated stochastic overlapping generations model of the US economy and study the nature of mortality and disability risks sharing provided by the OASDI program to workers, and study how the program improves elderly poverty prevalence in the long-run stationary equilibrium. I also examine the effect of the program on aggregate capital accumulation.

Disability and mortality risks are two significant risks that affect individual worker's labor supply, savings and wellbeing. Over time, an individual worker may develop work-limiting disabilities with a small but a positive probability, which limits from engaging in any substantial gainful activity (SGA) in the labor market. Often such disabilities result in death of the worker within a year after the incidence or prolong for many years. When a worker becomes disabled, his earnings reduce almost to zero, leading to very low levels of consumption during disabilities. A disability insurance program that charges a reasonable premium to an able worker and pays out a certain fraction of his productive year's earnings when he becomes disable, it can smooth his consumption and improve his wellbeing. The DI component of the OASDI program provides such insurances. Without the OASDI program or disability insurance markets, individuals will self-insure against such risks by saving more and working longer hours when he is able so that he can spend resources from his savings to endure disability.

In the case of mortality risk, if an individual knew exactly how long he was going to live, he would have planed his asset holdings and labor supplies over time in such a way that he ensured himself a uniform stream of consumption over his life span. However, when the timing of death is uncertain, one the one hand, he would like to save more during his young age as a precaution against the event that he lives longer than he expected. On the other hand, since he is more likely to survive in young ages and there are only small chances that he will survive to old

ages, he would like to consume more out of his asset holdings during young ages and save very little for his old age. The relative magnitudes of these two opposite effects would determine his asset holdings and consumption pattern over his life cycle. If the second effect is, however, very strong, he will end-up with little resources for his old age in the self-insured economy. This outcome is not because individuals are irrational and myopic so they do not save enough for their old age, as argued by some to justify the existence of an OASDI program. This outcome is the optimal decision under rational expectations. An annuity scheme that allows an individual to put his savings in it during his young ages, and get a stream of fixed incomes from it during his retirement ages till he dies, can pool mortality risks across the population, and thus can assure a higher level of consumption during older ages. The OASI part of the OASDI program provides such annuities to workers. However, the fixed income that the OASI program pays to a retired individual is computed on the actuarially fair pay-as-you-go basis, which could be lower than the rate in a private market especially when the interest rate is higher than the growth rate of the economy.

Many well-known economic problems[2] associated with these two types of risks prevent well functioning private disability and annuity markets to emerge. The OASDI program plays the role of these missing markets. Workers, who earn an insured status by working and contributing to the OASDI Trust Fund a certain minimum amount of time, are eligible to get annuities and survivors benefits from the OASI program, and disability benefits from the DI program. At this stage of the analysis, following the computational simplifications adopted in other research in the literature, I focus only on the annuity component of the OASI program. I will include survivor's benefits component in my future work.

Compared to an economy that does not have an OASDI program or private markets for sharing disability and mortality risks, how does the availability of an OASDI program affect the means and variances of consumptions, asset holdings and earnings over the life cycle of a representative individual? How does it affect elderly poverty? In addition, how does it affect aggregate capital accumulation? What is the worth of the OASDI program to individuals? What are the optimal tax-benefits rates for the OASI and DI programs that maximize a representative consumer's average lifetime welfare?

[2]The problems are moral hazard and adverse selection.

Almost all previous studies of the US economy that used an overlapping generations general equilibrium framework find negative effects of the program on individual life time welfare and long-term capital accumulation. For instance, Feldstein (1985) finds that unless a portion of the population is completely myopic and thus lack foresight to provide for their own old-age, an OASI program does not improve welfare. Hubbard and Judd (1987) use an overlapping generations model with mortality risks and liquidity constraints that prevent from borrowing against future labor incomes (this is also the set-up of the present paper). They find that an OASI system reduces welfare of a representative individual in the long run. The reason for this finding, however, may not be the liquidity-constrained assumption. For instance, Auerbach and Kotlikoff (1987) use an overlapping generations model that does not incorporate any kind of risks but allows consumers to borrow against their future labor incomes. They find that the OASI program significantly reduces the long-run individual welfare and aggregate capital stock. Against these findings on the other hand, Imrohoroglu et. al. (1995) assume that the rate of time preference is greater than unity in an overlapping generations model with mortality risks. They find that the OASI program improves welfare of a representative individual.

No previous studies examined the risk-sharing properties of the DI program within an overlapping generations general equilibrium model. Chandra and Samwick (2005), however, consider a partial equilibrium framework without taking into account the feedback effects of the DI program on the macro economy. They exclude mortality risks and the OASI component of the OASDI program. They find that the DI program improves welfare of a representative worker; furthermore, a representative worker is "willing to pay about 5 percent of expected consumption to eliminate the disability risk" that he may face; and "no more than 20 percent of the mean assets accumulated before voluntary retirements are attributable to disability risks".

In this study, I incorporate both disability and mortality risks, and consider both the OASI and the DI components of the OASDI Program. I examine the long-run equilibrium and take as benchmark an economy in which individuals self-insure themselves against these risks by adjusting their own savings and labor supplies without access to an OASDI program or private markets for sharing these risks. The main findings of the paper are that the OASI and DI programs together improve lifetime welfare of workers, reduce variations of consumption and asset holdings over their life cycles, and virtually eliminate elderly poverty. The value of the OASDI program to a representative worker is as high as if he has an extra 13.72 percent higher consumption at all ages of his life at the benchmark equilibrium. The value is even higher for the DI program. For the OASI

program, however, disregarding the survivor's benefit component of the program, and without incorporating dependence of individual wellbeing on the wellbeing of others, the actuarially fair pay-as-you-go (PAYGO) financed annuity component of the program does not improve individual lifetime wellbeing. Since the OASDI program mitigates the precautionary motives for savings, the macroeconomic costs of the program are that it reduces the aggregate capital stock and per capita consumption and income.

Following the literature, I use a notion of replacement rate as the percentage of the working population's average yearly wage (AWI) that the program will pay out to an individual in case the risky event covered by the program occurs. The replacement rate that maximizes the lifetime wellbeing of an individual turns out to be zero percent for the OASI program without the survivor's benefits component, and 90 percent for the DI program. Under a less plausible assumption followed in a few studies that individuals value future consumption more than present consumption, the optimal OASI replacement rate becomes a positive number (around 55 percent for the chosen parameter values).

The rest of the paper is organized as follows. Section 2 briefly describes the overlapping generations framework and the values of the parameters used to calibrate the model. Section 3 reports the findings of the paper. Section 4 concludes the paper and outlines the extensions of this basic framework for future work.

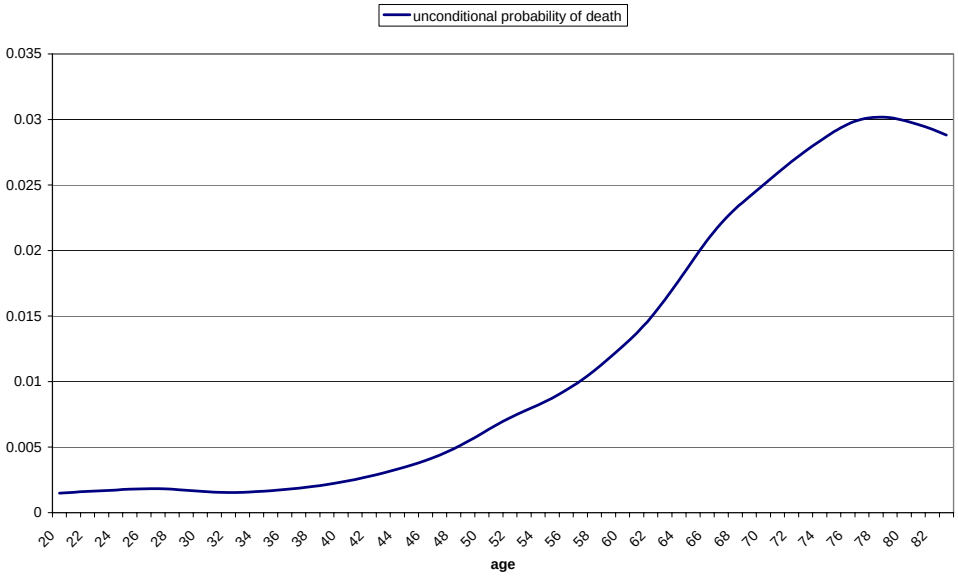
2. The Basic Overlapping Generations Framework

In this overlapping generations model, each individual lives a finite number of periods. Each period can be viewed as a year. I assume that starting from age 21 individuals decide how much to save. In the present draft of the paper, I assume that individuals supply a fixed number of hours of labor in each period. Individuals pay OASDI taxes and anticipate receiving DI benefits if he becomes disable during any period before his mandatory retirement at age 65, and anticipate receiving OASI benefits starting at the mandatory retirement age of 65 until he dies. The benefits that he receives from each program are constant fractions of his earnings during his able working years. This rate is referred to in this paper as replacement rate. I take these rates as policy parameters, which I calculated from benefits data in Trustees Report 2006. The OASI and DI tax rates are, however, calculated in an actuarially fair pay-as-you-go-basis. At the end of a period if an individual die, his savings becomes unintended bequest. Following others in the literature, I

assume that this unintended bequest is distributed equally to all living individuals in the economy. There are possibilities for distributing the unintended bequest, and the results might be sensitive to the distribution rule. I examine this in a future draft of the paper.

In this model, after retiring at the age of 65, individual live for maximum 20 more years in retirement, i.e., the maximum age is 85. At each age, an individual may remain in good health, or may become disabled, or may die. In this study, the probability of death at any age is assumed to be independent of his disability status. From the Trustee's report, I have taken the age invariant probability of disability incidence and the probability of recovery from disability health status to be 0.01 and 0.001 respectively. Following Imorohoroglue et al (1995), I used the survival probabilities from Faber (1982). I derived the probability of dying at various ages from these survival probabilities. I have plotted these probabilities in Figure 1. The percentage of population dying at the end of age 85 is 25.78, which shows that taking the maximum age to be 85 is very restrictive. This assumption has been made in previous studies for computational simplification, which I have also followed in this draft. In the final draft of this paper, I will update the analysis to a maximum age of 110.

Figure 1: Probability of dying at the end of an age



Following much academic research, we assume that the gross domestic product Y is produced with an aggregate capital K and aggregate labor hours measured in "efficiency units" (explained below) L by using the following Cobb-Douglas production function:

(0.1) $$Y = F(K, BL) = K^{\sigma}(BL)^{1-\sigma}, 0 < \sigma < 1.$$

The parameter *B* denotes the productivity level of a reference worker in a given year. The amount of output measured in some base period dollars that a worker unit can produce is his productivity level. The productivity level of a worker in a given year will depend on his level of experience. Therefore, a unit of more experienced labor can produce more income than a unit of less experienced labor. We assume that the age of a worker is a good surrogate for his experience and we take the least experienced labor as the reference labor. The productivity level of the reference worker also increases over time. The unit of reference labor hour in a reference base period is known as the *labor in efficiency unit*. In the above production function, in aggregating labor hours of workers from different age groups, I weighted their raw labor hours by their age specific productivity levels. I tried several estimates of the age-specific labor productivity parameters. I report results, however, only for the estimates of age-specific labor productivity levels from Hansen (1993). The parameter σ in the above production function measures the output elasticity of capital, i.e., the percentage increase in output from a one percent increase in capital. In competitive markets, σ also measures the share of the rental income in the national income. Following much of academic research, I take $\sigma = 0.35$.

Individuals derive utility from consuming goods and leisure time, which determines their savings and labor supply behaviors. I assume that if an individual in any period consumes c units of consumer goods and the portion ℓ of a period as leisure, his wellbeing in that period is measured by $u(c,\ell) = \frac{\left[c^{\gamma}\ell^{1-\gamma}\right]^{1-\eta}}{1-\eta} 0 < \gamma \le 1, \eta \ne 1$. The wellbeing in period t to total lifetime wellbeing is discounted by the discount factor β. At the beginning of his life, he could be with some probability in any of the paths determined by his experiences of health shocks and his decisions about asset holdings and labor supplies in each period. I take as a measure of his lifetime wellbeing the expected value of utilities that he could attain in all such paths, which is given by

(0.2) $$U = E\sum_{t=0}^{T} \beta^{t}\psi_{t}u(c_{t}, \ell_{t}).$$

where T is the maximum age that an individual can live, and ψ_t is the probability that he is alive during age t.

In the above specification, the parameter γ measures how an individual values consumption of material goods over his leisure – the higher the value of γ, the more the individual prefers consumption over leisure. In this draft of the paper, I assume labor supply is exogenously fixed at $1-\ell_t = 0.45$ in each period during working age and $1-\ell_t = 0$ during retirement. Without loss of generality, I assume that $\gamma = 1$. Any other value of γ will produce the same results. The parameter η measures an individual's preference for substituting consumption between two periods – the higher the value of η, the lower is the individual's preference to substitute consumption of one period over another period. In the present context with risks, η also measures an individual's attitude towards risk. When $\eta = 0$, the individual is risk neutral. A higher value of $\eta > 1$, means he is more risk averse. This parameter affects savings.

The estimates of η for the US workers vary from study to study. For this analysis, following many studies, I assume the following parameter values drawn from several academic research studies: $\eta = 2.0$, the depreciation rate for capital = 0.08, and the discount factor for aggregating inter-temporal utility = 0.9726. Furthermore, I assume that the population growth rate is 1.2 percent and the productivity growth rate is 1.65 percent. From the 2006 Trustees Report, I find the average wage index (AWI) for 2005 to be $36,953 and the average benefits per retired worker to be $17,551, which includes benefits to the worker and any family members.

The parameter *B* in the production function is a scale factor, which we calibrate in such a way that the long-run average yearly earnings from the model match the 2005 AWI in the Trustees Report.

At the beginning of period t, an individual of age a has k_0 amount of assets, which are carried from the previous period. He gets an income of rk_0 from his assets. This income plus his assets k_0 is one component of his budget for this period. If he is in normal health during the period, he works $1-\ell$ hours and given the wage rate and his productivity level, he earns wages w_a. He pays OASI and DI taxes out of his earnings. If he is disabled, he gets disability

benefits D_a, which amounts to DI replacement rate times AWI. During his retirement age, he does not work and he gets only OASI benefits and no DI benefits in the amount of OASI replacement rate times AWI. From his total income, he decides how much to consume and how much assets to hold for the next period to maximize his expected utility given above.

I have used the dynamic programming approach to solving individual's choice problem. I use grid search method to find the optimal asset holdings, by restricting the search to 4097 grid points of asset choices. I implemented the numerical computations of this model using the Sun's public domain object oriented Java programming language.

3. Findings

3.1 The OASDI Program and the Life-cycle pattern of consumption and asset holdings

The source of variations in consumption, asset holdings and earnings in this model is differential health shocks. In this economy, all individuals begin their lives from the same initial position of zero asset holdings and a normal good health status. As time progresses, they vary in their experiences of disability health shocks over their life cycles which affect their earnings and hence consumption and asset holdings. There are also many other types of shocks that affect their earnings. In this paper, I consider only disability health shocks that prevent one from engaging in substantial gainful activity (SGA) in the labor market. While individuals all start equal, will drift from each other over time in terms of their asset holdings and consumption levels. In the absence of the OASDI program, and in the absence of disability insurance and annuity markets, risk-averse individuals will self-insure themselves to cope with mortality and disability risks. Figures 1 and 3 show the average levels of their consumption and asset holdings, and Figures 2 and 4 show variances of consumption and asset holdings, which measure how far they drift apart from each other as they get older, as mentioned above. For comparison, I have plotted these variables for two scenarios: one with the current OASDI

program, and the other one without any OASDI program or markets for sharing these risks, i.e., the benchmark scenario.

The figures show that the levels of consumption and asset holdings are higher in the case of self-insured case as compared to the economy with the OASDI program. Moreover, note that the OASDI program reduces the variations in both asset holdings and consumption across individuals of all age groups. The variances and averages of both variables peak at the retirement age, with a notable difference that under the self-insurance economy, consumption peaks at an earlier age and at a higher value. That means, under self-insurance, precautionary motives for savings dominates and individuals save higher amounts and consume at a higher rate when they are young as discussed earlier in the introduction.

Figure 2: Average consumption at aech age

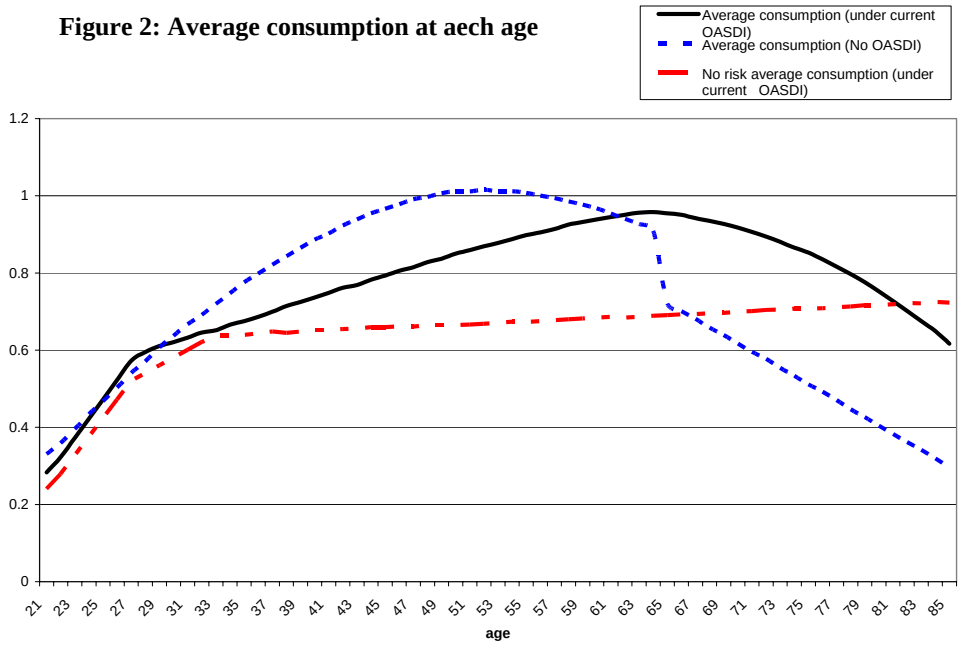


Figure 3: Variance of consumption at each age

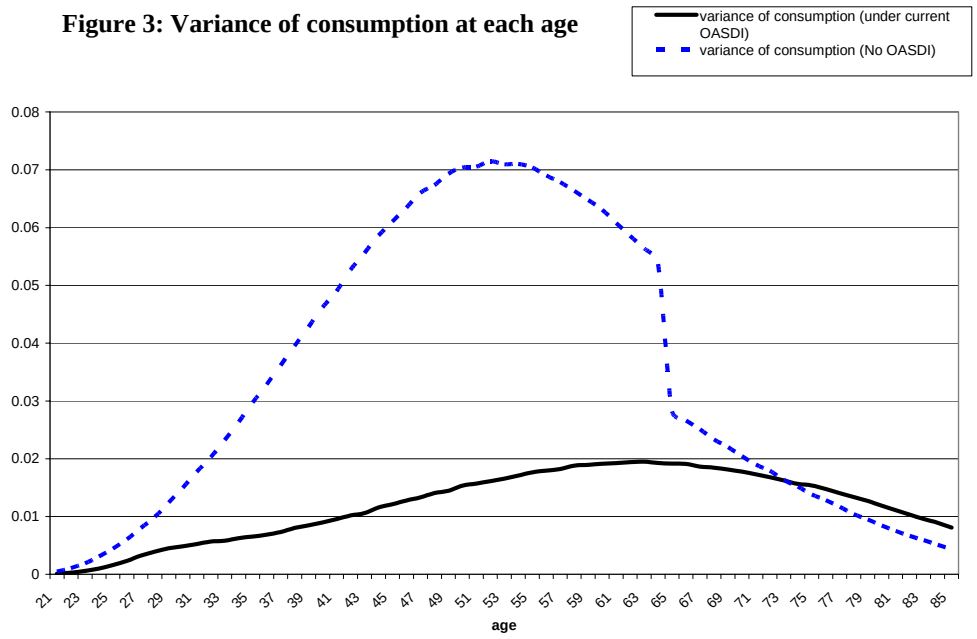


Figure 4: Average asset holdings at each Age

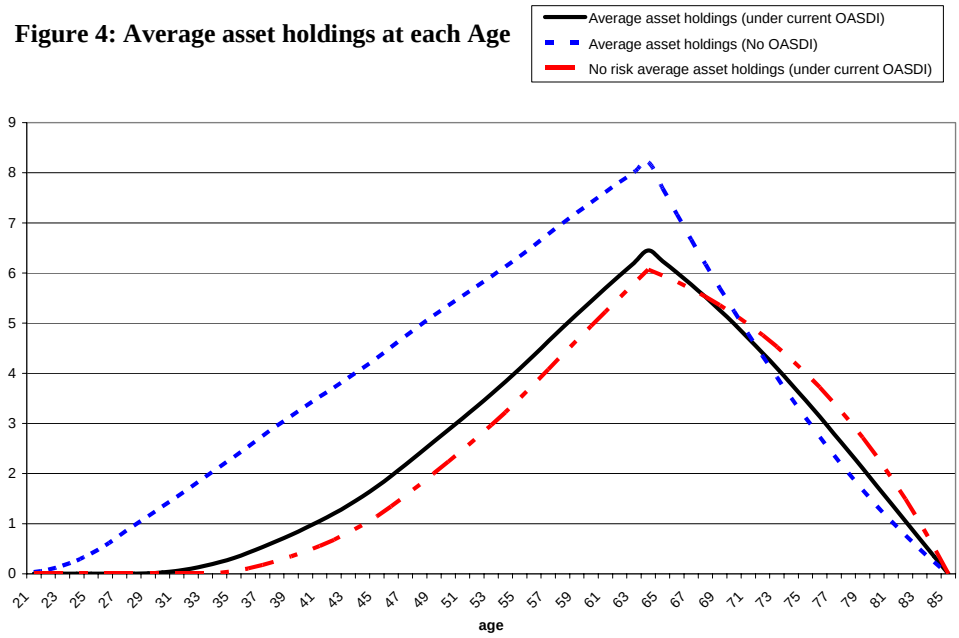
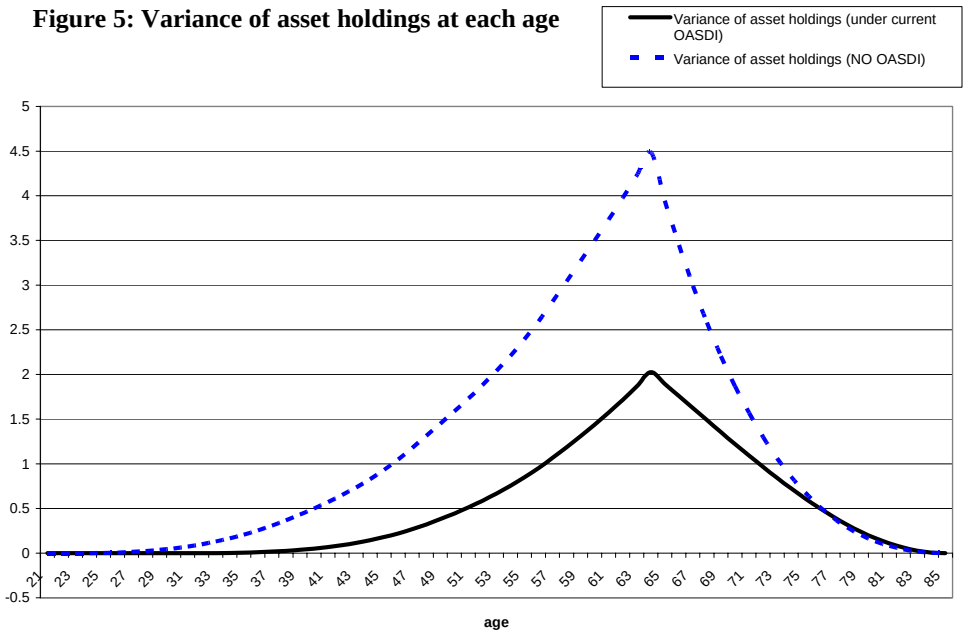


Figure 5: Variance of asset holdings at each age



3.2 Effect of the OASDI Program on Individual Lifetime Welfare, Elderly Poverty rate and on Aggregate Capital

How does the OASDI program affect individual's lifetime welfare? How much does the OASDI program mean to individuals from the point of view of risk sharing? How does the program affect elderly wellbeing and poverty rates? Finally, how does the program affect the long-run capital, per capita income, and consumption? I compare these with the benchmark scenario of individuals self-insure themselves against the mortality and disability risks without having access to any social insurances or private insurances to share the mortality and disability risks.

Table 1 compares the equilibrium aggregate effects of the OASI and DI programs with the benchmark case. I computed the average lifetime welfare of an individual for two values of the time preference parameter, $\beta = 0.976$ and $\beta = 1.011$. For both parameter values, the individual welfare is higher in the case of the OASDI program as compared to the self-insurance case. Welfare units are abstract, and it is hard to interpret how much economic difference those welfare gains mean. Therefore, to get a better

perspective, I computed the equivalent variation for each welfare gains or losses. The equivalent variation measures a welfare gain as equivalent to a percentage increase in his consumption level at every age in the benchmark scenario. The equivalent variation for the gain in welfare from the OASDI program is 13.72 percent. This means that the OASDI program makes an individual feel as well off as in the self-insurance situation with a 13.72 percent higher consumption at each age. The qualitative nature of the welfare gains is similar for $\beta = 1.011$.

To examine the contributions of each component program to this welfare gains, I computed these for each program separately. I report results for the OASI program in column 3 and the DI program in column 4. Note that while the DI program improves welfare for both values of β. The PAYGO financed actuarially fair annuity component of the OASI program does not improve welfare when $\beta = 0.96$. It improves welfare, however, when $\beta = 1.011$. The assumption of $\beta > 1$ means that individuals prefer future consumption relatively more strongly than present consumption, which is found in a few econometric studies, but most economists think it is an unrealistic assumption.

So what positive role the OASI program has on the welfare of the workers? To address this, I report in Table 2 the percentage of population of different retirement ages that will fall below poverty in the presence of the OASI program and in the absence of the OASDI program. I have taken for illustration $20,000 in 2005 dollars as a cut-off point for poverty. It is clear from Table 2 that in the presence of the OASI program, the percentage of elderly population in poverty is negligible, whereas in the absence of the OASI program, significantly high percentages of elderly population are in poverty. Furthermore, the rate of poverty increases as individuals become older Thus, the OASI program has a positive role in the US society: It virtually eliminates incidence of elderly poverty.

It is important to note that this finding is different from the traditional arguments for the OASI program that individuals are myopic or irrational and thus they do not save enough for their retirement, and the OASI program performs a paternalistic role of saving

for the retirement of these myopic non-optimizing people. In this model individuals have rational expectations meaning that individuals know with some small but positive probability they will survive to old age. However, because the present is more certain than the future, their optimal behavior is to consume most of their savings at young ages when they are more sure to live, and leave very little for old ages, likelihood of reaching which are very low.

Another important role played by the OASI program is that it provides survivor's benefits to a deceased worker. When I include this in future work, the model may show welfare gains from the OASI program, for the parameter value $\beta = 0.967$. This positive role will be in addition to virtually eliminating elderly poverty that I mentioned earlier. The computation of the equilibrium becomes more complex in this case, and that is why very little has been investigated in the literature. I will incorporate this in a follow-up study.

Note that while the OASDI program reduces variances of asset holdings and consumption levels and reduces elderly poverty, the program reduces the aggregate capital stock, consumption level and per capita income in the long-run as compared to the self-insured benchmark case.

This shows the macroeconomic and individual welfare costs of providing the income guarantees through OASI to the elderly population, without which a large percentage of elderly population would fall into poverty even when they rational expectations and make perfectly rational asset holding decisions.

Table 1: Evaluation of Insurances Provided by the OASI and DI Programs

	In the Presence of Mortaility and Disability Risks				No Risks	
	Without publicly provided OASDI, i.e., replacement rates for OASI = 0, and DI = 0	Publicly provided OASDI with replacement rates for OASI = 0.44 and DI = 0.4	Publicly provided OASDI with replacement rates for OASI = 0 and DI = 0.4	Publicly provided OASDI with replacement rates for OASI = 0.44 and DI = 0	Publicly provided OASDI with replacement rates for OASI = 0 and DI = 0	Publicly provided OASDI with replacement rates for OASI = 0.44 and DI = 0.4
Welfare						
β =0.976	77.71	87.88	91.13	73.77	91.09	86.86
β =1.011	60.31	103.77	99.09	75.19	100.48	105.75
Equivalent Variation						
β =0.976		11.58	14.73	-5.33	14.69	10.54
β =1.011		41.89	39.14	19.80	39.98	42.97
Per capita income						
In 2005 dollars	70,360.86	53,717.90	61,588.66	65,473.24	56,618.98	53,717.90
Interest Rate	3.37	8.18	6.41	4.92	6.00	7.37
Asset holdings						
Mean (2005 dollars)	229,164.93	131,954.06	158,309.73	187,626.55	149,780.50	129,482.35
Variance (*E-6)	4,615.92	1,813.18	1,776.93	3,371.20		
Consumption						
Mean (2005 dollars)	48,765.42	47,540.68	48,513.05	48,470.44	41,389.45	40,611.80
Variance(*E-6)	151.00	44.43	50.64	133.81		
Earnings						
Mean (2005 dollars)	45,057.08	36,953.00	39,439.62	41,927.19	36,236.14	34,379.46

Notes: 1) The compensating variation is the percentage increase in bench mark consumption stream that makes him as well off at the benchmark situation as he is in the present situation.

Table 2: Elderly Poverty with and without the OASDI Program

Age Group	Percentage of population in poverty	
	Under the current OASDI Program	Without an OASDI Program
65	0.00	0.77
66	0.00	0.88
67	0.00	1.02
68	0.00	1.21
69	0.00	1.41
70	0.00	1.69
71	0.00	2.04
72	0.00	2.43
73	0.00	3.01
74	0.00	3.70
75	0.00	4.67
76	0.00	5.78
77	0.00	7.35
78	0.00	9.66
79	0.00	12.36
80	0.00	16.29
81	0.00	21.40
82	0.01	27.87
83	0.01	35.93
84	0.02	46.86
85	0.04	61.13

3.3 Optimal OASDI Replacement Rates

In the previous subsection we saw that given the current replacement rate of 0.4 for the DI program, the OASI program reduces lifetime welfare when $\beta = 0.967$ and improves lifetime welfare when $\beta = 1.011$. What would be the OASI replacement rate for each β that would maximize a representative individual's lifetime welfare? I find that for $\beta = 0.967$, the optimal OASI replacement rate is 0, and for $\beta = 1.011$, the optimal replacement rate is 0.55, instead of the currently assumed rate of 0.44 (See table 3 for details).

I also computed the optimal replacement rates for the OASI and DI jointly that would maximize a representative individual's lifetime welfare. When $\beta = 0.967$, the replacement rates come out to be 0 for the OASI program and 0.9 for the DI program.

When β = 1.011, the replacement rates come out to be 0.55 for the OASI program and 0.9 for the DI program.

Table 3: Equilibrium results for various SI replacement rates given a fixed DI replacement Rate .3

SI Replacement Rate	Wage rate	Interest rate	Capital-Labor Ratio	Capital stock in efficiency	Per capita income	Average yearly Earnings (in 2005 dollars)	Average consumption (in 2005	Welfare β = .967	Welfare β = 1.011
0.00	1.65	0.06	6.45	2.36	61,588.66	39,439.62	48,513.05	91.39	98.45
0.05	1.64	0.07	6.37	2.33	61,311.74	39,262.29	48,488.47	91.17	99.44
0.10	1.63	0.07	6.21	2.27	60,744.92	38,899.31	48,339.56	90.80	100.27
0.15	1.61	0.07	6.06	2.22	60,216.72	38,561.06	48,208.25	90.43	100.96
0.20	1.60	0.07	5.92	2.16	59,716.72	38,240.88	48,076.75	90.05	101.54
0.25	1.59	0.07	5.80	2.12	59,298.95	37,973.35	47,978.01	89.69	102.02
0.30	1.58	0.08	5.68	2.08	58,832.14	37,674.42	47,852.14	89.31	102.42
0.35	1.57	0.08	5.57	2.04	58,410.36	37,404.32	47,738.96	88.92	102.75
0.40	1.56	0.08	5.46	2.00	58,013.85	37,150.41	47,627.11	88.55	103.00
0.45	1.55	0.08	5.37	1.96	57,647.45	36,915.78	47,529.74	88.17	103.21
0.50	1.54	0.08	5.27	1.93	57,281.74	36,681.59	47,431.65	87.79	103.35
0.55	1.53	0.09	5.18	1.89	56,906.32	36,441.18	47,325.07	87.39	103.45
0.60	1.52	0.09	5.10	1.86	56,584.08	36,234.83	47,232.54	87.01	103.40
0.65	1.51	0.09	5.02	1.84	56,258.62	36,026.42	47,168.97	86.61	103.17
0.70	1.50	0.09	4.94	1.81	55,954.82	35,831.86	47,052.80	86.22	102.94
0.75	1.49	0.09	4.87	1.78	55,658.34	35,642.01	46,962.76	85.83	102.69
0.80	1.48	0.09	4.80	1.76	55,371.56	35,458.37	46,884.32	85.44	102.41
0.85	1.48	0.10	4.74	1.74	55,150.71	35,316.94	46,831.69	85.06	102.09
0.90	1.47	0.10	4.68	1.71	54,893.08	35,151.96	46,758.57	84.66	101.78
0.95	1.46	0.10	4.62	1.69	54,617.49	34,975.48	46,671.52	84.25	101.42
1.00	1.46	0.10	4.56	1.67	54,352.48	34,805.77	46,594.80	83.84	101.06

4. Conclusions

This paper used a stochastic overlapping generations model and calibrated it to the US economy to examine the nature of mortality and disability risks sharing protections that are provided by the OASDI program to individual workers. The model incorporated both disability and mortality risks. The paper studied properties of long-run equilibrium, taking as benchmark an economy in which individuals self-insure themselves against these risks by adjusting their own savings and labor supplies without access to an OASDI program or private markets for sharing these risks.

The main findings of the paper are that the OASI and DI programs together improve lifetime welfare of workers, reduce variations of consumption and asset holdings over their life cycles, and virtually eliminate elderly poverty. The value of the OASDI program to a representative worker is as high as if he has an extra 13.72 percent higher consumption at all ages of his life at the benchmark equilibrium. The value is even higher for the DI program. For the OASI program, however, disregarding the survivor's benefit component of the program, and without incorporating dependence of individual wellbeing on the wellbeing of others, the actuarially fair pay-as-you-go financed annuity component of the program does not improve individual lifetime wellbeing. Since the OASDI program

mitigates the precautionary motives for savings, the macroeconomic costs of the program are that it reduces the aggregate capital stock and per capita consumption and income.

- The paper used a notion of replacement rate as the percentage of the working population's average yearly wage (AWI) that the program will pay out to an individual in case the risky event covered by the program occurs. The replacement rate that maximizes the lifetime wellbeing of an individual turns out to be zero percent for the OASI program without the survivor's benefits component, and 90 percent for the DI program. Under a less plausible assumption followed in a few studies that individuals value future consumption more than present consumption, the optimal OASI replacement rate becomes a positive number (around 55 percent for the chosen parameter values).

It is possible that when the survivor's benefits component of the OASI program and dependence of wellbeing of an individual on other's wellbeing are incorporated in the model, the OASI program will produce welfare gains. Furthermore, which economic group - differentiated by gender, race and education - benefits by how much from these programs is an important issue to examine. I am currently working on these. I will report these findings in a future draft of this paper once the results are finalized.

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