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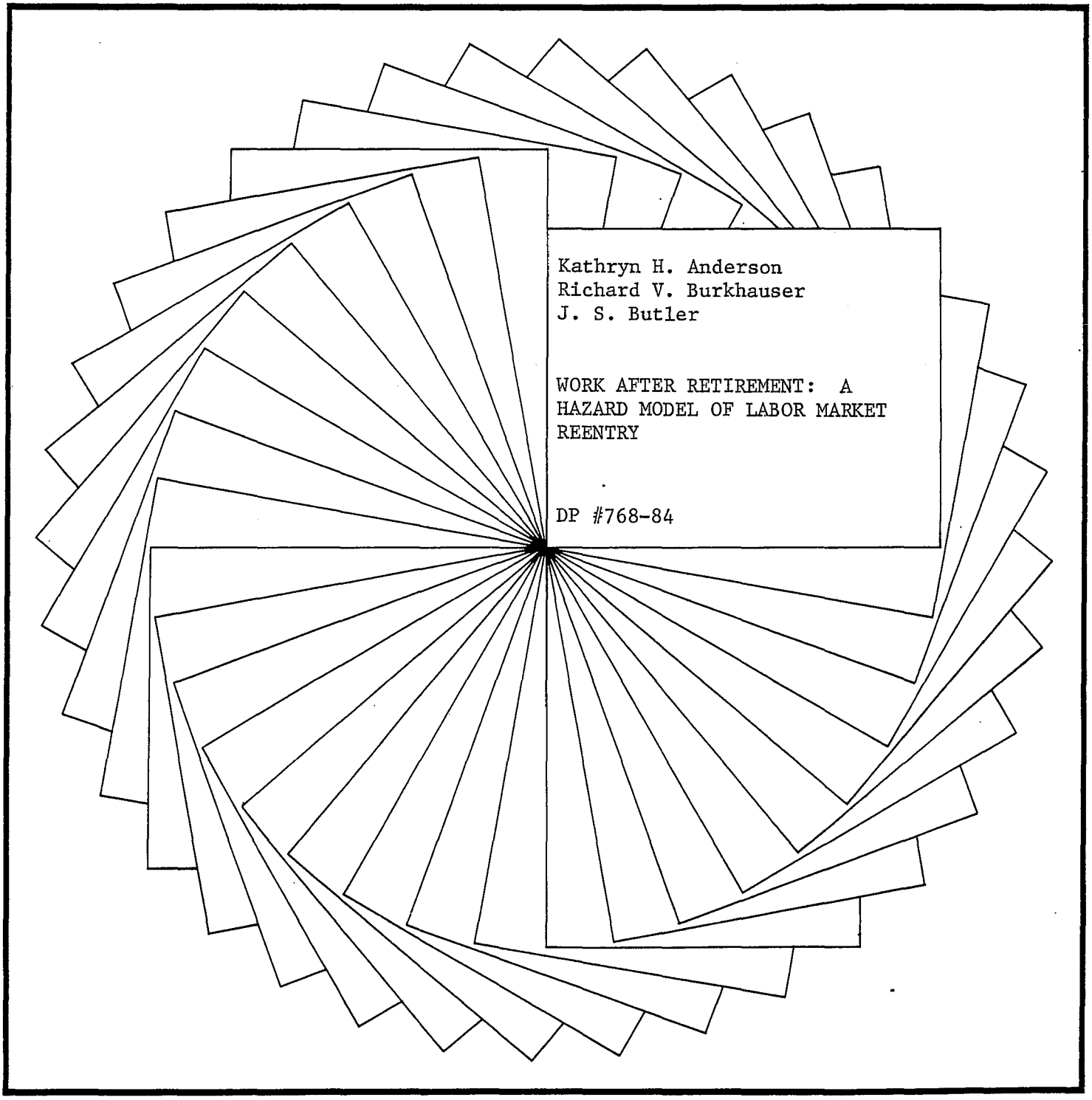

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WORK AFTER RETIREMENT:

A HAZARD MODEL OF LABOR MARKET REENTRY

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Abstract

For older workers, retirement does not mean a permanent end to job search. Using data from the Retirement History Survey, we find that of those who were not working and declared themselves either fully or partly retired between 1968 and 1977, over one quarter worked again by 1979. Using a dynamic hazard rate model, we find that economic variables including government transfer programs--Old Age and Survivors Insurance and Supplemental Security Income--significantly affected the timing of reentry. We argue that in evaluating changes in such programs it is important to consider their effect not only on retirement but also on the reentry of those already retired.

Work After Retirement: A Hazard Model of Labor Market Reentry

The link between government transfer programs targeted on the aged--social security (OASI) and Supplemental Security Income (SSI)--and the dramatic fall in the labor supply of this age group has been the subject of much attention in the economics literature.[1] The great majority of studies on this issue concentrate on the retirement decision and either explicitly or implicitly assume that decision to be a permanent one.[2]

Yet, a look at the career of Mohammed Ali or Richard Nixon shows that this decision is not irrevocable. Both men reentered the labor market and resumed careers after announcing their retirement. This pattern of retirement followed by reentry is not confined to public figures.

Using data from the 10-year Retirement History Survey (RHS), we look at men and women aged 58 to 63 in 1969 who stopped working and declared themselves fully or partly retired between 1968 and 1977.[3] We trace the incidence of their subsequent labor market reentry after declared retirement. After establishing that reentry is not a rare occurrence among those in our sample, we examine their decision using a dynamic hazard model.

Our findings suggest that economic variables, including government transfer programs, significantly affect the timing of reentry. After controlling for individual differences in the propensity to reenter, we find negative time dependence--i.e., the longer one remains retired, the less likely one is to return to work in a subsequent period. However, unlike hazard-based search models of the type estimated for younger unemployed workers, we find this relationship is not monotonic. The

propensity to return to work actually increases for a short period--approximately four years--before it falls.

The Incidence of Labor Market Reentry

It is commonly assumed that a worker who declares himself retired has permanently left the labor market. This belief is reinforced to some degree by cross-sectional data which show relatively low levels of labor force participation for older age groups. Recently, Hamermesh (1984), using two consecutive waves of the RHS, found that only 9 percent of his sample of retired households with no earnings in the previous year worked in the following year.

Table 1 provides an alternative view of reentry. Here, a retirement state is defined as not currently working and declaring oneself fully or partly retired. Reentry is defined as working for wages or salary at a regular job for at least two weeks over a subsequent period--two years.

Using these state definitions, we find that a surprisingly large percentage of those who retired between 1968 and 1977 returned to work by 1979. Of the 5,494 individuals who retired, 26 percent subsequently worked. Of those who declared themselves fully retired, 21 percent reentered; of those who declared themselves partly retired, 50 percent reentered.

The degree of reentry found in our sample of older retired workers argues that retirement does not necessarily signal an end to job search. It is to this little-researched aspect of labor market behavior that we now turn.

Table 1. Distribution of Labor Force Activity in Subsequent Periods for Those Who Retired between 1968 and 1979: All Retirees

Response	Years Since Retirement					
	0-2	2-4	4-6	6-8	8-10	Total
Full Sample[a]						
Stayed retired	510	665	667	389	96	2327
Reentered job market[b]	1085	242	83	25	6	1441
Died[c]	279	189	122	60	10	660
Lost, unknown reasons	462	316	191	78	19	1066
Total	2336	1412	1063	552	131	5494
Fully Retired[d]						
Stayed retired	450	589	605	339	81	2064
Reentered job market	667	182	62	20	4	935
Died	242	163	109	56	10	580
Lost, unknown reasons	384	276	169	63	15	907
Total	1743	1210	945	478	110	4486
Partly Retired[e]						
Stayed retired	60	76	62	50	15	263
Reentered job market	418	60	21	5	2	506
Died	37	26	13	4	0	80
Lost, unknown reasons	78	40	22	15	4	159
Total	593	202	118	74	21	1008

Source: Retirement History Survey, 1969-1979.

Notes: [a]Not currently working and self-declared fully or partly retired.

[b]Work at least two weeks at a regular job over the two-year period between interviews.

[c]Based on social security death records merged with the RHS.

[d]Not currently working and self-declared fully retired.

[e]Not currently working and self-declared partly retired.

A Hazard Model of Reentry

We estimate the reentry process using a single-transition hazard model (Lancaster, 1979; Flinn and Heckman, 1982). Job search is assumed to occur after declared retirement as a response to initial conditions and changes in income, health, family structure, and taste. To take a job after retirement, a retiree must receive a wage offer greater than the marginal value of his time during retirement. This reservation wage, $W_R(t)$, is determined primarily by the flow of retirement income (OASI, individual pension, and SSI income) and preferences for leisure relative to work after retirement. The conditional probability of taking a job during a small interval (t,dt), given retirement at time t, is the hazard rate, h(t), which depends on the probability of receiving a wage offer at least equal to $W_R(t)$, weighted by the probability, r(t), that an offer is received:

$$h(t) = Pr[W > W_R(t)]r(t)dt. \tag{1}$$

In a single transition model, in which the retiree chooses only to reenter or to remain retired, h(t) is expressed as

$$h(t) = \frac{g(t)}{1 - G(t)}, \tag{2}$$

where g(t) and G(t) are the density and distribution functions of time to reentry. The expected length of time before reentry occurs is

$$E(L) = \int_0^{\infty} \exp\{- \int_0^{t} h(z)dz\}dt. \tag{3}$$

Variation in h(z) due to variation in the wage offer distribution, the rate function, and/or W_R, causes variation in duration or the length of retirement.

In our sample, we have three separate groups of retirees. First, there are N_E initial retirees who take a job sometime before the end of the survey period. Second, there are N_R initial retirees who are still retired by the end of the period. Third, there are N_D initial retirees who either die before taking a job or disappear from the survey for unknown reasons. We have modeled the behavior of the first two groups.

We assume that all retirees are initially looking for work and will find work at some point in the future; we know the reentry date of the retirees in group one. In group two, the point of reentry occurs after the last wave of our panel survey. We do not model the behavior of the retirees in group three. We assume that death or exit from the survey for unspecified reasons is not a choice of the individual; it is treated as exogenous to the choice of reentry. The numerical information on these group three retirees, however, is used as long as they are in the sample. As with the group one and two retirees, they are assumed to be looking for a job up to the point of exit from the survey.

The likelihood function maximized in this one-transition model consists of two parts. Among the N_E retirees who find a job, we know when the job begins. The probability of finding a job at t_j+e_j, conditioned on initial retirement, is

$$\frac{g_j(t_j+e_j)}{1 - G_j(t_j)} = h_j(t_j+e_j). \tag{4}$$

The N_R retirees' reentry intervals are still open in 1979. For these individuals, the probability of not finding a job between t_i and t_i+u (where u is the end of the survey), conditioned on initial retirement, is

$$\frac{1 - G_i(t_i+u)}{1 - G_i(t_i)} . \tag{5}$$

The likelihood function is, therefore:

$$L = \prod_{j=1}^{N_E} \frac{g_j(t_j+e_j)}{1 - G_j(t_j)} \prod_{i=1}^{N_R} \frac{1 - G_i(t_i+u)}{1 - G_i(t_i)} . \tag{6}$$

t_i, t_j, u, and e_j are all known. t_i and t_j are the dates of initial retirement, u is the number of periods between initial retirement and the last wave of the survey, and e_j is the number of periods between initial retirement and acceptance of a job.

The hazard rate defined above, h(t), has three components: an observable component measuring variation across individuals, a time profile measuring time dependence, and an individual-specific, unobservable random component (worker heterogeneity). We model the first component, θ_1, as an exponential function:

$$\theta_1 = \exp(X'\beta). \tag{7}$$

The X's are indicators of the individual's reservation wage, wage offer

distribution, and the probability of receiving an offer. The X's can either remain invariant over time or change as the retiree ages.

The second component, θ_2, examines the time profile to reentry after controlling for individual differences in the propensity to reenter. The functional form we chose is

$$\theta_2(t) = \exp^{\alpha t+\beta t^2}. \tag{8}$$

The quadratic form above allows us to estimate points of maximum or minimum time dependence.

The third component, v, examines worker heterogeneity or unobserved tastes for leisure, for example. We assume that v follows a log-normal distribution, and we integrate out the unobservable.

Data and Variables

The data are obtained from the RHS, a 10-year longitudinal study of the behavior of men and women aged 58-63 in 1969. Interviews were conducted at two-year intervals. Our sample consists of individuals who, at some survey date between 1969 and 1977, are not working and report themselves as either fully or partly retired.[4] We eliminate individuals who have not worked in the market after 1967 and those who are severely handicapped or bedridden or who lack certain information, such as a computable permanent wage. Our sample consists of 5,494 men and women; of these, 4,486 are fully retired and 1,008 are partly retired.

The X-variables in our model measure the individual's employability, the determinants of his reservation wage, and his health and demographic characteristics. The time-invariant X-variables include age at retire-

ment, declared retirement status, sex, race, self-employment status on last job, and permanent wage. The time-varying X-variables are home ownership status, health, number of dependent children, marital status, and flows of real income from government transfers and individual pensions.

Social security, SSI and pension income variables are flow variables expressed in 1979 dollars.[5] Social security (OASI) and pension income is the sum of actual respondent and spouse benefits each year. SSI income is equal to the amount received in SSI and old-age benefits. Note that SSI replaced old-age assistance benefits in 1974.[6]

Our principal concern here is the degree that variables directly susceptible to government policy changes--social security, SSI and pension benefits--affect the timing of reentry. We expect each is negatively related to market reentry.

Other economic variables of interest are home ownership status and wage. We expect that home ownership is strongly related to wealth and hence is negatively related to job reentry. As measured here, it is a dichotomous variable equaling one if the respondent is living in his or her own home. We expect a higher permanent wage to be positively associated with reentry, since workers with a higher permanent wage can be considered more likely to reenter because their foregone earnings are greater. We expect that postretirement wage offers are likely to be positively correlated with permanent wage. This variable is based on permanent wage equations estimated in Appendix Tables A.1 and A.2.

Health has consistently been found to affect the retirement decision, and we expect changes in a retiree's health also to influence

reentry. If one's health is relatively better than that of one's peers, we expect the probability of reentry will be increased.[7]

We also include three variables which may capture taste for leisure and opportunity for reentry. We expect those who report themselves as fully retired to have a greater taste for leisure than those who report themselves as partly retired. Thus, we predict they are less likely to reenter. Age at retirement has an uncertain sign. While age is positively related to retirement, it need not be negatively related to reentry. To the degree that workers who retire later have a greater taste for work, it is possible that they may be more likely to return to work. Finally, a variable for self-employment on last job is included since it is commonly held that the self-employed have greater flexibility in retirement choice. Hence we expect reentry to be less likely since they are not constrained in initial retirement choice by policies of a firm.

We also include demographic variables: race, sex, marital status, and dependent children. Blacks and women have traditionally been seen as having a weaker commitment to the labor force, while married workers and workers with dependent children have a stronger one.

Finally, we expect negative time dependence. Lancaster (1979) has found, for instance, in a sample of younger men, that the longer one has been unemployed, the less likely one is to reenter. This is what would be predicted for older men, based on Table 1 patterns. There is a considerable amount of reentry--24 percent--up to two years after retirement. This is followed by much smaller rates of reentry by those who remain retired. Of those remaining retired for two years, 1.5 percent reenter by the end of the fourth year, 2.0 percent by the

end of the sixth year, and 2.1 percent reenter by the end of the eighth year.

The means and variances of all variables used in our empirical work are reported in Table 2. The estimated coefficients and asymptotic standard errors obtained from the estimated hazard models are presented in Table 3. We have estimated our model for all retirees and for two subsets of retirees--those retiring before reaching age 65 and those retiring at or after reaching age 65.

Column 1 of Table 3 contains the hazard results for our full sample. The three major policy variables available to government are all significant at the 1 percent level in the expected direction. Increases in real social security benefits, in private pensions, or in SSI significantly reduce the likelihood of reentry into the labor market after retirement. Hence these variables which have proven to be important factors in the retirement decision are also shown to affect reentry.

Other economic variables, however, are not found to be significant in this decision. We are not able to show that either permanent wage or home ownership affect reentry. It may be that the wage estimate used here, which is based on past wage history, is not a good predictor of the opportunity wage in the market once retirement has occurred, and home ownership may not accurately proxy wealth.

Health, which has traditionally been found to affect the retirement decision, is not significant here.[8] The demographic variables sex and race are likewise insignificant at standard levels, but married retirees and those with dependent children are more likely to reenter.

Table 2. Summary Statistics

Variables	All Retirees	Retired Prior to Age 65	Retired at or after Age 65
Time invariant			
Age at retirement - 65	-.166	-1.677	2.167
	(.239)	(1.534)	(1.370)
Sex (female=1)	.224	.221	.229
	(.417)	(.415)	(.420)
Race (nonwhite=1)	.058	.056	.061
	(.234)	(.230)	(.240)
Self-employed (=1)	.073	.054	.083
	(.260)	(.227)	(.275)
Permanent ln wage	2.253	2.281	2.205
	(1.015)	(1.007)	(1.027)
Retirement status (full time=1; part time=2)	1.162	1.157	1.168
	(.368)	(.364)	(.373)
Time variant			
Home ownership (=1)	.702	.698	.708
	(.457)	(.459)	(.454)
Health better than others (=1)	.307	.275	.357
	(.461)	(.447)	(.479)
Health worse than others (=1)	.461	.465	.451
	(.498)	(.499)	(.498)
Children totally supported	.098	.119	.066
	(.451)	(.463)	(.429)
OASI benefits (in $10,000 units)	(.219	.149	.330
	(.275)	(.260)	(.261)
Pension benefits (in $10,000 units)	.173	.167	.184
	(.388)	(.404)	(.360)
SSI (in $10,000 units)	.002	.001	.003
	(.021)	(.012)	(.029)
Married (=1)	.727	.750	.692
	(.445)	(.433)	(.462)

Note: Statistics reported are the mean and the standard error (in parentheses). The statistics for the time-variant variables are calculated during the first retirement period.

Table 3. Estimates of Parameters of Hazard Model for All Ages and for Subsamples Determined by Age at Retirement

Independent Variables	Parameter Estimates		
	Full Sample	Retired Prior to Age 65	Retired at or after Age 65
Constant	-8.090** (.510)[a]	-8.008** (.611)	-10.590 (1.186)
OASI benefits	-2.597** (.364)	-3.861** (.497)	-.892 (.560)
Pension benefits	-.361** (.166)	-.387 (.255)	-.282 (.222)
SSI	-7.953** (2.206)	-6.848** (2.420)	-9.851 (5.411)
Permanent wage	-.077 (.096)	-.102 (.112)	.111 (.182)
Home ownership	.006 (.165)	-.051 (.204)	.009 (.288)
Health better	.215 (.221)	.309 (.263)	.229 (.412)
Health worse	.078 (.178)	.107 (.215)	.191 (.316)
Retirement status	1.652** (.176)	1.668** (.220)	1.760** (.333)
Age at retirement (minus 65)	.123** (.032)	.075 (.057)	.146 (.088)
Self-employed	-.028 (.219)	.135 (.265)	-.508 (.386)
Sex	.197 (.246)	.316 (.297)	-.338 (.473)
Race	-.146 (.238)	-.114 (.292)	-.348 (.411)
Married	.802** (.245)	.891** (.297)	.347 (.467)
Children	.264* (.129)	.252 (.139)	.132 (.294)
Time	3.836** (.313)	3.438** (.348)	7.949** (1.089)
Time squared	-.928** (.067)	-.760** (.073)	-2.488** (.295)
Sample size	5,494	3,340	2,154

Note: Asymptotic standard errors are in parentheses.

*Significant at the 5 percent level.

**Significant at the 1 percent level.

The variables we include to measure tastes for work--retirement status and age at retirement--were significant at the 1 percent level. Those who declared themselves partly retired are more likely to reenter in a given period than those who are fully retired. Age at retirement has a strongly positive effect, indicating that those who retire at older ages are more likely to return to work in a given period than younger retirees.

This somewhat surprising result suggests that tastes for work might differ between those who retire early and those who retire late. Social security receipt is a major work disincentive at age 65 and over. It is much less so between ages 62 through 64.[9] We now take that information into account in looking more closely at the age variable in an attempt to understand why workers who retire at later ages are more likely to reenter.

Columns 2 and 3 contain the results of our hazard model estimation on the two subsamples: those who retire before they reach age 65 (N = 3,340) and those who retire at or after reaching age 65 (N = 2,154). Those who worked to age 65 or more originally worked during an age period when the wealth value of future social security benefits was falling. Once workers reach age 65, the marginal increase in the present discounted future social security benefits associated with an additional period of work is less than the loss of benefits and the additional social security taxes paid during the period. (See Burkhauser and Quinn, 1983a, and Clark and Gohmann, 1983, for evidence of this.) Hence, they might have a greater taste for work than other workers and be less sensitive to economic incentives. Those conditions would be consistent with a tendency of this group to return to work because

of dissatisfaction with their state. Workers who retired before age 65, however, did so in the face of a much smaller loss, or possibly a gain, in social security wealth. They may be much more sensitive to economic incentives and less dissatisfied with their state after retirement. Thus, these younger retirees are less likely to reenter both because of taste differences and because now, at older ages, the marginal loss in social security wealth is even higher than at the age of initial retirement.

The results in these columns lend some support to this view. In both models the age of retirement is no longer significant. While social security income reduces the probability of reentry among retirees in both age groups, its effect is only significant, and is three times larger, among the younger retirees. In Appendix Table A.3 we list the t-test statistics for all variables in the two equations and show that the difference between the social security coefficient in the two retirement age groups is significant.

Finally, we turn to time dependence. While we find that the marginal change in the likelihood to reenter eventually falls, this is not the case in the early periods of retirement. In the full sample the estimated time dependence is $\exp(3.836 - .928\ t^2)$. A quadratic is maximized at $t = -2/(2\hat{\beta})$. Thus the hazard reaches a maximum, other things constant, at $t = 2.067$, where each period represents two years. Thus we find that the hazard of reentry for our sample actually rises for four years and falls thereafter.[10] The time dependence of those who retire at a later age peaks a little earlier than that of those who retire earlier. Those retiring before age 65 have a peak at 2.26 periods (4.52 years); those retiring at or after age 65 have a peak

at 1.60 periods (3.20 years). However, a t-test indicates that they are not significantly different.[11]

A Measure of the Relative Importance of Various Economic Values

Table 3 shows that economic variables susceptible to change by federal policy significantly affect the timing of reentry. One method of showing the relative importance of these variables is to measure the change in expected duration that will occur with a change in one variable, other things held constant. Another measure which allows some sense of the relative importance of variables is the elasticity of the expected duration with respect to changes in policy variables. Table 4 contains these values for the principal economic variables in Table 3.

From the parameters of a hazard model it is possible to calculate an expected duration of time before succumbing to the hazard--here reentering the labor market (see equation 3). Besides calculating the expected duration, the first derivatives of the expected duration with respect to various explanatory variables can be calculated. For example, the average increase in duration of retirement resulting from an increase in social security benefits can be calculated. The derivative of expected duration, E(L), with respect to the k-th explanatory variable is given by equation 9. The change refers to a constant change in either a fixed or changing variable which is permanent and applies to all time periods.

$$\frac{\partial E(L)}{\partial X_k} = \int_0^{\infty} \frac{\partial}{\partial X_k} \exp\left[-\int_0^{t} h(z)dz\right]dt. \qquad (9)$$

Table 4. Derivatives and Elasticities of Selected Variables

Variables	Full Sample		Retired Prior to age 65		Retired at or after age 65	
	Derivative (years)[a]	Elasticity	Derivative (years)	Elasticity	Derivative (years)	Elasticity
OASI benefits (per $1,000)	-4.69	0.41	5.65	0.49	1.81	0.16
Pension benefits (per $1,000)	.65	0.03	.57	0.03	.57	0.03
SSI benefits (per $1,000)	14.35	0.04	11.02	0.03	20.00	0.05
Permanent wage (per $1)	1.39	0.08	1.49	0.08	0.23	0.01

[a]Increased duration in years of retirement with a change of one unit of independent variable.

$$\frac{\partial E(L)}{\partial X_k} = \int_0^{\infty} - \left[\int_0^{t} \frac{\partial h(z)}{\partial X_k} dz \right] \exp\left[- \int_0^{t} h(z)dz \right] dt.$$

Table 4 shows the results of our calculations. The first derivatives in equation 9 are calculated using numerical integration. The elasticities are calculated according to equation 10:

$$\frac{EE(L)}{EX_k} = \frac{\partial E(L)}{\partial X_k} \cdot \frac{\bar{X}_k}{E(L)}, \tag{10}$$

where $\bar{X}_k$ is a selected value of X_k. Mean or representative values of the various inputs are used.[12]

The elasticities, while positive, are small for both SSI and pension benefits. Social security by comparison is 10 times more elastic. This suggests that social security is likely to provide policymakers with the most sensitive mechanism to effect reentry into the work force. Hence, for example, the new tax on social security benefits imposed in 1984 on high-income social security beneficiaries may have some effect on the work effort of a group normally considered permanently out of the labor force.

Conclusions

In this paper we have empirically examined the decision of retired workers to return to work. This phenomenon is much more important than might be expected by those who look only at cross-sectional data. In our data, which trace retirees for up to eight years after retirement, reentry occurs in over one quarter of the cases. Little research attention has been focused on this issue. Reentry can occur for many reasons--a change in tastes for leisure or a change in one's standard

of living. Government policies can affect the likelihood that work after retirement occurs by altering the flow of real retirement income either directly via social security or SSI benefit changes or indirectly through changes in tax laws or inflation policy.

Using a single-transition hazard model to estimate the parameters affecting reentry, we find that changes in the flow of income from social security, pensions, or SSI significantly affect the timing of labor market activity. From a policy perspective, the measured effects of social security are particularly important. Social security benefits have a strong negative effect on the probability of reentry. Thus, in evaluating changes in this program on the work effort of older age groups, it is important not only to consider its effects on retirement but also on the reentry of those who are already retired.

NOTES

[1]See Danziger, Haveman, and Plotnick (1981), Mitchell and Fields (1982), and Thompson (1983) for recent reviews of this literature.

[2]See Mitchell and Fields (1984) and Burkhauser and Quinn (1983a) for recent examples. With the exception of Gustman and Steinmeier (1984), who provide mainly descriptive statistics of work after retirement, no empirically based study has investigated the factors which affect the decision to return to work after retirement.

[3]A number of definitions of retirement have been used in the literature. We chose our definition because it conforms most closely with that used in measuring labor force participation. In this sample of older workers, however, the distinction between unemployed and out of the labor force is not a useful one. We find virtually no respondents who are not working and reporting themselves unemployed. We believe the interesting movement is from not working at older ages to reentry into the work force. Operationally, our definition combines two separate questions from the RHS: We include in our retirement state definition those who are currently not working and who report in a separate question that they are either fully or partly retired. This differs, for instance, from the Gustman and Steinmeier (1984) taxonomy by linking actually not being at work with the retirement state definition.

[4]The last period of the sample is the one whose interview date just precedes reentering or dying. There are five interviews possible.

[5]Because OASI and SSI benefits in a given period are subject to an earnings test, in single-period analysis such a measure is endogenous. However, in our dynamic model benefits are measured only in periods of retirement and not in the period of reentry.

[6]In 1973 the RHS did not separately ask questions on welfare income sources but merely summed all such sources. We are forced to use this value for 1973 SSI. Because aged respondents are not likely to be eligible for AFDC or other cash transfers, we do not expect this to be a serious measurement problem.

[7]Note that, like other time-variant variables, our subjective health measure is not considered in the period of reentry. Hence it is less susceptible to the biases of measurement raised by critics of subjective health measures--see for instance Parsons (1982), Anderson and Burkhauser (1984), and Bazzoli (1984).

[8]This result is consistent with that found by Bazzoli (1984) for the retirement decision when self-reported health in the period prior to retirement is used to measure health status.

[9]There is considerable dispute regarding the degree that social security (OASI) discourages work prior to age 65. In the period of this study, however, the actuarial increase for those who postponed benefit acceptance past age 65 was considerably below a fair one. It is likely that for the great majority of workers, social security discouraged work past age 65. For a fuller discussion see Burkhauser and Turner (1982).

[10]It is possible that this is an artifact of our data. The RHS traces individuals over only part of their remaining lives. By 1979, individuals in the sample were aged 68-73; we are not able to observe the behavior of very old individuals. Men in our sample were 58-63 in 1969, with an average life expectancy of 75 years. We only have data on one side of the age distribution around the mean.

[11]The asymptotic variance of $a/(2b)$ is $V(a)/(4b^2) + V(b)a^2/(4b^2) - Cov(a,b)a/(2b^3)$. The variances and covariances are generated by the maximum likelihood procedure. The estimates of a and b are highly correlated, about -0.9 to -0.95. The t-value reported in the text is $(2.26-1.60)/(0.195+0.004)^{0.5}$.

[12]As noted elsewhere, the expected duration is quite long because many of the persons in the sample are essentially stayers rather than movers, which a standard hazard model does not recognize. The expected duration is estimated to be 40.0; the permanent wage to be 2.25; the values of OASI, pension, and SSI benefits to be 3.5, 2.0, and 0.1, in units of thousands of dollars. These are the approximate averages of these variables associated with retirees not returning to work for three periods. The means, and hence the elasticities, are smaller for values drawn from earlier returnees.

Appendix

Table A.1. Earnings Function

Independent Variables	Coefficient	Standard Error
Constant	5.704**	.024
Occupation		
Professional	.346**	.028
Farmer	-.212**	.071
Manager	.347**	.024
Clerical	.147**	.025
Sales	.109**	.032
Craftsman	.161**	.020
Household worker	-.512**	.047
Service worker	-.101**	.024
Farm laborer	-.879**	-.138
Laborer	-.179**	.029
Industry		
Agriculture	-.164**	.065
Mining	-.155**	.060
Construction	-.067**	.024
Transportation	.007	.023
Trade	-.369**	.020
Fire	-.068**	.030
Repair	-.222**	.037
Personal services	-.465**	.033
Entertainment	-.252**	.059
Services	-.101**	.024
Government worker (1 = yes)	-.029	.017
Self-employed (1 = yes)	-.220**	.021
Education		
Elementary	-.267**	.017
High school	-.090**	.018
High school graduate	.363**	.037
Some college	.059**	.024
College graduate	.324**	.030
Race (1 = nonwhite)	-.139**	.020
Sex (1 = female)	-.476**	.021
Selectivity bias correction[a]	1.035**	.095
Sample size	10,303	

*Significant at the 5 percent level.
**Significant at the 1 percent level.
[a]Based on Olsen (1980).

Table A.2. Participation Equation

Independent Variables	Coefficient	Standard Error
Constant	.890**	.013
Occupation		
Professional	.058**	.019
Farmer	.071	.045
Manager	.057**	.016
Clerical	.062**	.017
Sales	.039	.021
Craftsman	.045**	.013
Household worker	.036	.030
Service worker	-.010	.016
Farm laborer	-.121**	.050
Laborer	-.047**	.019
Industry		
Agriculture	.0004	.0003
Mining	-.176**	.038
Construction	-.030	.016
Transportation	-.008	.015
Trade	-.017	.013
Fire	.041*	.020
Repair	.024	.025
Personal services	-.021	.021
Entertainment	.036	.040
Services	.073**	.015
Government worker (1 = yes)	.026*	.012
Self-employed (1 = yes)	.015	.014
Eligible for pension (1 = yes)	-.114**	.010
Education		
Elementary	-.073**	.011
High school	-.035**	.012
High school graduate	-.010	.023
Some college	-.034*	.015
College graduate	-.037	.020
Race (1 = nonwhite)	-.026*	.013
Sex (1 = female)	-.174**	.011

*Significant at the 5 percent level
**Significant at the 1 percent level

Table A.3. Tests for Difference in Estimated Coefficients in Samples of Younger and Older Retirees[a]

Independent Variables	t-statistic
Constant	1.936
Age - 65	-.676
Sex	1.170
Race	.464
Self-employed	1.374
Permanent wage	.042
Retirement status	-.231
Home ownership	-.169
Health better than others	.128
Health worse than others	-.220
Children totally supported	.370
Social security	-3.964
Pensions	.311
Welfare	.507
Married	.984

$$aa_t = \frac{\beta_y - \beta_0}{\sqrt{s_y^2 + s_0^2}}$$

where: β_i = coefficient in ith sample
s_i = standard error of estimate in ith sample
i = y(< 65), 0(≥ 65)

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