NBER Working Paper Series

SOCIAL SECURITY AND RETIREMENT DECISIONS

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Working Paper No. 107

CENTER FOR ECONOMIC ANALYSIS OF HUMAN BEHAVIOR
AND SOCIAL INSTITUTIONS

National Bureau of Economic Research, Inc.
204 Junipero Serra Boulevard, Stanford, CA 94305

Revised October 1975

This research was partially supported by a grant from the Rockefeller Foundation.

SOCIAL SECURITY AND RETIREMENT DECISIONS: ABSTRACT

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One of the most striking features of the postwar U.S. economy has been the rapid decrease in the labor force participation of the elderly at a time when the health of this group has been improving. In spite of this, previous research, based on retrospective interviews with the retired population, usually concludes that poor health accounts for the overwhelming majority of retirements.

The current results suggest that nothing could be further from the truth. Using data from the Panel Study of Income Dynamics, we follow a cohort of white married males through their sixties to estimate a model of retirement behavior. Using several definitions of retirement suggested in the literature, the results suggest that the two key policy parameters of the social security system - the income guarantee and the implicit tax on earnings - exert an enormous influence on retirement decisions. For example, our results suggest that a decrease in the implicit tax rate on earnings from one-half to one-third would reduce the annual probability of retirement by almost sixty percent!

Applying the coefficient estimates to time series data on the labor force participation of the elderly implies that the social security system has been the major factor in the explosion in earlier retirement.

SOCIAL SECURITY AND RETIREMENT DECISIONS*

by

Michael J. Boskin**

The rapid growth of the social security system in recent years has been one of the most important developments in the United States' economy: social security benefits and taxes are each the second largest--and fastest growing--item on their respective side of the federal government budget and will soon exceed $100 billion. For a large fraction of all U.S. families, social security taxes exceed their income taxes and expected social security benefits are the major item in their retirement portfolio. The system has become so large that even modest changes in benefits or their method of finance may have important impacts on the entire economy. While the social security system is widely heralded by politicians and the public as a vital element of our income security system, it recently has come under increased criticism from economists. For example, Pechman, Aaron and Taussig [19] and Brittain [3] object to payroll tax finance as inequitable; Buchanan [4] and Campbell [5] would like to see the transfer, or anti-poverty,

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*I am indebted to William Barsky, Louis Garrison and Henry Moore for research assistance, and participants at various seminars plus T. Connor, L. Lillard, F. Nold, J. Pechman, J. Ross, L. Thompson and P. Van de Water for useful suggestions.

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This paper should not be considered an official NBER publication, as it has not undergone the full NBER review.

goal of the system separated from the income replacement, or annuity, goal; and Feldstein [7] estimates a huge substitution of expected social security benefits for private savings, which in turn leads him to question whether the system should be financed on a pay-as-you-go basis [9].

The primary objective of social security is to replace income during retirement (or disability); in so doing, social security benefits supplement--and potentially substitute for--prior savings (including private pensions, equity in a home, savings accounts, stocks and bonds, etc.), intrafamily transfers of income and, perhaps most importantly, continued earnings. The purpose of the present paper is to focus on the potential inducement to retire earlier in the presence of social security than in its absence, and the corresponding substitution of social security benefits for potential earnings. Toward this end, section 1 reviews some previous attempts to study retirement behavior. Section 2 presents a simple theoretical model which explains the ways in which the current social security system affects labor supply and retirement decisions. Section 3 details the data used in the analysis. Section 4 reports the empirical results--primarily probability of retirement equations which relate retirement decisions to parameters of the social security system and other financial and demographic variables. Section 5 concludes with a discussion of some of the implications of the results for social security policy, as well as some suggestions for future research.

1. A Cursory Review of the Literature on Retirement

Social security guarantees elderly retired persons a certain income based upon their previous covered earnings and taxes some of these benefits back if earnings exceed a modest amount. Hence, both the income and wage effects of the system operate to reduce labor supply. Since some workers achieve a preferred consumption bundle by working enough so that they receive no benefits (i.e. they elect not to be covered currently by the system), others would retire independently of their social security benefits, and the sizes of the income--or benefit guarantee--and wage--or earnings test--effects are unknown, the overall effect of social security on retirement is primarily an empirical question.

Previous research on retirement decisions may be divided into three types corresponding to the type of data used: retrospective studies of retired workers, prospective studies of workers approaching retirement age, and studies of the labor force participation rate of the elderly.

In an early and frequently cited study, Steiner and Dorfman [20] report the results of a special 1952 Follow-Up Survey of the Aged to the Current Population Survey. In particular, all men not in the labor force were asked why they stopped working. They conclude that "...only a small proportion of the older population had been driven out of the labor force by retirement systems."[1]

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[1] Steiner and Dorfman [20], p. 49.

Thus, the overwhelming majority retired "voluntarily"; further, ". . . in 79 per cent of all voluntary retirements poor health was the major reason for retirement."[1] While it is undoubtedly correct that some people retire because of poor health, accepting the conclusion that most do so from retrospective surveys of retired workers is hazardous: poor health is certainly the most socially acceptable reason for retirement and, on average, the health of those interviewed had probably deteriorated since retirement. Yet retrospective studies invariably conclude that poor health is the primary reason for retirement.

For example, Wentworth [23] summarizes a series of Social Security Administration surveys of the aged in the years 1941-1963 by noting that ". . . approximately 88 percent of the beneficiaries queried in the 1941-51 surveys and 74 percent of those in the 1963 survey had their jobs terminated by their employer or were forced to quit because of ill health."[2] Thus, the conclusion usually reached in these studies is that social security benefits cushion income declines beyond the control of the individual worker and that relatively few workers are induced to retire to receive benefits. On the other hand, the 1963 Social Security Survey of the Aged [22] also found that a substantial fraction of those nonbeneficiaries reporting an inclination to retire soon intended to do so to obtain retirement (public and/or private) benefits. Further, a considerable

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[1] Steiner and Dorfman, op. cit., p. 49.

[2] Wentworth [23], p. 5.

shift into partial retirement--reduced hours of work and changes in occupation--was noted. Finally, Epstein and Murray [6] note an increase in the number of aged men ". . . who might get some kind of job if they were interested, but prefer the leisure of retirement."[1]

Barfield and Morgan [1] conducted an interesting study of prospective retirement plans; in particular, they focused on the decision to retire before age 65. Analyzing data from a national sample collected in 1966, they report ordinary least squares regressions of whether or not early retirement was planned on a variety of variables. The most important result was that planned early retirement was strongly and positively related to expected pension income (government and private) and negatively associated with a subjective evaluation of health. While these results are both intriguing and suggestive, relying on reported plans for retirement --in an uncertain world where expectations may not be realized--is hazardous at best. A preferable alternative is to analyze actual retirement decisions.

In his classic study, Long [15] notes the decline in the labor force participation rate of older workers in the U.S. and elsewhere since 1890. He examines a variety of types of data, and concludes that neither the growth of pension programs--public and private--nor the general increase in personal disposable income accounts for the sharp decline. Indeed, Long's major conclusion

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[1]Epstein and Murray [6], p. 105.

is that jobs have been competed away from older workers by younger women.

Pechman, Aaron and Taussig [19] were the first to present evidence that social security accelerates retirement; they report the results of an international cross-sectional regression on aggregate data for 1960 from 19 countries of the labor force participation rate of the population over age 65 on the ratio of per capita benefits to the average wage in manufacturing and other variables. Their results suggest that the higher this replacement ratio, the lower the labor force participation rate of the elderly, i.e., the more generous the social security system, the lower the labor supply of the elderly. Whether this is caused by the income effect of high benefit guarantees, the wage effect of rigid earnings tests in countries with generous benefits or even the wage effect of higher social insurance taxes to finance the higher benefits is impossible to tell from their results. Feldstein [8] reports a similar result, also based on an international cross section, on his way to estimating private savings functions. He also notes a negative effect on labor force participation of men over 65 of retirement tests. While these studies are open to the usual criticisms of international cross sections, the results do suggest that higher social security benefits do induce a withdrawal from the labor force.

Thus, there are two competing conjectures concerning the effects of social security on retirement. On the one hand, a group of studies suggest that the social security system plays a relatively passive and minor role, the major reason for retirement being poor health. On the other, evidence from international cross-sections - albeit hardly the type of data upon which one would like to place exclusive reliance - suggests that social security induces - or enables - elderly men to withdraw from the labor force.

Aggregate time series data for the United States reveal that the labor force participation rates of elderly males have fallen dramatically in the postwar period. These data are presented in Table 1.1. The rate for both whites and nonwhites is currently less than half of the rate in the late nineteen forties. In the 55-64 age bracket, the rates have fallen thirteen and twenty-one percent for whites and nonwhites, respectively. The decline in this age group, of course, is heavily concentrated in the rates for men in their early sixties; more men now claim initial social security benefits age age sixty-two than at age sixty-five.

This sharp secular decline in the labor force participation came during a period when the economy was relatively healthy and the health of the elderly on average improved; it also came during a period of broad extention of social security coverage and sharp increases in benefits. While these correlations may be merely a coincidence, they should make us skeptical of the survey data alleging social security had no effect and poor health was the prime mover in retirement decisions.

We shall present and analyze below evidence from an entirely different--and in many ways superior--type of data: a panel study of a cohort of elderly men. Before doing so, it is worthwhile to examine in somewhat more detail the ways in which social security affects labor supply.

Table 1.1

Labor Force Participation Rates for Elderly Males, 1948-74

	White		Nonwhite	
	55-64 yrs.	65 and over	55-64 yrs.	65 and over
1948	89.6	46.5	88.6	50.3
1949	87.6	46.6	86.0	51.4
1950	87.3	45.8	81.9	45.5
1951	87.4	44.5	84.6	49.5
1952	87.7	42.5	85.7	43.3
1953	87.7	41.3	86.7	41.1
1954	89.2	40.4	83.0	41.2
1955	88.4	39.5	83.1	40.0
1956	88.9	40.0	83.9	39.8
1957	88.0	37.7	82.4	35.9
1958	88.2	35.7	83.3	34.5
1959	87.9	34.3	82.5	33.5
1960	87.2	33.3	82.5	31.2
1961	87.8	31.9	81.6	29.4
1962	86.7	30.6	81.5	27.2
1963	86.6	28.4	82.5	27.6
1964	86.1	27.9	80.6	29.6
1965	85.2	27.9	78.8	27.9
1966	84.9	27.2	81.1	25.6
1967	84.9	27.1	79.3	27.2
1968	84.7	27.3	79.6	26.6
1969	83.9	27.3	77.9	26.1
1970	83.3	26.7	79.2	27.4
1971	82.6	25.6	77.8	24.5
1972	81.2	24.4	73.6	23.6
1973	79.0	22.8	70.7	22.6
1974	78.1	22.5	70.2	21.7

Source: Manpower Report of the President, 1975.

2. Social Security and Labor Supply

The social security system has three basic features which affect life-cycle labor supply and saving decisions: the benefits, the social insurance contributions, and the earnings test. The social security system imposes a tax for old age (and disability) insurance of approximately 6 percent each on employees and employers[1] on the first $14,100 of earnings; it provides benefits during retirement based in part on previous taxes; and potential benefits are reduced if earnings exceed a certain modest amount. Thus, throughout one's working life the social security tax reduces the after-tax wage rate. Once one retires, the system provides an income flow, but imposes an implicit tax on earnings beyond a certain amount.

Focusing on a year during which a worker eligible for social security benefits is contemplating retirement, and ignoring life cycle phenomena,[2] we may characterize the effect of the system on labor supply and retirement decisions in the usual way. Before accounting for the social security system, the budget constraint of the individual is

$$(1+r)K + W(T-L) = PX + \Delta K. \tag{2.1}$$

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[1]It is usually argued that employees bear both parts of the tax (see Brittain [2]); however, Feldstein [10] has called this assertion into question, when the system affects saving. If we argue that the benefits would be financed by some other tax (which may itself affect saving and/or labor supply), the employee burden argument is probably a good approximation.

[2]A simple discussion of life-cycle effects is presented in Appendix B.

Assets plus earnings equals consumption of goods plus saving

With a tax rate of t, benefits of B when no earnings are made, and an implicit tax under the earnings test of α, the budget constraint becomes

$$B + K(1+r) + W(1-t-\alpha)(T-L) = PX + \Delta K. \qquad (2.2)$$

Graphically (ignoring saving), the budget constraint changes as in Figure 1, where we see that the worker, in attempting to maximize utility, must choose which arm of the budget constraint he wishes to be on. Since for the period we will be studying, the earnings test had two components (a 50 cent reduction per dollar of earnings over a certain range, then increasing to a dollar), the effective budget constraint has three arms: the parts AB, BC and CD. Hence social security creates a situation where workers face a kinky budget constraint. In some cases social security will not affect labor supply during part of old age. In Figure 1a, the worker works full time regardless of the social security system; in Figure 1b, the worker retires completely regardless of the social security system. However, many workers may be in the situation depicted in Figures 1c and 1d: in the former, the worker works a substantial amount of time in the absence of the social security system, but retires completely in its presence; in the latter, social security induces

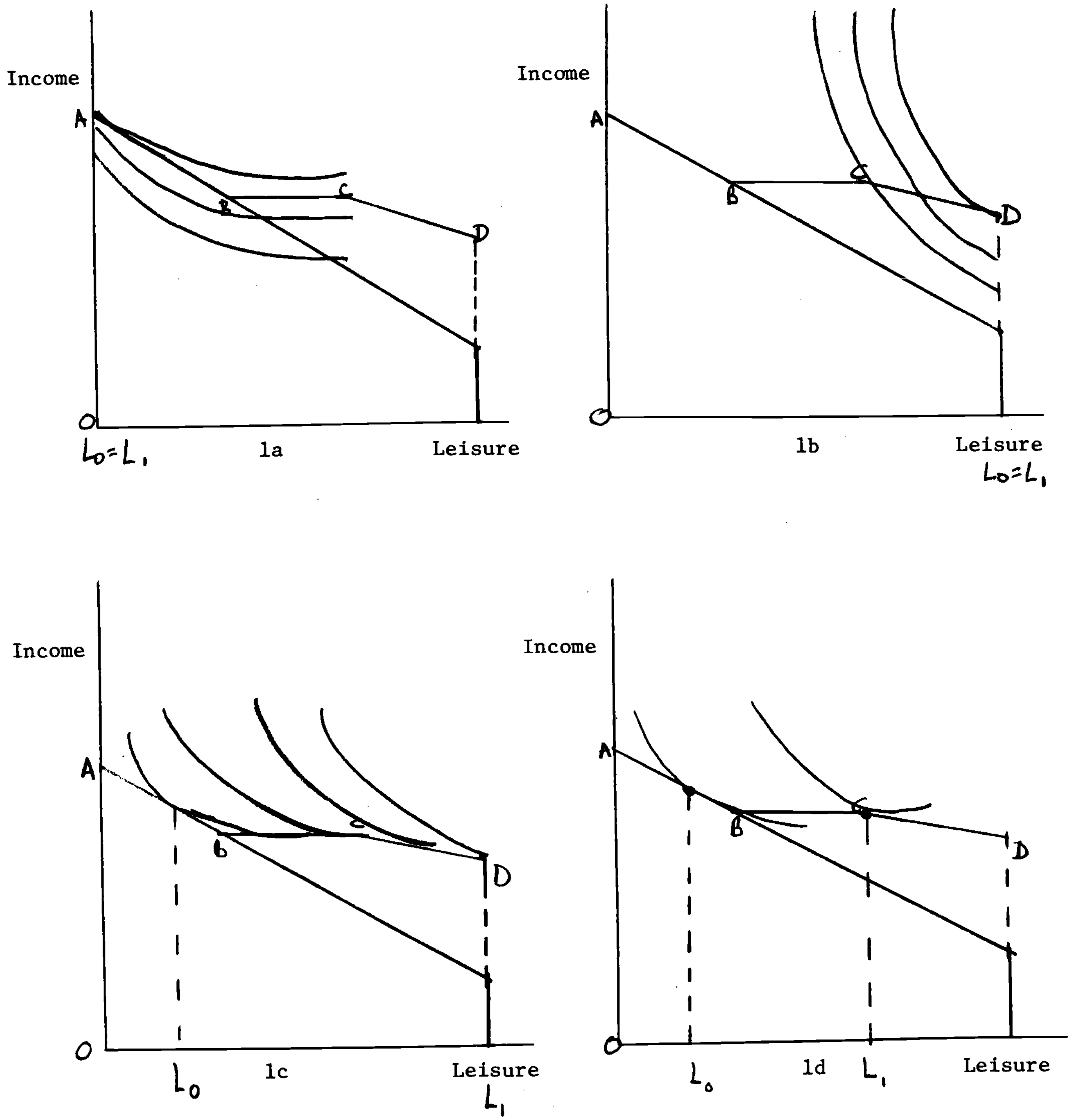

Figure 1. Social Security and Labor Supply

partial retirement.[1]

These effects--providing an income support and taxing earnings with the earnings test--both operate to reduce the labor supply of some elderly workers. Before turning to an attempt to estimate them, we remind the reader of two points made above: asset holdings are endogenous and determined simultaneously with life-cycle labor supply decisions; social security benefits may drive down income from assets[2] and the one-period analysis is then conditional upon the value of assets held; and the system may well affect labor supply prior to old age through the taxes and through the effects of benefits on the shadow price of saving.

Since we do not have data following individuals over their entire lifetime--or even a substantial fraction thereof--we can say very little about the life-cycle phenomena described above. Hence, we turn to a discussion focusing on one important part of of the life-cycle--old age--and the retirement decision.

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[1]This multi-armed budget constraint produces certain econometric problems in estimating labor supply functions. The density of labor supply piles up at several discrete values; hence we must estimate the probability the worker will choose to be on one of the three arms of the budget constraint simultaneously with hours worked conditional upon being on a particular arm. I am currently working on a generalization of Tobit analysis to deal with this problem. The estimates presented below, in part, skirt this issue. See Hall [11] for a discussion of this problem in the two-armed case.

[2]See Feldstein [7] for evidence this indeed occurs.

3. The Data

The data for this study are taken from the Panel Study of Income Dynamics, a national sample of five thousand households.[1] The important feature of these data from our viewpoint is that the households were reinterviewed annually for the five years 1968 through 1972.[2] Hence, for each year of the survey period, a substantial amount of information is available on each household. Especially relevant are the data pertaining to earnings, assets, age, occupation, hours of work, length of time on the current job, etc.

From this body of data, I have extracted information on 131 households which were headed by the same white married male, aged 61 through 65, for the five years of the survey. Hence, by the end of the five years, these heads of households are aged 66 through 70. We follow the labor market status of these heads of households through the crucial years of retirement decisions. The variables used in the analysis are described below.

Retirement. A study by the Social Security Administration [21] notes no less than six definitions of retirement in common use. Among these are zero hours of work per year, less than 35 hours per week of work, saying that one is retired, etc. The common perception of retirement is a stepping-down from normal career patterns--leaving the main job or occupation, working less and earning less. A

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[1] These data are described in detail in Survey Research Center [21].

[2] The annual reinterviewing is still in progress.

substantial number of people say they are retired while working several hundred hours per year for several years. Several definitions of retirement were tried in the estimation of the probability of retirement equations: less than quarter-time work, less than half-time work, less than one-tenth time work, and the individual worker's statement that he was retired. The result using all four definitions are similar, and only those for quarter-time work are presented below.[1] This definition corresponds roughly to the point where most of the sample becomes subject to the earnings test. A state of quasi-retirement was also defined for use in following a pattern of gradual stepping-down from full-time work. Again, similar results were obtained for several definitions mapping hours of work, wages, and occupation into quasi-retirement. The definition used in the results presented below was less than half-time work (or earnings less than half of full-time earnings on the job previously held).

The distribution of actual hours and earnings--as we would suspect from the discussion above--tends to pile up in certain ranges, roughly corresponding to full-time work, work not subject to the earnings test, etc. Further, about 40 percent of the sample retired before age 65, while slightly under 40 percent were still working at age 66 and beyond. Of the latter, two-fifths were working very few hours.

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[1]The other results are available upon equest.

Social security benefits. The maximum social security benefits obtainable for the couple are based on the primary insurance amount from estimated average monthly earnings. Average monthly earnings are estimated as the social security maximum for those earning the maximum or receiving the maximum benefit during the survey period and imputed either from a regression of earnings on education, occupation, and other personal characteristics or from actual benefits received and information on age, earnings, etc. The benefits formula for each year is used and benefits are adjusted downward for each year from age 62 to 64, and, of course, are zero for age 61. It is worth pointing out that the group under study receives social security benefits which are a large multiple of their taxes paid in plus interest. This occurs both because of the blanketing in of all existing workers each time benefits are increased and the large increase in legislated benefits, which bear little relation to taxes paid in plus interest (see Campbell [5] and Brittain [3]).

Income from assets. Income from assets include the usual rents, pensions, dividends, interest and asset part of business income. Also included are the imputed income to home ownership (at 6 percent of equity) and to automobiles (at 12 percent of value). Experiments with a two-year average yielded results virtually identical to use of current income from assets.

Net earnings. Net earnings refers to earnings net of earnings-tested decreases in social security benefits. They are calculated in two ways--using actual earnings and using expected earnings at full-time or part-time work, i.e. for different measures of a standardized number of hours.[1] While the former is potentially endogenous, it reflects the actual point chosen on a particular arm of the budget constraint. In any event, the results are quite similar regardless of the definition used. We standardize at 1750 hours for those not working in defining potential net e rnings for full-time work, and at 875 hours for quasi-retirement. Changing these indexes of a standard number of hours by modest amounts does not affect the results.[2]

Age dummies. A variable taking the value one when the worker is 65, zero otherwise; and likewise when the worker is 62.

Education. Years of schooling.

Spouse's earnings. Only infrequently does the spouse's earnings amount to a substantial share of total earnings. The actual figures are used. Were our data set much larger, we would have attempted to build a simultaneous husband-wife retirement model. Since only a small fraction of these wives worked any appreciable amount, we eschew any such attempt here.

Hours ill. Total hours of illness estimated for the year. In light of the conjecture reported above that poor health is the primary cause of retirement, it is interesting to note that for those people in the sample who retired, the average hours of illness the year prior to retirement was 59.2; for the entire sample of work years, the average was 84.5!

All dollar values are adjusted for inflation by deflating by the consumer price index.

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[1] Potential full-time earnings are imputed on the basis of a regression of earnings on education, occupation, location, union membership, health, etc.

[2] Again, results are available upon request. Variables referring to the specific year were also included (year dummies, unemployment rate, etc.), but their coefficients were small and not statistically different from zero.

4. Empirical Results

As mentioned above, there are many different definitions of retirement which have been used by various researchers. Generally, retirement entails a stepping down from a normal career and employment pattern. The stepping down may entail an abrupt reduction of hours of work to zero, a change of job or occupation, a gradual reduction of hours of work, etc. We may conceive of the worker as being in one of N labor market states (e.g., state 1 may be full-time work on the career job, state 2 part-time work on the same job, state 3 full-time work on a different job,...,state N zero hours of market work, etc.). Observing individual workers for a sequence of years, we may characterize this stepping down process by a matrix of transition probabilities:

$$P = \begin{matrix} P_{11} & \cdots & P_{1N} \\ \vdots & \ddots & \vdots \\ P_{N1} & \cdots & P_{NN} \end{matrix}$$

where P_{ij} is the probability that the worker moves from state i (e.g., full-time work) to state j (e.g., part-time). These probabilities, in turn, depend on a vector of variables such as earnings, social security benefits, age, health and education, some of which depend upon which state the worker chooses to occupy.

As a simple example, consider a two-way partition of labor market states into working and retired. Then P_{12} is the probability a worker retires in a given period. P_{12} may depend upon social security benefits and earnings, which differ dramatically if he works or retires. Of course, once we know P_{12}, we also know P_{11}, the probability the worker keeps working. Finally, there is a duality between the transitions among states[1] and the distribution of the elderly population among the various labor market states.

A full derivation of this model as the multinomial logistic parameterization of a multi-state Markov chain is presented in Appendix A.

As mentioned above, we have experimented with different numbers of states defining employment status as well as different definitions of the states. The results are rather robust against modest changes in the definition of the states. Our data limit us to a two-state (working/retired) and a three-state (close to full-time work, quasi-retirement, retirement) parameterization. We examine the effect on the probability of retirement of several types of variables: health (hours ill), wage effects (net earnings), income effects (social security benefits and income from assets), cross-wage effects (spouse's earnings), and institutional retirement tests (represented by a dummy variable for age 65). Conjectures on the signs and magnitudes of these effects were discussed above in the review of the literature. Briefly, one school of thought would expect the effects of the age dummy and hours ill to be large and positive, and most other effects to be small. As we shall see, nothing could be further from the truth.

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[1]Note that some transitions may have probabilities of zero or close to zero, i.e., it may be rare to observe certain transitions.

Table 4.1 presents our basic probability of retirement equation. We note first that the sign of the health effect is opposite to that conjectured in numerous previous studies. This effect, however, is not estimated very precisely. While some workers undoubtedly do retire for reasons of poor health and the measure of health is open to question, these data provide no support for the conjecture that poor health is the prime mover in retirement decisions.

The effects of all of the other variables are measured quite precisely, and operate in the expected direction. The probability of retirement in a given year at mean values of the right hand variables is about eight percent.

There is clearly a large increase in the probability of retirement at age 65. Whether this is due to social custom or institutionalized retirement rules within firms is difficult to judge. It is not uncommon for workers to change occupations in their sixties--stepping down from their normal career to a lower wage part-time job.

There is a small negative effect of the spouse's earnings on the probability of retirement.[1] Thus, leisure of husbands and wives appear to be complements in old age.

Turning attention to income from assets, we note that the effect of an increase in asset income is a modest increase in the probability of retirement. At mean values of the other variables,

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[1] Were our data set larger, we would have attempted to examine the retirement decisions of husbands and wives simultaneously.

Table 4.1

Probability of Retirement Equation

Variable	Coefficient ($\times 10^3$)[a]
Social security benefits	0.917 (0.288)
Income from assets	0.135 (0.051)
Net earnings	-1.49 (0.39)
Age = 65 dummy	1248.7 (307.6)
Spouse's earnings	-0.218 (0.093)
Hours ill	-1.38 (1.21)
log likelihood = -141.026	

[a] Asymptotic standard errors in parentheses.

a $1,000 annual increase in income from assets increases the probability of retirement by 15 percent.

The effect of the income guarantee in social security on the probability of retirement is large and, as expected, positive. Indeed, it is seven times as large as the effect of income from assets. An increase in social security benefits from $3,000 to $4,000 per year per couple raises the probability of retirement from 7.5 percent to 16 pèrcent. Why is the effect of social security benefits so much more important than the effect of income from assets? Social security benefits are guaranteed for the remainder of one's life and are indexed against inflation.[1] Further, to the extent bequests are planned, personal wealth may be transferred to one's heirs, whereas social security benefits cannot. Also, income from assets includes the imputed income to owner-occupied housing; the elderly may be reluctant to borrow against their equity for fear of living so long as to have to vacate the house and pay capital gains taxes.

Finally, net (after tax and earnings test) earnings has the predicted negative effect; indeed, it is large and measured quite precisely. The negative effect of net earnings is roughly half again as large as the positive effect of the income guarantee. A $1,000 increase in net earnings reduces the probability of retirement by about 60 percent. Since the earnings test reduces net earnings substantially for some fraction of elderly workers, it clearly

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[1]Benefits are now indexed directly; previously, they were implicitly indexed--with a lag--by periodic Congressional review.

dramatically increases the probability of retirement.[1] A reduction of the implicit tax on earnings from one-half to one-third cuts the annual probability of retirement in half for typical workers. The relationship between benefits and the earnings test is also important. In the example given above, a $1,000 increase in social security benefits which exposed more earnings to the earnings test would have only about one-fourth the impact on retirement as a pure increase in benefits (i.e., a $1,000 increase combined with a $1,000 increase in earnings exempted from the earnings test).

Thus, the overall impact of the social security system, through the income guarantee and the earnings test, is clearly to induce retirement.

We noted above that the coefficient for social security benefits was much larger than the coefficient for income from assets. We may make a formal test of the equality of these two coefficients by the likelihood ratio method. Table 4.2 reports the results of a regression in which the coefficients of social security benefits and income from assets are constrained to be equal. The quantity $-2 \ln \lambda$, where λ is the ratio of the constrained to the unconstrained maximum of the likelihood function is a χ^2 variable. In this case, our χ^2 statistic of 7.23 exceeds the critical value at conventional levels and we reject the hypothesis that the effects of social security benefits and income from assets are equal. This conclusion has a startling implication if Feldstein's [7] result is correct that private savings substitute virtually dollar for dollar with

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[1] See the discussion in section 5 below.

Table 4.2

Probability of Retirement Equation

Variable	Coefficient ($\times 10^3$)[a]
Social security benefits + income from assets	0.160 (0.049)
Net earnings	-1.203 (0.169)
Age = 65 dummy	1415 (300)
Spouse's earnings	-0.178 (0.090)
Hours ill	-1.595 (1.273)

log likelihood = -144.742

$\chi^2(1)$ = 7.23

[a]Asymptotic standard errors in parentheses.

social security savings. Even in an actuarily sound program, the net impact of this substitution is an inducement to retire![1]

[1]Even once account is taken of the using up of social security capital.

In Table 4.3, we present results from a logistic regression expanded to include education and age sixty-two, and year dummies. Mincer [17] notes the positive correlation between education and retirement age. This simple correlation may disguise the influences of other variables associated with increases in education (such as higher earnings). The estimated coefficient has the expected negative sign, but is quite small and not measured very precisely.

Since the worker may retire and commence receiving social security benefits at age sixty-two, we include a dummy variable for age equals sixty-two. The estimated coefficient is negative, and not measured at all precisely.

To see if there is a general age effect on retirement (in addition to the age equals sixty-five effect) over this age range, dummy variables for each year were included. If there is a general age effect, the coefficients should increase year by year. In fact, this is not the case.[1] Hence, in this age range, age does not appear to affect retirement probabilities except indirectly through its effect on the other variables. At later ages there well may be a pure age effect.

The coefficients of the original variables change only slightly with the introduction of these additional variables. The most notable change is the slight increase in the absolute value of the coefficient on net earnings. These results suggest that our results are not at all due to a spurious correlation through time among age, retirement and social security benefits.

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[1] A formal likelihood ratio test of the equality of these coefficients passes easily at conventional levels.

Table 4.3

Probability of Retirement Equation

Variable	Coefficient (x 10^3)[a]
Social security benefits	0.893 (0.353)
Income from assets	0.132 (0.051)
Net earnings	-2.048 (1.028)
Age = 65 dummy	1189.5 (313.1)
Spouse's earnings	-0.225 (0.099)
Education	-0.036 (0.053)
Age = 62 dummy	-774.3 (2202.3)
Year 1	-1962.0 (709.8)
Year 2	-2534.3 (760.5)
Year 3	-1985.1 (783.9)
Year 4	-1502.9 (862.0)
Log likelihood	-136.02

[a]Asymptotic standard errors in parentheses.

Finally, we present in Table 4.4 the results of a slightly more general model--one with three labor market states: regular work, quasi-retirement, and retirement, as defined above in section 3.[1] The estimated coefficients are quite similar to those in Table 4.1, all coefficients having the same sign as in the simpler model, and most are measured relatively precisely.

Again, we note the positive inducement to retire at age 65 and the negative effect of spouse's earnings.

The effect of income from assets on the probability of either retiring or quasi-retiring is positive, but modest.

The effect of social security benefits on the probability of either retiring or quasi-retiring is positive and much larger than that of income from assets. At mean values of the independent variables, a $1,000 increase in social security benefits is associated with an increase of 40 percent in the probability of quasi-retirement and of 60 percent in the probability of retirement.

Again, the negative effect of net earnings--modest in the case of quasi-retirement and large in the case of retirement--is measured quite precisely. The earnings test induces both quasi-retirement and complete retirement.

Of course, there are also movements out of quasi-retirement (part-time work), usually into complete retirement. We present in Table 4.5 estimates of the probability of such movements.[2]

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[1]We noted a small amount of "unretirement" in the data and tried to estimate probability of unretirement (P_{21}) equations. The small sample size prevented us from noting any general tendencies.

[2]Infrequent movements from quasi-retirement back to full-time work also occur; our estimates for this movement were very imprecise and are not reported here.

Table 4.4

Probability of Retirement Equations

Variable	Coefficient ($\times 10^3$)[a]	
	Quasi-Retire	Retire
Social security benefits	0.470 (0.250)	0.497 (0.204)
Income from assets	0.107 (0.064)	0.125 (0.060)
Net earnings	-1.95 (0.47)	-1.37 (0.49)
Age = 65 dummy	1720 (408)	617 (317)
Spouse's earnings	-0.121 (0.101)	-0.390 (0.194)
log likelihood = -200.136		

[a]Asymptotic standard errors in parentheses.

Table 4.5

Probability of Movement from Quasi-Retirement
to Complete Retirement

Variable	Coefficient ($\times 10^3$)[a]
Social security benefits	0.355 (0.188)
Income from assets	0.150 (0.095)
Net earnings	-1.66 (0.45)
Age = 65 dummy	806 (359)
Spouse's earnings	-0.255 (0.153)
log likelihood = -103.57	

[a]Asymptotic standard errors in parentheses.

Combined with the results from Table 4.4 they reveal a picture of gradual (perhaps stepwise is more accurate) retirement; movements from full-time to part-time work (perhaps in a different occupation) to complete retirement over a number of years are not uncommon.

Again, the effects are those we have come to expect--strong negative net earnings effects, strong positive social security income and age equal to 65 effects, and modest income from asset effects. Because of the smaller number of potential observations, the individual coefficients are not measured as precisely as those reported above. Hence, we have somewhat more confidence in the empirical results reported above. It is worth noting that for many elderly persons working part-time, social security benefit increases may not be earnings tested over a modest range.

Thus, the results reported above describe a complete stochastic structure of retirement decisions--including the stepping-down gradually phenomenon described above. The estimates may be used to estimate the effects of alternative policies on retirement decisions and their time path.

What do these results imply for the time series decline in the labor force participation rates of elderly males? Of the variables affecting retirement, the effect of the growth in spouse's earnings would be to reduce the probability of retirement; so, perhaps, would the improved health of the elderly (despite our unreliable negative coefficient!). Certainly the growth of after-tax real earnings would do so. Of these three effects, the effect of net earnings is the only one which would be very important given our coefficients. Hence, we must seek an explanation for the decline in the labor force participation in the tremendous increase in social security benefits[1] and the negating of part of the effect of net earnings increases by the earnings test and expansion of social security coverage. Indeed, assuming on average that one-half of the real increase in earnings has been offset by reduced social security benefits and allowing for the growth in real "full" social security benefits, using the coefficients in Table 4.1 suggests that the social security system has increased the annual probability of retirement by some forty percent! Since the actual reduction in labor force participation (refer back to Table 1.1) appears to be about fifty percent for the over sixty-five group and perhaps half of that for the 61-65 age cohort, we see that social security has been the prime mover in the acceleration of retirement![2]

We turn next to a discussion of some overall implications of these results and some suggestions for future research.

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[1]The modest growth in income from assets combined with the small coefficient account for only a very small increase in the annual probability of retirement.

[2]Of course, with much more data we could try to track retirement by age, marital status, occupation, etc. The aggregate figures may cover up important differences among different groups!

5. Conclusion

If the results reported above are at all accurate, they suggest that recent increases in social security benefits and coverage, combined with the earnings test are a significant contributor to the rapid decline of the labor force participation of the elderly in the United States. The social security system is inducing (or enabling) a substantial fraction of the elderly population to retire earlier than they would have in the absence of the system. While a general analysis of the welfare economics of such movements is beyond the scope of this paper, a few comments are worth making.

First, the earnings test creates a huge distortion in the labor supply decisions of a large number of elderly workers. The distortion of this work-leisure choice produces the usual dead-weight loss of the analysis of the effects of taxes on labor supply (see Harberger [12]). Liberalization of the earnings test would dramatically reduce the probability of retirement and improve the allocation of resources.[1] However, the flow of funds through the social security system probably would have to be increased. This has led many researchers (e.g., Pechman, et. al. [19]) to argue that reduction of the implicit tax in the earnings test is too costly. Two provisos need to be added to this allegation.

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[1] One can also imagine a wide variety of external economies and diseconomies associated with driving the elderly out of the labor force.

First, the only real resource cost would be any additional distortions resulting from increased taxes to finance the change in the earnings test (and these are likely to fall well short of the marginal gain in welfare of reducing the earnings test tax both because the labor supply of the elderly is much more elastic than that of the general population and because the marginal welfare cost is a function of the marginal tax rate on earnings, which for many elderly persons substantially exceeds the rate for the non-elderly).

Second, the large labor supply elasticity itself would substantially reduce the net impact on the flow of funds required to finance the additional benefits for two reasons: the increased labor supply of the elderly would increase the direct social security taxes paid by the elderly and the decreased earnings tested rate would apply to a larger earnings base.

Second, while we have produced no direct evidence relating to the effects of social security on saving or labor supply prior to old age, our results are certainly consistent with the induced retirement effect discussed by Feldstein [7] in his analysis of social security and saving. Thus, any substitution of social security for private saving is in spite of induced retirement working to increase saving.[1]

Finally, let me conclude by noting that the conclusions above are based on a single source of data and a modest sample size. Further

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[1]Indeed, the results of Munnell [18] suggest that the induced retirement effect thus far has offset the asset substitution effect. She suggests the net effect eventually will be a decrease in saving.

analysis of panel studies[1] is certainly in order to help confirm or reject these conclusions; indeed, I hope that the entire subject of social insurance will begin to receive the attention it deserves.

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[1]Once the mature males sample of the Parnes data reaches retirement age and once the Retirement History Survey records several more years of information, we will have two large samples with which to address the questions raised in the current paper.

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Appendix A: The Statistical Model

We observe an individual's labor market behavior for five consecutive years. Let the individual be in one of N states (e.g. full-time work, quasi-retirement, retirement), choose the conditional logit parametrization of the probabilities of movements among states,[1] and focus for the moment on transitions out of a single state, say state 1; we have the following Markov model of retirement behavior:

$$P_{11,st} = \frac{1}{1 + \sum_{N} e^{\beta_n' X_{nst}}}$$

(A.1)

$$P_{1\ell,st} = \frac{e^{\beta_\ell' X_{\ell st}}}{1 + \sum_{N} e^{\beta_n' X_{nst}}} \qquad \ell = 2,\ldots,N$$

where $P_{1\ell st}$ is the probability individual s will move from state 1 (e.g. full-time work) to state ℓ (e.g. retirement) in period t, X_{nst} is a vector of variables for individual s in time t in state n, and the β's are unknown parameters to be estimated. The β's may be interpreted as relative shadow weights or prices attached to the variables in choosing which state to move to each period. We choose

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[1]Conditional logit estimation is developed in McFadden [16].

the maximum likelihood method of estimating β.[1] The part of the likelihood function referring to a single state i may be written as:

$$\mathcal{L}_i = \prod_{s=1}^{S} \prod_{t \varepsilon T_{is}} P_{iv,st} \qquad v \varepsilon [1,N] \qquad \text{(A.2)}$$

where T_{is} is the set of times individual s is in state i. The entire likelihood function, of course, is $\prod_i \mathcal{L}_i$. To maximize the likelihood of observing our sample in the sequence of states they occupy, given their right-hand variables in each state in each period, we take logarithms

$$\ln \mathcal{L}_i = \sum_s \sum_{t \varepsilon T_{is}} \ln P_{iv,st} \qquad \text{(A.3)}$$

and differentiate with respect to the unknown β,

$$\frac{\partial \ln \mathcal{L}_i}{\partial \beta_{\ell q}} = \sum_s \sum_{t \varepsilon T_{is}} \frac{\partial \ln P_{iv,st}}{\partial \beta_{\ell q}} \qquad \text{(A.4)}$$

where ℓ denotes possible states and q indexes right hand variables. Hence, we have as many first-order derivatives as the product of the number of right hand variables and one less than the number of states. Now

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[1] See Kendall and Stuart [14] for a discussion of the properties of maximum likelihood estimators and Kemeny and Snell [13] for an introduction to Markov chains.

$$\frac{\partial \ln P_{ivst}}{\partial \beta_{\ell q}} = -X_{\ell q,st}\, P_{i\ell,st} \qquad \text{if } v \neq \ell$$

and (A.5)

$$\frac{\partial \ln P_{i\ell,st}}{\partial \beta_{\ell q}} = X_{\ell q,st}\,(1 - P_{i\ell,st}) \qquad \text{if } v = \ell.$$

Equations (4.5) may be substituted into (4.4). To maximize the likelihood function, these first derivatives must be set equal to zero and the resulting system of equations solved. We use Newton's method, which requires information on the second partial derivatives of the likelihood function. The iterative procedure is defined by

$$\beta_{\tau+1} = \beta_{\tau} - [B]^{-1}_{\beta\tau}\, A_{\beta\tau} \tag{A.6}$$

where τ refers to iteration number, B is the matrix of second partial derivatives, and A is the vector of first partial derivatives, each evaluated at the β vector obtained in iteration τ. Typical elements of the matrix of second partial derivatives are

$$\frac{\partial^2 \ln \mathcal{L}_i}{\partial \beta_{un}\, \partial \beta_{\ell q}} = \sum_{s} \sum_{t\epsilon T_{is}} \frac{\partial^2 \ln P_{iv,st}}{\partial \beta_{un}\, \partial \beta_{\ell q}} \tag{A.7}$$

where

$$\frac{\partial^2 \ln P_{iv,st}}{\partial \beta_{un}\, \partial \beta_{\ell q}} = \begin{cases} X_{\ell qst}\, X_{unst}\, P_{i\ell st}\, P_{iust} & u \neq \ell \\ -X_{\ell qst}\, X_{unst}\, P_{i\ell st}(1 - P_{i\ell st}) & u = \ell \end{cases} \tag{A.8}$$

The iterative process is said to converge when successive iterations yield sufficiently similar estimates of β. Further, the square roots of the negative of the diagonal elements of B may be used as estimated standard errors of the estimated coefficient vector β.

The important thing to note about the model is that it enables us to capture the stochastic structure of retirement decisions--retirement may take place gradually as potential retirees pass through a series of labor market states (full-time work, part-time work, complete retirement, etc.), perhaps even moving back and forth among several. Our model potentially enables us to capture such movements through their dependence on a series of variables which may in turn depend upon time. Thus, if accurate estimates of the coefficients are found, the effects of alternative policies, such as the provision of social security benefits and the earnings test under social security, which affect the variables influencing retirement decisions, on the time structure and extent of retirement may be estimated.

Appendix B: A Life Cycle Labor Supply Model

Consider an individual planning his lifetime consumption of goods, X, and leisure, L. We assume the individual acts to maximize discounted lifetime utility subject to a budget constraint, i.e. he

$$\text{maximizes} \int_{t=0}^{T} e^{-rt}\, U(X, L)dt \qquad (B.1)$$

subject to

$$\dot{K} = rK + W(t)(T - L(t)) - P(t)X(t), \qquad (B.2)$$

where T is time available, K is assets, $\dot{K}$ saving, and W(t) and P(t) are the wage rate (after-tax) and price of consumption goods.

Form the Hamiltonian

$$\mathcal{H} = e^{-\delta t}\, U(X,L) + P_K(t)[rK + W(t)(T-L(t)) - P(t)X(t)] \qquad (B.3)$$

where $P_K(t)$ is the shadow price of saving. Necessary conditions for an optimum are then

$$\dot{P}_K(t) = \frac{-\partial H}{\partial K} = -r\, P_K(t),$$

$$\frac{\partial H}{\partial C} = e^{-\delta t}\, \frac{\partial U}{\partial X} - P_K(t)P(t) = 0 \qquad (B.4)$$

and

$$\frac{\partial H}{\partial C} = e^{-\delta t}\, \frac{\partial U}{\partial L} - P_K(t)P(t) = 0.$$

Rearranging, and dividing, we see that

$$\frac{\frac{\partial U}{\partial X}}{\frac{\partial U}{\partial L}} = \frac{P(t)}{W(t)}, \qquad (B.5)$$

i.e. the consumer workers equate the instantaneous marginal rate of substitution between goods and leisure to their relative prices. Further

$$P_K(t) = \frac{e^{-\delta t}\frac{\partial U}{\partial X}}{P(t)} = \frac{e^{-\delta t}\frac{\partial U}{\partial L}}{W(t)} \qquad (B.6)$$

the shadow price of saving is equal to each of the time discounted marginal utilities of consumption and leisure, divided by their respective prices. From this set of optimum conditions, we may derive the consumer-worker's optimal lifetime pattern of consumption of leisure and goods, as well as the comparative dynamic effects on the consumption of goods and leisure of changes in wages, prices and assets. Since explicit solutions require specific functional forms for utility functions, we present here only a heuristic discussion of these effects. The general labor supply function may be written as

$$LS = f(P, W, K_0) \qquad (B.7)$$

where the coefficients on the price, wages and assets depend upon age, the interest rate and the initial shadow price of saving as well as upon parameters of the utility function.

Fist, compared to the usual comparative static result that labor supply may be an increasing or decreasing function of wage rates, depending upon whether the income or substitution effect dominates, the wage elasticity of labor supply now also depends upon the sensitivity of the shadow price of saving to wage changes. A permanent increase in wage rates makes the individual wealthier and is most likely to decrease the shadow price of saving.

Second, the time pattern of labor supply also depends upon the shadow price of saving. An increase in this initial shadow price will accelerate the time rate of change of leisure consumption.

Thus, any program which alters the wage rates or assets of individuals potentially affects labor supply and saving over the entire life cycle.