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PARTIAL RETIREMENT AND THE ANALYSIS OF RETIREMENT BEHAVIOR

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ABSTRACT

This paper examines the phenomenon of partial retirement. Topics covered include: (1) the quantitative importance of partial retirement, (2) institutional constraints in addition to mandatory retirement which limit the opportunity to retire partially in the main job, (3) the effect of these constraints on the specification of the relevant structural equations in a life cycle retirement model, (4) the impact of standard explanatory variables on four outcomes -- complete retirement, partial retirement both in and outside the main job, and non-retirement, (5) the importance of partial retirement even for those who do not face mandatory retirement, are not covered by a pension and are healthy, (6) the sensitivity of results based on a dichotomous retirement variable to whether the partially retired are classified as retired or not retired.

A number of studies have either treated partial retirement inappropriately or have adopted unrealistic assumptions about the opportunity set facing potential retirees. Our findings call their results into question.

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Between full-time work and complete retirement, many individuals pass through a state of partial retirement. Some of these older workers reduce their work effort in the same jobs they held as prime age workers, but many more partially retire by taking another job. Much previous work has either ignored or mistreated this phenomenon of partial retirement. In this paper we will document the important of partial retirement and consider a number of consequences of inappropriately analyzing its role in the retirement decision.

Much of our effort is aimed at answering six questions and providing related information pertaining to partial retirement. The six questions are as follows:

1. How important is partial retirement, both in absolute terms and relative to full retirement and non-retirement?

2. Do individuals who partially retire do so by reducing their work effort in the jobs they held as prime age workers, or do they partially retire outside their "main jobs?"

3. What opportunities are available to older workers wanting to retire partially in their main jobs? That is, what evidence is there for institutional limitations which would prevent older workers from partially retiring in their main jobs?[1] And if such limitations are found, how should theoretical and structural econometric models of the retirement process be modified to account for them?

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[1]For a discussion of cooperating factors and resulting limitations on the worker's opportunities to determine the length of work day, see Deardorff and Stafford (1980).

4. How is partial retirement, both within and outside the main job, influenced by the standard set of policy related and other explanatory variables normally included in studies of retirement behavior?

5. Is partial retirement both in and outside the "main job" an important option for those who are not forced out of their main job by ill health, mandatory retirement, or enticed out by attractive pension benefits?

6. Is partial retirement important enough so that estimated probabilities of retirement and the estimated responsiveness of the retirement probability to policy related and other explanatory variables depend strongly on whether partial retirement is incorporated in the analysis? That is, is partial retirement important enough so that if a study is to analyze correctly the determinants of retirement, it must also consider partial retirement?

The paper is divided into four main parts. The first section examines basic descriptive statistics drawn from the Retirement History Survey. These statistics indicate the extent and nature of partial retirement and provide answers to the first two questions posed above. In addition, they are used to examine the sensitivity of measurement to the definition of retirement adopted. Findings in this section indicate that partial retirement is a more important phenomenon than is suggested by most studies of retirement behavior. They also indicate that partial retirement, especially partial retirement in the main job, would be an even more important phenomenon in the absence of institutional constraints placing lower limits on time spent at work.

Section 2 sketches a number of different models of retirement behavior. In this section, we illustrate how differences in the

opportunities for work on a full-time or part-time basis in the main job and for employment outside the main job affect the specification of the relevant structural equations in a life cycle retirement model. Particular attention is paid to the possibility that different people face different constraints on their ability to reduce hours in their main job, and even to remain in their main job at all past a certain age.

The next section presents empirical results for a basic retirement equation in which there are four outcomes: full retirement, partial retirement in the main job, partial retirement outside the main job and nonretirement. The results from this section are used to answer the last three questions posed above. Findings are summarized and conclusions are presented in the final section.

I. The Extent and Nature of Partial Retirement

This section contains descriptive statistics relevant to the phenomenon of partial retirement. Most of these data are from the Retirement History Survey, a longitudinal sample of individuals who were 58 to 63 years old when they were initially surveyed in 1969. They have been reinterviewed every two years. Responses from four survey years (1969, 1971, 1973, and 1975) are pooled. This procedure means that there is a greater number of observations for those in the middle ages of the survey than for those in age brackets falling in the extremes for the group sample. Our analysis is restricted to white males who are not self-employed in their main job.[1]

It is useful to begin by considering how the frequency of full and partial retirement is affected by the definition of retirement used. One obvious way to define retirement status is to use some objective measure based on wages or hours. Another is to accept the individual's self-description of retirement status. For each survey year the questionaire asks whether the respondent considers himself to be completely retired, partially retired, or not retired. In Table 1, we relate the responses to this question to observable indications of work effort reduction, either in the form of a reduction in hours per week worked, or in the form of a reduction in wages which may be associated with an

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[1] In general, the self employed have a higher probability of being partially retired than do those who are not self-employed (Quinn, 1980). They were dropped from this study because of the difficulty in imputing a meaningful wage rate to such individuals.

easier or more flexible job. The horizontal axis of this table measures the ratio of the current wage the individual is receiving to the wage that the individual received in his main (lifetime) job.[1] For this purpose, the main job is taken to be the job that the individual held at age 55 (as long as the individual worked at least 30 hours per week in this job), or if wages and hours information is unavailable for this job, the longest job that the individual has held if information is available for that job.[2] The vertical axis of this table similarly measures the ratio of current weekly hours to weekly hours in the main job.

The top part of the table considers wage and hours information for people who report that they are partially retired. Most of the individuals who indicate they are partially retired do in fact exhibit a substantial reduction either in hours worked or in the wage rate they are receiving for working. For example, 68 percent of these people have reduced either their wages or their hours by over 40 percent from the

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1 All nominal wages in this study have been deflated to 1967 using the adjusted hourly earnings index. (Economic Report of the President, Table B-35)

2 The wages and hours in the main job are measured as of the time the individual terminated the job or, if he was still in it in 1969, as of that year. This procedure was necessitated by the data. By defining the main job as the full-time job held at age 55 we do not mean to imply that there is no turnover in the main jobs. Data pertaining to such turnover are presented in Table 2 and are discussed below. We do, however, take the job held at age 55 to be representative of the full-time opportunities available to the individual during prime working years. In requiring information for the main job, and in defining the main job as we do, there will be a tendency to eliminate from the sample those in occupations which are characterized by very high turnover, eg., construction.

Table 1

Wage and Hours Distributions by

Reported Retirement Status

current hours/ main job hours	current wage/main job wage 0-20%	20-40%	40-60%	60-80%	80-100%	>100%
	Self-reported as Partially Retired (Percentage of 1417 observations)					
0-20%	.1%	.3	1.2	.9	.6	4.4
20-40	.7	2.6	4.9	3.5	2.5	6.7
40-60	1.1	4.0	5.1	3.1	2.5	4.7
60-80	.6	2.8	2.8	2.6	.8	4.4
80-100	.6	1.6	2.1	1.9	1.7	2.5
>100	3.5	2.0	2.5	3.0	3.0	12.5
	Self-reported as Not Retired (Percentage of 9691 observations)					
0-20%	0%	0	0	0	0	.1
20-40	0	0	.1	0	0	.8
40-60	0	0	.1	.1	.2	1.1
60-80	0	.3	.3	.3	.6	3.2
80-100	.1	.5	.8	1.3	3.2	7.6
>100	.6	1.1	2.3	5.4	15.0	55.1

levels of wages and hours that they exhibited in their main jobs. (Those exhibiting such a reduction fall in the cells above and to the left of the dashed line in the table.) From the information in the table, it appears that for those reporting partial retirement, a reduction in wages from the main job, suggesting an easier or more flexible job, is slightly more common than is a comparable percentage reduction in hours worked. The statistics for individuals who report themselves as not retired are presented in the lower part of the table. Relatively few of these individuals exhibited a substantial reduction in either wages or hours from the levels found in the main job; only 8 percent had reductions in either wages or hours that were as large as 40 percent.

Table 1 indicates that some people consider themselves to be partially retired even though they are working more, and for higher wages, than they did in their main jobs, while others consider themselves not retired even though they have experienced a substantial drop in hours or wages. Nevertheless, there is a close correspondence between observed changes in wages and hours and reported status. Indeed, although in our empirical analysis we classify people into different retirement categories based on reported status, we obtain similar findings when we base the definition of full-time work on an objective measure —— i.e., working at least 60% of the hours for at least 60% of the wage paid in the main job.[1]

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[1]The advantage of measuring the dependent variable by self-reported rather then objectively measured retirement status is that fewer observations need be eliminated from the sample using the former definition. An alternative definition, one which does not distinguish between retirement and part-time work, classifies as partially retired all these who work less than some number of hours. (E.g., Zabalza, Pissarides and Barton, 1980).

Table 2 reports on the percentages of individuals by age according to their response as to whether they are retired, partially retired or not retired, whether they are still in or have left the main job, and whether or not the individual has faced or will face mandatory retirement in the main job. Note that the number of people in their late 60's who report they are partially retired is substantial. Indeed, among those 65 or over who are working the number who are partially retired is comparable to the number who are working full-time. Around 20 percent of the people in this age range who do not face mandatory retirement on the main job are partially retired at any point in time. For those who will or have faced mandatory retirement on the main job and are 65 or above, the comparable figure is 11 percent.

One comparison of interest contrasts the information in columns 1 and 2 with that in 3 and 4. This comparison suggests that while a person who is not retired is much more likely to be working in the same job as the one he held at age 55, a person who reports that he is semi-retired is considerabley more likely to be in a different job from the one held at 55.

Table 2 also provides information on the relation between retirement status and mandatory retirement on the main job. Compared to individuals who do not face mandatory retirement, those who are facing mandatory retirement in the future have a higher probability that they will still be working full-time in their main job and a reduced probability that they will either have taken another full-time job or will have partially retired in any kind of a job. After the mandatory retirement age, a few people are able to remain in their main jobs, indicating that for these individuals, either the mandatory retirement requirement

Table 2

Retirement Status, Job Changes, and

Mandatory Retirement

Age	Not Retired		Partially Retired		Retired	Observations
	In Main Job	Not in Main Job	In Main Job	Not in Main Job		
	Among Those Not Facing Mandatory Retirement					
58-61	61.12	21.17	1.57	3.61	12.52	2796
62-64	33.53	18.60	3.01	10.82	34.04	3984
65-69	7.63	7.79	2.92	17.30	64.36	3866
	Among Those Facing Mandatory Retirement in the Future					
58-61	76.96	9.99	0.50	2.61	9.95	2222
62-64	48.81	10.69	1.40	5.98	33.12	2778
65-59	11.12	6.55	1.66	9.54	71.14	1268
	Among Those Having Faced Mandatory Retirement					
58-61	11.76	11.76	5.88	29.41	41.18	17
62-64	4.92	3.28	1.64	21.31	68.85	61
65-69	1.16	2.42	0.45	11.10	84.87	1117

*Note that for an observation to be included in this table, it was necessary that we could determine whether or not there is mandatory retirement in the individual's main job. The probabilities of partial retirement for those included in this table are somewhat below the probabilities for the entire sample. For example, the probability in the entire sample of a white male who is 65 or above reporting he is partially retired is about 19% compared to a weighted average of 17% for the same age group in the above table.

must have been waived, or that the initial response was incorrect. Nevertheless, most people who were subject to mandatory retirement and have passed the mandatory retirement age do indeed leave their main jobs, and are correspondingly more likely to be retired completely.[1] While a substantial fraction of individuals face mandatory retirement in their main job, and must either find another job or retire after mandatory retirement age is reached, of more interest to us is the finding that a large group of people is induced to leave their main job even though they are not subject to mandatory retirement provisions, presumably because they find an alternative job that is more attractive in some way, such as offering easier work or more flexible hours.

Although Table 2 indicates that a significant number of people of different ages are partially retired, it does not tell us how likely any particular individual is to become partially retired at some point in his life. In the extreme, these figures might reflect either a

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[1] It should be recognized that from this table alone, we cannot be sure that the differences in retirement probabilities seemingly associated with mandatory retirement are not, at least partially, the result of a correlation between mandatory retirement and some excluded factor (eg., the availability of a pension, or perhaps more troubling, the opportunity for an older individual to retire partially on the main job). The retirement equations we estimate below will attempt to standardize for some, but not all, of these other influences. In particular, the Retirement History Survey provides no objective information on which main jobs offer the opportunity for partial retirement and which do not. Figures which do provide some information on the opportunities for partial retirement are discussed below.

situation in which one in five or six individuals partially retires and remains in that state for a number of years, or it might reflect a situation in which a large number of individuals partially retires but remains in that state for a relatively short duration. Table 3, which reports on the relation between the fraction of individuals who were partially retired during at least one of the four survey years of the Retirement History Survey according to age in the last survey year, 1975, suggests that the actual situation falls between these extremes, with at least one-third of such individuals becoming partially retired at some time during their lifetime.[1]

Two implications of the data in Tables 2 and 3 should be emphasized. First, since they indicate that partial retirement is an important phenomenon, they imply that if a dichotomous measure of retirement status is used, as it is in many studies, (eg., Clark and Johnson, 1980, and Quinn, 1977) findings may differ in a non-trivial way depending on whether the partially retired are classified with the retired or with those still working. Second, it also means that a model of retirement behavior which excludes the possibility of partial retirement is mis-specified with respect to an important aspect of behavior, and raises the possibility that any resulting specification errors may be large. Thus the descriptive statistics raise the possibility that inappropriate treatment of partial retirement in analyses of retirement behavior may have important consequences. These implications underline the importance

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[1]The table is confined to individuals for whom retirement status is self reported for all four waves of the survey.

Table 3

Percentage and Number of Individuals Indicating They Were Partially Retired In Any of The Four Waves of The Survey*

Age in 1975	Reported Retirement Status	
	Percentage	Number
64	23.5%	1389
65	25.5	1228
66	32.3	1195
67	33.2	1221
68	33.4	1208
69	38.0	1115

*Data are confined to those who responded to all four waves of the survey.

of the last of the questions posed in the introduction.

The data in Table 4 indicate the percentages, by occupation and industry, of those in our sample who report that they are semiretired. Among occupations, professionals, managers, craftsmen and operatives are least likely, and farmers sales workers, private household workers and service workers are most likely to report they are semiretired. There are analogous differences among industries. Individuals in manufacturing, transportation, communication and public utilities, and public administration are least likely to report they are semiretired, while individuals in agriculture, forestry, fisheries, finance, insurance and real estate, personal services, wholesale and retail and construction are most likely to report they are semiretired. These distributions are in accord with general notions about which occupations and industries provide opportunities for part-time work.[1]

Our primary data source, the Retirement History Survey, does not contain any direct evidence as to whether these differences in the proportion of semiretired workers reflect differences in the opportunities for a worker to phase into retirement by reducing hours of work on the main job. A question was asked on the University of Michigan Survey Research Center's Panel Study of Income Dynamics which does provide

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[1]There is some direct information on flexible retirement arrangements. Consistent with the figures presented in Table 3, according to a 1979 survey by the Bureau of National Affairs, only 10% of responding manufacturing companies offered tapered retirement programs where hours could be gradually reduced as the individual phased into retirement, and just 3% of manufacturing companies made such programs available to all employees. On the other hand, 27 percent of what they call non-business concerns (universities, hospitals, etc.) had such programs, with all employees eligible in 19% of the responding non-business concerns. For related data on industries and occupations which provide opportunities for part-time work, see Deutermann and Brown (1978).

Table 4

The Distribution By Occupation and Industry of Older Individuals Who Are Semi-Retired

Occupation of Current Job	Percentage Semi-Retired
Professional	11.0
Farmers	31.8
Managers	10.7
Clerical	15.4
Sales	26.6
Craftsman	11.7
Operatives	10.9
Private (Household)	38.9
Service (except Private Household)	22.0
Farm Labor	34.5
Labor (except farm & mine)	16.9
Non-response	25.6
All	15.6

Industry of Current Job	Percentage Semi-Retired
Agri, forest, Fisheries	31.9
Mining	12.7
Construction	17.5
Manufacturing	6.2
Trans, Com & Public Util.	9.8
Wholesale & Retail trade	18.9
Finance, Ins. & Real Estate	23.8
Service (except personal)	13.7
Personal Service	28.1
Entertainment & Recreation	14.5
Public Admin.	10.0
Non Response	26.8
All	15.6

strong evidence that on many jobs, workers are not free to work less.[1] Using yearly observations from 1971 to 1975 for 25 to 54 year old males, 56% of those for whom one can determine whether they are at a lower limit to time worked on their job indicate that they could not work less even if they wanted to. For full time workers who are between 55 and 65 years of age, the comparable figure is 60 percent.

These findings are contrary to the assumption used in many studies (for instance, Gordon and Blinder) that workers are free to vary their hours continuously between zero and full-time work. And, because the required information is not reported on the PSID, these figures do not take into account that some individuals, although technically free to reduce hours on their main job, would face severe penalties in doing so because their pensions are determined by a formula based on final average salary.

In sum, we find that partial retirement is a relatively common phenomenon among older workers. The partial retirement occurs primarily in jobs other than the individual's main lifetime job, despite the fact that an individual's wage rate is likely to be higher in the main job

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[1] The skip pattern in that question is such that some people are not asked whether they could reduce time at work if they wished to. Specifically, if the person indicated that there was no more work available on the job, and that he would like to work more hours, he was never asked if he could work less if he wanted to. This problem affected approximately 27% of the sample.

than in other jobs. The descriptive statistics suggest that institutional limitations--directly on hours or indirectly through pension and mandatory retirement regulations--prevent a number of people from reducing hours worked on their main jobs. Indeed, without these limitations, partial retirement might well be even more prevalent than it actually is.

II. Variations on the Life Cycle Model of Retirement Behavior and Implications for Estimation

In this section we explore models of retirement behavior and modifications required by various limitations on the opportunities for partial retirement. First, we briefly describe the standard life cycle model of retirement behavior. We then discuss how differences in opportunities for partial retirement are reflected in the specification of the utility function and the opportunity set facing each individual, and how this influences the retirement decision that emerges from the standard life cycle model.

The basic retirement decision may be viewed as the solution to a lifetime utility maximization problem. In the simplest form of this problem, the individual is assumed to live for T years, and at each point in time he may choose both his level of consumption and his work effort. The total utility that the individual achieves from his decisions is given by:

$$U = \int_0^T u[C(t), H(t), t; \underline{a}]dt \qquad (1)$$

where C(t) is consumption at time t, H(t) is labor supply at time t,

and $\underline{a}$ is a vector of parameters which influence the shape of the individual's utility function. The utility function is assumed to be separable over time, and labor supply is measured in units such that H(t) must lie between 0 and 1. The individual maximizes this utility function subject to the budget constraint:

$$\int_0^T e^{-rt} C(t)dt = K_0 + \int_0^T e^{-rt} H(t)W(t)dt \qquad (2)$$

where r is the real interest rate, K_0 is initial wealth, and W(t) is the wage offer at time t.

This problem is of the form that may be analyzed with the theory of optimal control.[1] With some minor assumptions about the boundedness and continuity of the function u, optimal control theory assures that a solution to the problem does exist. That is, there is a consumption path C*(t) and a labor supply path H*(t) which satisfy the budget constraint and which yield a higher total utility than any other pair of paths which also satisfy the constraint. The optimal paths will in general vary with the parameters $\underline{a}$ in the utility function and with the wage path W, so that the optimal paths should more completely be written as C*(t; $\underline{a}$, W) and H*(t, $\underline{a}$, W).

Consider now the effect of introducing alternative job environments, i.e., altering the opportunity set facing the worker. The job

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[1] For studies which utilize control theory in analyzing the retirement problem, see Reimers (1977), Sammartino (1978), and Clark and Johnson (1980).

environment contemplated in the basic model is one in which the individual is free to vary his hours on the job without affecting the wage rate which is available to him. A second job environment analyzed in the literature requires that the labor supply decision be an all-or- nothing one, so that the person must either work full-time or retire (Burbidge and Robb, 1980). This is imposed on the model by requiring that H(t) take on only the extreme values 0 and 1.[1] A third environment would be one in which the worker is subject to mandatory retirement provisions in his main job at age R, after which he must work in another job, possibly at substantially reduced wages, if he desires to continue to work.[2] Analytically, this environment differs from the first only in that it specifies that there is likely to be a sharp drop in the wages available to the worker after age R. Before mandatory retirement H(t) refers to hours supplied to the main job, and after mandatory retirement it refers to hours supplied to the alternative job.

Two further environments assume that there are always two jobs available to the individual, and that some aspect of the main job becomes more onerous over time, ultimately causing the individual to choose an alternate "semiretirement" job or to retire completely. These environ-

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[1] The restriction that H(t) can be only 0 or 1 introduces a complication into the optimal control problem, namely, that the control set is no longer convex [e.g., 0.5 is a linear combination of 0 and 1 but is not itself a permissible value for H(t)], as required by the optimal control theory. This kind of complication, which is also found in many of the other extensions examined in this section, can be overcome by a technique described in Gustman and Steinmeier (1981). The important point for purposes of the present discussion is that even with this complication, the control problem still possesses a determinate solution for the optimal paths of consumption and labor supply.

[2] Both Boskin and Hurd (1978) and Gordon and Blinder (1980) consider mandatory retirement, but only in a context where hours worked are fully variable at the wage offered on the main job.

ments require that both the utility function and the budget constraint be modified to allow for both jobs. The utility function would become

$$U = \int_0^T u[C(t), H_1(t), H_2(t), t; \underline{a}]dt \qquad (3)$$

where the subscripts indicate the labor supply to the two jobs. Normally, not both $H_1(t)$ and $H_2(t)$ can be positive——that is, the individual may choose one job or the other, but not both. The corresponding budget constraint is

$$\int_0^T e^{-rt} C(t)dt = K_0 + \int_0^T e^{-rt}[H_1(t)W_1(t) + H_2(t)\ W_2(t)]dt \qquad (4)$$

where $W_1(t)$ and $W_2(t)$ are the wages in the two jobs. In one of these environments, the main job becomes increasingly difficult to perform as the individual becomes older (e.g., the job may involve hard physical labor). This is reflected in the fact the $H_1(t)$ reduces the value of the utility function more than would a similar number of hours $H_2(t)$ in the transition job. (For a related analysis, see Quinn, 1977.) The other environment limits work in the main job to be either full-time or not at all, while part-time work is permitted in the transition job. This may be introduced in the model by constraining $H_1(t)$, but not $H_2(t)$, to be either 0 or 1.

For each of the five job environments described above, the optimal control problem will have as a solution a determinate pair of paths for consumption and labor supply. However, these paths will in general not be identical. This means that the paths of consumption and labor supply

are dependent not just on the parameters $\underline{a}$ which influence the shape of the utility function and the wages offered to the individual, but they also depend on the type of job environment within which the individual must make his decisions. This may be explicitly indicated by writing the optimal paths more completely as $C^*(t; \underline{a}, W, e)$ and $H^*(t; \underline{a}, W, e)$, where e is an index of the type of job environment relevant to the particular individual.

Social security and/or private pensions may also be introduced into the models. The Social Security system has two effects on the model. One is to reduce the net wage in any period by the amount of the Social Security tax:

$$W_n(t) = (1 - s)W(t)$$

where $W_n(t)$ is the after-tax wage and s is the Social Security tax rate. The second effect is to introduce additional payments to the individual which are determined from a complicated relationship involving past wages, past employment choices, and several Social Security parameters. These benefits are given by the expression $b(W, H, t; \underline{S})$ where W and H are the time paths of wages and hours, respectively, and $\underline{S}$ is a vector of Social Security parameters. $W_n(t)$ and b are introduced into model of retirement behavior through the budget constraint.

Private pensions may be introduced into the models in much the same way as Social Security. Instead of the Social Security tax rate s there is the pension contribution rate p, and the private pension benefit formula $f(W, H, t, \underline{P})$ replaces the Social Security benefit

formula b. $\underline{P}$ is a vector of parameters which determine the shape of the benefit function. For both Social Security and private pensions, changes in the contribution rate and the benefit formula, by changing the shape of the lifetime budget constraint facing the individual, may be expected to affect optimal consumption and labor supply paths over time. Thus, $C^*(t)$ and $H^*(t)$, in addition to being functions of $\underline{a}$, W, and e, may also be considered as functions of the contribution rates s and p and the vectors $\underline{S}$ and $\underline{P}$ which determine the nature of the benefit formula.

Implications for Estimation.

The optimal path of labor supply $H^*(t)$ provides a basis for the retirement equations estimated in the next section. The path is a function of wages, the individual characteristics which cause utility functions to vary from person to person, the specific job environment facing the individual, and the contribution rates and benefit formulae for Social Security and pension plans. By defining complete retirement, partial retirement, and full-time work in terms of the labor supply path $H^*(t)$, the retirement status of an individual can be made a function of these same variables.[1] In a model with a single job, for instance, partial retirement might be defined as the reduction of labor supply below full-time work, and complete retirement might be defined as the cessation of labor supply. In terms of $H^*(t)$, partial retirement would occur if $0<H^*(t)<1$, and complete retirement would occur when $H^*(t) = 0$.

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[1] The arguments of the reduced form relations would not be altered even if one were to modify the life cycly model to meet objections as to its utility in explaining savings and consumption behavior such as those raised by Kurz (1981).

In a model with two jobs, partial retirement might be alternatively defined to occur when the individual leaves the main job and enters the transition job. It should be clear that these definitions contain a degree of arbitrariness, a problem which is compounded if only two retirement states ——working and retired——are considered. In this latter case, it may make a great deal of difference to the estimates whether someone who is still working but at considerably reduced hours is considered to be retired or working.

The retirement status, however defined, can thus be estimated as a function of age and of the variables which cause budget constraints and utility functions to vary among individuals. The problem, of course, is that without a specific derivation of the retirement equation from the structural model (which is usually impossible without severely simplifying assumptions or questionable approximations), we have little idea about the form that this function might take. After all, the function is being implicitly defined as the solution to a control problem, and one might suspect that the resulting form would be rather complicated. For this reason, it would be very dubious to try to estimate the retirement equation with a method which assumes a linear or some other rigid functional form. Rather, methods which can deal with flexible functional forms and let the data tell us about the shape of the function are required in this problem. One relatively easy-to-use technique that satisfies this requirement is the discrete multivariate analysis algorithm described in Bishop, Feinberg, and Holland (1975). Another technique which probably does almost as well in most cases is OLS with dummy explanatory variables and with a liberal search

for interaction terms among the dummy variables. Both of these methods use a potentially very large number of parameters to fit any function reasonably well.

III. Estimates and Implications of the Retirement Equation

This section addresses the last three questions raised in the introduction. The basic empirical model estimated here is a retirement equation of the kind developed in the last section. In this model, the dependent variable is the probability that an individual will fall in a given retirement category (completely retired, partially retired in the main job, partially retired outside the main job or not retired).[1] The explanatory variables are as follows:[2]

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[1] Indicators of retirement used in other studies include pension acceptance (Boskin and Hurd, 1978), hours per week of work (Zabalza, Pissarides and Barton, 1980) and a measure of labor market flow out of one job, and conditionally into another (Burkhauser and Quinn, 1980). Both hours of work per week and rates of flow from one job into others are imperfect indicators of retirement status. E.g., some individuals partially retire by cutting weeks, not hours, or by obtaining easier jobs. These individuals are not counted as partially retired when an hours per week criterion is used. In the case of the flow criterion, note that the flow out of a particular job includes individuals who are leaving one main job for another, others who are leaving one partial retirement job for another, and still others who are moving from either a partial retirement job or a main job into retirement. However, this flow excludes those partially retiring within the main job.

Two of the studies noted above utilize a dependent variable that consists of the probability of falling in one of three states——full retirement, partial retirement and non-retirement. (Boskin and Hurd and Zabalza, Pissarides and Barton.) However, both studies are based on models which incorporate a utility function specified not over the lifetime, but for a single period.

[2] We recognize that a number of these variables may be endogenous to the analysis. These include the two wages, pension or social security coverage, mandatory retirement provision on the job, and health status. A complete life cycle model might explain each of these in terms of the full opportunity set available to the individual and expected productivity over the life cycle, but that is beyond the scope of this paper.

1. A measure of age consisting of eight categories (58-59, 60-61, 62, 63, 64, 65, 66-67, 68-69).
2. A measure of the usual hourly wage (in 1967 dollars) in a non-retirement job, adjusted to age 63 in accordance with the age-wage profile estimated from a wage equation. There are four categories (<$2.00, $2.00-3.00, $3.00-4.25, and >$4.25/hr.).
3. A measure of the wage in a partial retirement job, adjusted to the 66-67 age range with an age-wage profile estimated for partial retirement jobs. There are four categories (<$1.25, $1.25-1.75, $1.75-2.60, and >$2.60/hr).
4. A measure of pension coverage in the main job, with three categories (no coverage, private sector pension coverage, and public sector pension coverage).
5. An indicator of Social Security coverage, with three categories (covered, not covered, and uncertain coverage due to missing information).
6. A measure of mandatory retirement provisions in the main job, with four categories (currently below the mandatory retirement age, currently above the mandatory retirement age, not subject to mandatory retirement provisions, and uncertain about mandatory retirement provisions due to lack of information).
7. A dichotomous measure differentiating between those who report they are healthy and those who do not.
8. A measure of marital status with three categories (never married, married with spouse present, and other).

9. A dichotomous indicator of whether the individual is supporting his or his spouse's parents.

10. A dichotomous variable indicating whether or not there are children under 18 in the home.

Three other variables which the analysis of the last section suggested should be included in the equation had to be omitted due to a lack of adequate date in the Retirement History Survey. These are an indicator of whether or not he individual was in a job environment which permitted a gradual reduction in work effort, a set of parameters describing the various pension plans, and an indication of the difficulty of work in the main job.[1] To the extent that these variables enter the retirement decision, and to the extent that they are correlated with other variables which are included in the equation, the omission of these variables will lead to standard omitted variables bias.

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[1] Unfortunately the PSID, which does contain information on the ability of workers to reduce hours, is inadequate in other ways, e.g., there are few older workers and no information on mandatory retirement. It is possible using the data in the Retirement History Survey to impute, in a crude way, the value of pensions. But no information is available in the Retirement History Survey on the crucially important effect of additional earnings on the marginal value of pension wealth, or on whether part-time work on the main job will affect adversely the level of earnings used to calculate pension benefits. For a discussion of the relation between the marginal value of the life-time pension stream and the increment in lifetime income associated with additional work, see Fields and Mitchell, 1981.

With regard to social security, a large number of parameters (the contribution rate s and the vector $\underline{S}$ which determines the nature of the benefit formula) from the model of retirement behavior discussed in Section II have been reduced to a simple dichotomous variable. This was done because the break points and the marginal tax rates between those points in the Social Security system do not vary across individuals once the wage offer curve, age, and marital status are standardized for.[1]

Since the single wage job environments described in the previous section can be subsumed under two-wage environments, separate wages for non-retirement and partial retirement jobs were included in the retirement equation for everyone. Where values of these wages were not directly observed, values were imputed separately for the wages in non-retirement and partial retirement jobs using wage equations estimated from those who did have observations on the type of wage in question. The variables in the wage equations included education, health, age, residence in an SMSA, and additionally for the non-retirement wage equation, occupation, pension eligibility, and the tenure that would have accrued to the individual had he remained in his main job.

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[1] It would be inappropriate to include as an exogenous explanatory variable in a retirement equation the current value of social security wealth. This measure is endogenous to any life-cycle labor supply decision. At best, one could include a measure of full social security wealth (i.e., a measure of social security wealth which is independent of work effort), but since full social security wealth is largely determined by variables already included in the model (wage in the main job, marital status, and social security eligibility), the inclusion of this variable would result in an unidentified or very weakly identified model.

All wages are adjusted to a standardized age using the age-wage profile from the estimated wage equation. We are assuming for purposes of our empirical analysis that wage profiles have the same slope. Therefore, the standardized wage measures the height of the profile. Use of this standardized wage variable is therefore consistent with the theory developed above, in which labor supply at any moment influenced by the course of events over the entire life cycle.

It was recognized that the imputation procedure might be subject to selectivity bias, and a test for selectivity bias was carried out. Essentially, we estimated a reduced form equation explaining the probability of full or part-time work and included a categorical variable based on this probability in the wage equations. The test did indicate that self-selection was present in the wage equations, but corrections for this problem had only a very minor effect on the estimated parameters of the retirement equation — usually changing parameter estimates by only a few tenths of a percentage point. Accordingly, the reported results do not standardize for the effects of selectivity bias.[1] Additional details of the procedure to correct for selectivity bias are found in Gustman and Steinmeier (1981).

The empirical estimates are based on discrete multivariate analysis, a technique which Haberman (1978) has shown to be exactly equivalent to multinomial logit when the explanatory variables are categorical, and

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[1] These results are available on request.

when equivalent sets of interactions are included. Unlike multinomial logit, however, discrete multivariate analysis permits a relatively easy search for complex interactions, which are expected both because the retirement equation is the solution to a complicated life cycle labor supply problem, and because previous work on retirement behavior leads us to expect complex interactions among such explanatory variables as health status, mandatory retirement provisions, pensions, and Social Security coverage, and wage offers. The test for the significance of particular interactions is a likelihood ratio test utilizing a test statistic (ΔG^2) which has a χ^2 distribution under the null hypothesis that the interaction in question has no effect on the dependent variable.[1]

Effect of the Explanatory Variables on Partial Retirement

The estimation produces a set of parameters which, by themselves, are tedious to interpret. Results are much more easily understood if they are presented in terms of how the sample would respond to changes in the various explanatory variables. Table 5 indicates the sample-weighted average impact of each of the explanatory variables on the four retirement status probabilities. The entries in the table are calculated by first finding the estimated impact of the variable in question on the computed probabilities for each individual in the sample, holding all other explanatory variables at the values actually observed for that individual, and then by averaging the responses across

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[1] Since discrete multivariate models are "hierarchical," a significant higher order term requires that all implied lower order interactions also be included.

the individuals in the sample. For example, the figures in the column entitled "Private Pension" are the calculated probabilities for a sample which was like the actual sample in all respects except that everyone had a private pension, less the probabilities calculated for a similar sample in which no one had a private pension.

Column 1 of the table reports the effect of variation in the wage offer on the main job between the highest and lowest categories. It can be seen that the major effect of a high wage offer in a nonretirement job is to reduce the probability of partially retiring outside the main job and to increase the probability of not retiring at all.[2] The change (decline) in the probability of partially retiring outside the main job is particularly large when compared to the percentage of respondents who actually do partially retire, as shown in Table 2. The effects of variations in the wage in the partial retirement job, as reported in column 2, are numerically much weaker.

[2]The non-responsiveness of partial retirement in the main job to full-time wages may be attributed to the fact that, for those who have the option of partially retiring in the main job, high full-time wages and high partial retirement wages go together.

Table 5

Estimated Impact of Explanatory Variables on Retirement Status.[a/]

Retirement Status and Age		Explanatory Variables: Wage In Non-Retirement Job	Wage In Partial Retirement Job	Private Pension	Public Pension	Above Mandatory Retirement Age	Below Mandatory Retirement Age
Not Retired	58-59	.028	.001	.007	-.011	-.892	.006
	60-61	.057	.004	-.021	-.027	-.433	.004
	62	.071	.006	-.036	-.054	-.530	.009
	63	.085	.009	-.105	-.067	-.410	.014
	64	.085	.010	-.062	-.019	-.330	.011
	65	.057	.006	-.138	-.016	-.174	-.045
	66-67	.039	.005	-.063	-.019	-.079	.019
	68-69	.026	.004	-.023	.019	-.072	-.012
Partially Retired in Main Job	58-59	.000	.005	-.005	.016	.354	-.013
	60-61	.000	.005	-.007	-.012	-.012	-.005
	62	.001	.010	-.013	-.022	-.026	-.010
	63	.001	.008	-.013	-.012	.016	-.015
	64	.003	.012	-.008	-.021	-.031	-.015
	65	.005	.014	-.033	-.041	-.035	-.013
	66-67	.004	.009	-.011	-.023	-.019	-.017
	68-69	.003	.007	-.015	-.023	-.021	-.002
Partially Retired Outside of Main Job	58-59	-.025	-.001	.010	.007	.606	.007
	60-61	-.048	-.002	.021	.028	.229	-.011
	62	-.063	-.002	-.019	.033	.013	-.017
	63	-.085	-.003	-.001	.008	.256	-.023
	64	-.096	-.003	.020	.024	.080	-.053
	65	-.097	-.002	.013	.052	-.062	-.044
	66-67	-.113	-.001	-.016	-.018	-.004	-.046
	68-69	-.093	.000	.037	-.038	-.075	-.047
Retired	58-59	-.004	-.004	-.013	-.012	-.068	.000
	60-61	-.008	-.007	.006	.011	.215	.012
	62	-.009	-.013	.069	.043	.542	.018
	63	-.001	-.014	.118	.071	.137	.024
	64	.008	-.018	.050	.016	.281	.057
	65	.036	-.018	.158	.004	.271	.102
	66-67	.070	-.013	.090	.059	.103	.044
	68-69	.065	-.011	.002	.042	.168	.061

[a/] The figures in this table are calculated as:

Column 1: Pr (Ret. Status/Highest Wage Category)
-Pr (Ret. Status/Lowest Wage Category)

Column 2: Pr (Ret. Status/Highest Wage Category)
-Pr (Ret. Status/Lowest Wage Category)

Column 3: Pr (Ret. Status/Private Pension) - Pr (Ret. Status/No Pension)

Column 4: Pr (Ret. Status/Public Pension) - Pr (Ret. Status/No Pension)

Column 5: Pr (Ret. Status/Above Mandatory Retirement Age)
-Pr (Ret. Status/Not Subject to Mandatory Retirement)

Column 6: Pr (Ret. Status/Below Mandatory Retirement Age)
-Pr (Ret. Status/Not Subject to Mandatory Retirement)

Table 5 (continued)

Estimated Impact of Explanatory Variables on Retirement Status [a/]

Retirement Status and Age		Explanatory Variables[b/] Social Security	Health Status	Never Married	Widowed, Divorced	Children at Home	Supporting Parents
Not Retired	58-59	.006	.207	-.021	-.033	.012	.027
	60-61	.013	.320	-.025	-.048	.020	.053
	62	-.088	.358	-.035	-.071	.036	.083
	63	-.073	.352	-.050	-.081	.035	.099
	64	.030	.210	-.047	-.083	.039	.113
	65	-.038	.171	-.043	-.065	.020	.101
	66-67	-.063	.083	-.026	-.041	.011	.078
	68-69	-.045	.022	-.018	-.027	.006	.063
Partially Retired in Main Job	58-59	.002	-.009	-.001	.002	-.004	-.002
	60-61	-.017	-.008	-.003	.001	-.003	-.002
	62	-.011	-.006	-.008	.001	-.007	-.001
	63	.016	-.007	-.005	.001	-.005	-.001
	64	-.018	-.015	-.012	-.002	-.009	.002
	65	.003	.008	-.012	-.004	-.008	.005
	66-67	.018	.007	-.009	-.003	-.005	.003
	68-69	.016	.007	-.006	-.003	-.003	.005
Partially Retired Outside of Main Job	58-59	.009	-.037	-.001	.001	-.004	-.005
	60-61	.006	-.026	-.003	.002	-.008	-.013
	62	.044	-.016	-.004	.000	-.017	-.021
	63	.070	-.027	-.005	-.002	-.019	-.026
	64	-.016	.021	-.010	-.011	-.021	-.024
	65	.063	-.011	-.018	-.021	-.024	-.017
	66-67	.076	.026	-.027	-.030	-.024	-.021
	68-69	.018	-.060	-.023	-.033	-.025	-.012
Retired	58-59	-.018	-.161	.023	.030	-.004	-.020
	60-61	-.002	-.287	.032	.045	-.008	-.038
	62	.055	-.336	.047	.070	-.012	-.062
	63	-.013	-.318	.059	.082	-.011	-.072
	64	.004	-.217	.069	.096	-.009	-.091
	65	-.028	-.169	.073	.090	.012	-.088
	66-67	-.031	-.116	.062	.075	.018	-.060
	60-61	.011	.031	.047	.064	.022	-.055

[a/] The Figures in this table are calculated as:

Column 1: Pr (Ret. Status/Eligible for Social Security)
-Pr (Ret. Status/Not Elegible for Social Security)
Column 2: Pr (Ret. Status/Healthy) - Pr (Ret. Status/Not Healthy)
Column 3: Pr (Ret. Status/Never Married)
-Pr (Ret. Status/Married, Spouse Present)
Column 4: Pr (Ret. Status/Widowed, Separated, or Divorced)
-Pr (Ret. Status/Married, Spouse Present)
Column 5: Pr (Ret. Status/Children at Home)
-Pr (Ret. Status/No Children at Home)
Column 6: Pr (Ret. Status/Supporting Parents)
-Pr (Ret. Status/Not Supporting Parents)

[b/] See next page.

Table 5 (continued)

[b] The following groups of variables interacted significantly in their effect on retirement status:

Group of variables	ΔG^2	degrees of freedom	prob-value
1. wage in partial-retirement job	25.1	9	99.7%
2. social security, pension	79.8	18	100.0
3. social security, mandatory retirement status	46.2	18	99.9
4. social security, age	234.4	42	100.0
5. children at home, pension	20.9	9	98.7
6. supporting parents, mandatory retirement status	18.2	9	96.8
7. marital status, pension	51.9	18	100.0
8. pension, mandatory retirement status	91.0	27	100.0
9. pension, wage in non-retirement job	122.4	27	100.0
10. mandatory retirement status, age	113.4	63	99.9
11. health, pension, age	100.0	63	99.7

The reader is reminded that since discrete multivariate models are "hierarchical," the inclusion of all higher order terms implies that lower order terms involving subsets of the same variables are also included.

Results presented in the next two columns indicate the relation between pension coverage and retirement outcomes. A person with a private pension exhibits a lower probability of either working full-time or retiring partially in the main job than does someone without a pension. Since normally one must leave the job to collect a pension, pension formulas which are actuarially unfair (i.e., with an expected value that declines with each additional year of work) would reduce the probability of work on the main job. In addition, since for individuals interest rates paid on borrowed funds exceed rates received on loans, liquidity effects of pension eligibility may encourage retirement. Finally, as noted previously, partial retirement on the main job will be discouraged if earnings in a year in which the individual works part-time would be counted in determining the pension benefit. The effect of public sector pensions is similar to that of private pensions.

Columns 5 and 6 consider the effects of mandatory retirement. The consequences of having already faced mandatory retirement on the probability of not retiring are enormous. Having already faced mandatory retirement makes it much less likely that an individual will be found in full-time work. This effect declines with age. The reason for this decline is that the probability of not retiring falls with age even for those who do not face mandatory retirement, so that the older the worker, the smaller is the <u>difference</u> in this probability associated with mandatory retirement. As would be expected, the probability of partially retiring in the main job is also lower for those who have already faced mandatory

retirement.[1] Some of those who have been forced out of their main job retire fully, while others are seen to take part-time jobs outside of the main job. Those who will face mandatory retirement in the future are less likely to retire partially in their main job than are those with no mandatory retirement, less likely to retire partially outside of their main job (but this effect is smaller), and by and large are more likely to keep working full-time in that main job.

For the Social Security variable, the results indicate that people covered by social security are generally less likely to be either retired or to be working full-time, and are more likely to be partially retired, especially outside of the main job, than are those who are not covered. Remaining findings indicate that health problems increase the probability of full retirement and reduce the probability of full-time work, that those with the responsibilities of supporting parents (or children) are more likely to be working full-time, and those without a spouse are more likely to report they have retired.

Partial Retirement Among Those Not Subject to Mandatory Retirement

In Table 6, we examine the behavior of an individual with a particularly interesting set of characterisitcs. The individual described in this table has no pension, no mandatory retirement provisions on the main job, and no health problems. In addition, he is eligible for

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[1] The sign and especially the magnitude of the effect on the probability of partially retiring for 58-59 year olds of having already faced mandatory retirement reflects what is likely to be an aberrant relationship for a very small sample of individuals in this category.

Social Security benefits, has no children at home, is not supporting parents, is married with spouse present, and has a wage offer in the third category for both jobs.

This individual is interesting because he is typical of the individuals analyzed in many retirement models. He is neither forced out of the main job by mandatory retirement or health nor is he enticed out by high marginal disincentives which are found in many pension plans.[1] Comparing Table 6 with the top part of Table 2, we find that this individual has about the same total probability of partial retirement as the average for everyone not subject to mandatory retirement (regardless of pension status, health, etc), but the partial retiree is somewhat more likely than average to be in the main job. Moreover, this individual is more likely than average to be working full-time, and correspondingly less likely to be fully retired. An important result from Table 6 is that even among people not subject to mandatory retirement, a significant number partially retire outside the main job. The data from the PSID, cited earlier, suggest that a plausible reason for this is that many people cannot reduce their workload in the main job and hence may find the reduced workload in an alternative job attractive even if it involves a lower wage rate. Together, these results lead us to question utility function parameter estimates, such as those obtained by Gordon and Blinder,

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[1]There remains the possiblity of an involuntary separation through a layoff. The data do not permit us to determine the reason for separation from a job. Note, however, that for some older workers a layoff may have an ambiguous meaning. That is, an employer with a UI tax rate that is not very sensitive to changes in the unemployment experience of its work force because the rate is at a ceiling or floor may agree to layoff some older workers before they retire to allow them to collect UI benefits. The period covered by the data predates changes in UI regulations which were designed to deal with this problem.

Table 6

Estimated Probabilites For An Individual in Good Health, Without a Pension, and Not Facing Mandatory Retirement[a]

Age	Retirement Status: Not Retired	Partially Retired in Main Job	Partially Retired Outside of Main Job	Retired
58-59	.988	.003	.001	.008
60-61	.970	.012	.011	.007
62	.865	.047	.036	.052
63	.827	.035	.054	.085
64	.616	.048	.088	.249
65	.396	.099	.089	.417
66-67	.218	.075	.129	.578
68-69	.099	.064	.117	.720

a/ Other characteristics for this individual are enumerated in the text.

based on models which predict that all partial retirement should occur in the main job unless mandatory retirement or involuntary separation intervene.

Dichotomous Dependent Variables

To answer the last of the questions we posed above, we turn now to the implications of our findings for retirement studies which utilize a dependent variable which is dichotomous — retired or not retired. A problem arises for such studies because there are only two retirement categories, with no clear cut criteria for deciding whether the partially retired should be classified as retired or not. The obvious question is whether findings are affected by the choice of which category the partially retired are placed in. This question can be answered by comparing the changes in the probabilities reported in the bottom panel of Table 5 with the negative of those in the top panel. The bottom panel indicates the responsiveness of the probability of being retired to variation in the independent variables, where the partially retired are not counted in the retired group. The top panel indicates the reponsiveness of the probability of full-time work to variation in the independent variables, and hence the negative of these figures indicates the responsiveness of the probability of retirement to variation in independent variables, where in this case the partially retired are counted as retired.

It is readily apparent from these figures that the choice of definition, i.e. whether the partially retired are classified as retired or not retired, may have a substantial impact on the measured effects of the explanatory variables on retirement probabilities. For example, a higher wage in the non-retirement job reduces the probability of

retirement when the partially retired are counted as retired, but when they are not counted, depending on age, it either has little effect on or increases the probability of full retirement. A similar effect can be observed for mandatory retirement (column 6). Other such effects can also be seen. These results demonstrate that the discrepency in findings between retirement equations using different definitions for a dichotomous retirement variable, which in turn depends on the size and direction of the effects of variation in the independent variable on the probabilities of partial and complete retirement, can, in some cases, be quite large. Thus we find that the treatment of partial retirement may importantly influence the findings of studies using a dichotomous retirement variable.

Interaction Effects

A number of interaction effects, which are reported in the footnotes to Table 5, are statistically significent. This means that the average responses reported in that table are not necessarily the responses we would expect from each individual in the sample. While we do not report in detail the effects of these interactions, some major effects should be mentioned.

1. There is a significant interaction between the pension variable and the wage offer in the main job. Among those with no pension, a higher wage in the main job reduces slightly both the probability of complete retirement and the probability of partially retiring outside the main job. Among those with a pension, a higher wage in the main job increases by as much as twenty percentage points the probability of complete retirement, and it reduces the probability of partially retiring outside the main job substantially more than for those with no pension.

On the other side of this interaction, low wage workers who are covered by a pension are more likely to retire partially outside of the main job than are those who are not covered. Among high wage workers, those covered by a pension are less likely to retire partially outside of their main job than are those with no pension. Instead, among high wage workers those with a pension are even more likely to retire fully.

2. Health status and private pension coverage exhibit a significant interaction effect. Poor health reduces the probability of working full time more for those with no pension than for those with a pension. Among those who are healthy, pension coverage reduces the probability of working full-time more than for those who are unhealthy.

3. Pension coverage and mandatory retirement provisions exhibit a significant interaction effect. For example, among those who do not have a pension, individuals who will face mandatory retirement are more likely to keep working full-time than are those who will not face mandatory retirement. Among those who have a pension, individuals who will face mandatory retirement are less likely to keep working full-time than are those who do not face mandatory retirement . Also, individuals are less likely to keep working full-time if they are covered by a pension than if they are not, and the negative effect of pension coverage is even stronger among those who will face mandatory retirement on their main job than it is among those who will not.

IV Conclusion

This paper has considered the role of partial retirement in the analysis of retirement behavior. It has been structured to provide

answers to six questions posed at the outset. These answers are summarized in the following conclusions: (1) Descriptive statistics pertaining to partial retirement demonstrate that partial retirement is indeed an important phenomenon. (2) Some individuals partially retire in their main job but a relatively larger number partially retire outside of their main job. (3) Individuals face a number of different opportunity sets. Most are not free to reduce hours in their main jobs. Differing opportunities for work on a full-time or part-time basis in the main job and for employment outside of the main job may be included in the specification of the relevant structural equations of a life cycle retirement model by appropriate modifications of the lifetime budget constraint and/or modifications of the form of the utility function. (4) The probability of partial retirement, especially of partial retirement outside of the main job, is related significantly to indicators of coverage from pension programs, mandatory retirement provisions, wage offers in main and partial retirement jobs, health, family status, and of course age. (5) For those who are not forced out of their main job by poor health or by mandatory retirement provisions, or who are not attracted out by pension provisions, partial retirement both within and outside the main job is an important phenomenon. The numerical importance of partial retirement outside of the main job for this group calls into question results based on models which make no allowance for this phenomenon. (6) Parameter estimates in studies of retirement behavior which use a dichotomous dependent variable are sensitive to the way the partially retired are classified — as retired or not retired.

A next important step to be taken if we are to understand retire-

ment behavior is to follow on the path-breaking work of Gordon and Blinder. Although these authors considered only a limited number of job environments, their work specifying and estimating a basic structural model of retirement, including most importantly the parameters of the utility function, was an important step forward. In the absence of good structural estimates, we cannot determine the effects of the major changes in retirement policy which have recently been proposed, such as changes in the ages of normal and early retirement under social security, changes in the permissible age for mandatory retirement, and changes in the structure and coverage of private pension programs. If, on the other hand, the parameters of the utility function and their distributions were known, we then would be in a position to simulate the effects of programs with rules that would result in kinks and bends in the budget line that have not as yet been encountered. However, if parameters estimates obtained from a structural model are to be reliable enough for use in policy analysis, the structural model must be specified correctly. This requires a full understanding of the opportunity set available to each individual. According to the evidence developed here, this opportunity set differs among individuals, especially the opportunities for partial retirement. An understanding of how and why these opportunities differ is a key requirement for any structural analysis of retirement behavior.

References

Bishop, Yvonne M., Stephen E. Feinberg, and Paul W. Holland, Discrete Multivariate Analysis: Theory and Practice (Cambridge, Massachusetts: The MIT Press, 1975).

Boskin, Michael J., and Hurd, Michael D. "The Effect of Social Security on Early Retirement." Journal of Public Economics 10, 1978.

Burkhauser, Richard and Quinn, Joseph, "The Effect of Changes in Mandatory Retirement Rules on the Labor Supply of Older Workers", mimeo, 1980.

Burbidge, John B., and Robb, A. Leslie. "Pensions and Retirement Behavior." Canadian Journal of Economics, August 1980.

Clark, Robert L. and Johnson, Thomas. "Retirement In Dual Career Families." Mimeographed, North Carolina State University, June 1980.

Deardorff, Alan V. and Stafford, Frank P., "Compensation of Cooperating Factors," Econometrica 44, July 1976, pp. 671-684.

Deutermann, William V. Jr. and Brown, Scott C., "Voluntary Part-Time Workers: A Growing Part of The Labor Force," Monthly Labor Review, Vol. 101, June 1978, pp. 3-10.

Fields, Gary S. and Mitchell, Olivia S., "Pensions and Optimal Retirement Behavior", mimeo, Cornell University, March 1981.

Gordon, Roger H., and Blinder, Alan S. "Market Wages, Reservation Wages and Retirement," Journal of Public Economics, Vol. 14, 1980, pp. 277-308.

Gustman, Alan L., and Steinmeier, Thomas L., "Some Theoretical and Empirical Aspect of the Analysis of Retirement Behavior," Final Report, submitted to the Office of Planning, Policy and Research, LMSA/PWBP, U. S. Department of Labor, February 1981.

Haberman, Shelby J., Analysis of Qualitative Data, (New York: Academic Press, 1978).

Hamermesh, Daniel S., "A General Empirical Model of Life-Cycle Effects In Consumption and Retirement Decisions," mimeo, 1981.

Kurz, Mordecai, The Life Cycle Hypothesis and The Effects of Social Security and Pensions On Family Savings, Stanford, May 1981.

Parsons, Donald O., "The Male Labor Force Participation Decision: Health, Reported Health and Economic Incentives." Mimeographed, Ohio State University, February 1980.

Quinn, Joseph F., "The Extent and Correlates of Partial Retirement," Mimeo, 1980.

_____, "Microeconomic Determinants of Early Retirement: A Cross-Sectional view of white married men," Journal of Human Resources, XII (3), 1977, 329-346.

Reimers, Cordelia. "Factors Affecting the timing of Retirement of American Men." Mimeographed, Princeton University, March 1977.

Rosen, Harvey S., "Taxes In A Labor Supply Model with Joint Wage Hours Determination," Econometrica, vol. 44, no. 3, May 1976.

Sammartino, Frank. "A Model of the Retirement Decision." Paper presented at the Labor Workshop, University of Wisconsin, Madison, February 1978.

Zabalza, A., Pissarides, C. and Barton M., "Social Security And The Choice Between Full-time Work, Part-Time Work and Retirement," Journal of Public Economics, vol. 14, 1980. pp. 245-76