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THE EFFECT OF SOCIAL SECURITY ON LABOR SUPPLY:
A COHORT ANALYSIS OF THE NOTCH GENERATION

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ABSTRACT

This paper uses aggregate birth year/calendar year level data derived from the Current Population Survey (CPS) to estimate the effect of Social Security wealth on the labor supply of older men in the 1970s and 1980s. The analysis focuses on the 1977 amendments to the Social Security Act, which created a substantial, unanticipated differential in benefits for otherwise identical individuals depending on whether they were born before or after 1917. This differential has become known as the benefit notch. There are two principal differences between the present analysis and the previous literature. First, this paper uses time-series variations in benefit levels to estimate the relationship between benefits and labor supply in an era when real benefits were falling for new recipients. Second, variation in benefit levels across cohorts is used to estimate the relationship between benefits and labor supply. The results support a conclusion that labor supply continued to decline for the "notch babies" who received lower Social Security benefits than earlier cohorts.

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Nearly half of all males age 65 or older participated in the labor force when the first Current Population Survey (CPS) was conducted in 1948; by 1988, this figure had dropped to 16%.¹ The substantial decline in the labor supply of older men in the second half of the twentieth century has led many researchers to investigate the effect of the Social Security system (OASI) on labor supply. The Social Security retirement system is an obvious suspect for the reduction in labor supply among the elderly because coverage under the law has expanded and benefits have increased throughout most of this time period. The Social Security program now provides benefits to more than 90% of those age 65 or older, and is the largest source of income among the elderly (Ycas and Grad, 1987). The scale and generosity of the program suggests there may be a link between Social Security and the decline in male labor supply.

Although a great many studies have attempted to measure the effect of Social Security on labor supply, there remains substantial uncertainty as to the impact of the program. The previous literature on Social Security and labor supply is summarized in the next section. A major shortcoming of previous cross-sectional studies is that factors that determine benefits (e.g., previous earnings) are likely to be correlated with labor force attachment and thus confound the estimated effect of the program.

On the other hand, a shortcoming of studies that rely on time-series variation is that Social Security benefits generally trended up in the post-World War II period, while labor force participation trended down. From the existing time-series and panel data studies it is difficult to determine whether the negative relationship between Social Security

¹See Labor Force Statistics Derived from the Current Population Survey, 1948-1987 (Washington, DC: US Government Printing Office, 1988).

benefits and labor supply is causal or due to some other variables that have also trended over time, such as income or pension wealth. A better type of experiment is needed to estimate the effect of Social Security on labor supply.

This paper attempts to extend the previous literature by examining the impact of the 1977 amendments to the Social Security Act. These amendments are unusual in that they led to an abrupt downward trend in prospective Social Security benefits for one generation of workers -- the so called notch babies born 1917-1921 -- while leaving benefits unchanged for previous generations.² The combination of high inflation in the 1970s and the hasty transition rules established by the amendments led the notch generation to receive substantially lower benefits than otherwise identical retirees who were born slightly earlier. This change in the Social Security system provides the first major break from the time-series pattern of increasing benefits, and provides variation in benefits across cohorts.

Our econometric strategy is to use panel data that follow several birth cohorts over time to estimate whether the large reduction in prospective retirement benefits for the notch cohort has had a measurable effect on their labor supply compared to other cohorts that were unaffected by the amendments. Since available micro-data sets do not cover the requisite time period, we have created an aggregate data set by using each March CPS from 1976 to 1988 to derive labor force data for single year-of-birth cohorts. We then estimate Social Security wealth for a representative individual with constant characteristics in each cohort, and

²The term "notch babies" was coined by Dear Abby to refer to the cohort of individuals that was adversely affected by the 1977 amendments.

use this data set to fit several reduced form labor supply models.

As a check on the reliability of the cohort analysis, we first fit the same labor supply equations to data covering the period analyzed in most previous micro-data studies of Social Security. These estimates closely match the previous literature (e.g., Hurd and Boskin, 1984). Our estimates of the effect of Social Security on labor supply of older males in the late 1970s and 1980s, however, are less consistent with the previous literature. When we control just for age effects, we find a much smaller Social Security wealth-labor supply elasticity in the 1970s and 1980s than in earlier years. Perhaps more importantly, partial-regression plots do not reveal a reversal in the downward trend in labor force participation for the cohorts surrounding the group that experienced declining Social Security wealth. Furthermore, when we control for age and period effects the relationship between Social Security wealth and retirement becomes insignificant. These findings suggest that the growth in Social Security wealth can not explain much of the decline in male labor supply.

I. Previous Literature

The literature on Social Security and labor supply has been amply surveyed elsewhere, and the details of the individual studies will not be reviewed here.³ Instead, we will characterize the major methodologies used by previous studies, and summarize their findings.

Studies of the impact of Social Security on labor supply may be categorized into two types. One relies primarily on time-series variations in the law to identify the effect of changes in benefits or other parameters of the Social Security system on labor supply, and the other relies on cross-sectional variations (e.g., across families) in benefits to identify the effect of the Social Security system.⁴ Studies that utilize panel data are a hybrid, potentially drawing on both time-series and cross-sectional variation in benefits.

Studies that examine cross-sectional data estimate how the prevailing Social Security law influences behavior in a given year (examples are Pellechio, 1979 and 1981, and Gordon and Blinder, 1980). The variations in Social Security benefits among individuals at a point in time result from differences in individual circumstances -- such as past earnings, age, or family status -- but not from differences in the Social Security law because everyone is covered by the same law. Since the factors that cause individual circumstances to vary are also likely to have an independent effect on labor supply, there is a fundamental problem of identification in

³For detailed reviews of this literature, see Aaron (1982), Fields and Mitchell (1984a), Boskin (1986), Parnes (1988), and Quinn, Burkhauser and Myers (1990).

⁴Of course, there are other important differences that distinguish past studies, such as the labor supply measure used, but we believe that a major difference among the analyses is the source of variation in benefits.

cross-sectional studies of the Social Security program. The impact of Social Security can only be untangled from the impact of other variables using cross-sectional data if functional form assumptions are made, such as the assumption that marital status does not directly influence labor supply.⁵

Panel data that follow individuals over time and time-series data provide a means to allow changes in the Social Security law itself to influence the benefits that individuals receive. Many of the papers that rely on time-series variations in benefits are based on the Retirement History Survey, which follows individuals over the years 1969-1979 (examples are Hurd and Boskin, 1984; Burtless, 1986; and Anderson, Burkhauser and Quinn, 1986). This was a period of rapidly rising Social Security benefits resulting from ad hoc changes in the law and the over indexation of benefits. Most of the analyses of data from this time period find that more generous Social Security benefits tend to reduce labor force participation, induce earlier retirement, or induce individuals to retire earlier than they had previously planned. The magnitude of the estimated labor supply reduction, however, varies considerably across studies.

The study that comes closest to the present analysis is Moffitt's (1987) time-series analysis of labor supply in the years 1955-1981. Moffitt estimates log-linear earnings functions to measure the impact of changes in Social Security wealth on the labor supply of four broad age groups (25-34, 35-44, 45-64, 65 and over). His main conclusion is that although there is a negative relationship between Social Security wealth and labor supply, the timing of the labor supply response does not

⁵Quinn (1987) and Moffitt (1987) voice a similar critique.

correspond well to changes in Social Security wealth. The present study differs from Moffitt's work in that we examine single-year birth cohorts of older men, and focus on the period in which benefits rose and then fell in the late 1970s and 1980s.

That there is considerable disagreement as to the magnitude and direction of the effect of Social Security on labor supply is clear from the divergent conclusions reached by the many survey articles that have summarized this literature. For instance, after reviewing the past literature Aaron (1982) concludes there is little evidence showing Social Security has reduced the labor supply of elderly workers, while Boskin (1986; p. 62) concludes, "the acceleration in the decline of the labor force participation of the elderly from 1969 to 1973 was primarily due to the large increase in real Social Security benefits." Quinn, Burkhauser, and Myers (1990), Ippolito (1988), Parnes (1988) and Danziger, Haveman, and Plotnick (1981) reach more of a middle-ground conclusion, attributing a portion of the observed decline in labor force participation of older workers to Social Security.

One reason for the conflicting conclusions of the previous literature is that the source of variation in benefits has not been exogenous in the cross-sectional studies, and until recently there has been insufficient downward movement in benefits in time-series data to allow one to separate the effect of Social Security benefits from other variables that have trended over time. The latter issue is the focus of our analysis.

II. Double Indexation and the Notch in Benefits

Although many past amendments to the Social Security Act have had a

differential impact on different generations, the 1977 amendments are unusual in that they abruptly created permanently lower benefits for a large cohort of individuals compared to those who are otherwise identical but born slightly earlier. This differential is known as the "benefit notch." To understand how the notch came about, it is necessary to review the calculation of Social Security benefits.⁶

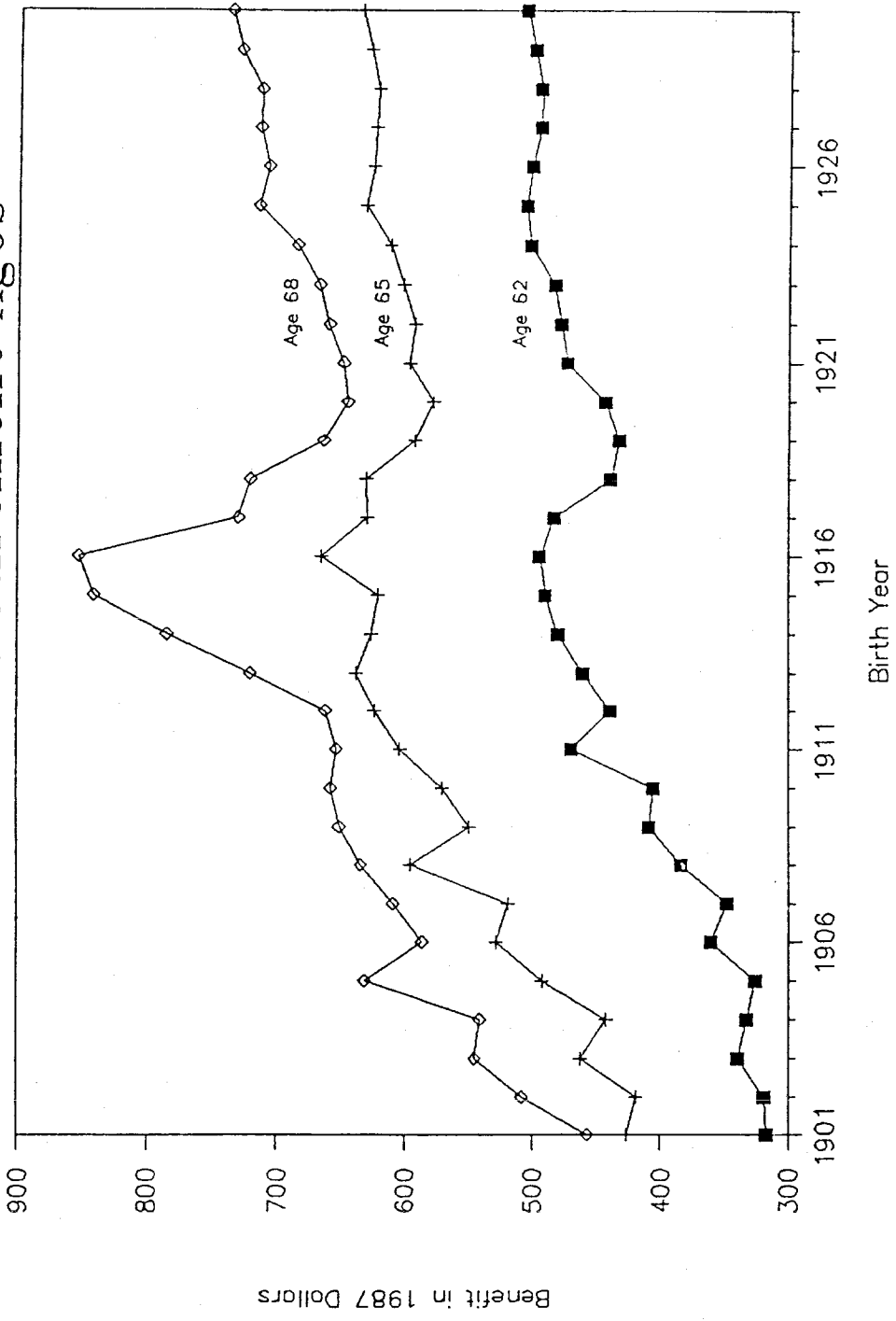
Prior to 1972, monthly Social Security benefits were based on average nominal monthly earnings (AME), generally excluding some years of low earnings. In calculating the AME, earnings were truncated at the Social Security taxable maximum. A fixed, progressive benefit formula was applied to the AME to derive the Primary Insurance Amount (PIA). The formula consists of several brackets for earnings, and assigns a specified (declining) percentage of earnings to be replaced for each bracket. Until 1972, Congress changed the benefit formula to raise benefits or to make adjustments for inflation on an ad hoc basis.

If a worker retires at the "normal" retirement age (65), benefits equal the PIA. An actuarial reduction is made for every month the worker retires before age 65. For retirement at the earliest possible age (62), the benefit is 80% of the PIA. Before 1972, no adjustments were made to benefits for workers who retired after age 65.

Figure 1 displays the real monthly Social Security benefit for selected retirement ages that a single worker would qualify for if he earned the average wage each year of his working life. Benefit increases

⁶This section draws heavily on General Accounting Office (1988), which has an excellent description of the legislation. See McKay and Schobel (1981) and Myers (1985) for further details on Social Security benefits. We omit a discussion of the 1983 amendments because the cohorts in the sample under study were not affected by the major changes they introduced.

Figure 1
 Monthly Social Security Benefits
 For Selected Retirement Ages



were enacted in 1967, 1969, and 1971, all exceeding the inflation rate. An even larger increase was enacted in 1972, leading to about a 15% rise in real benefits in the following year. In 1974, benefits grew slower than the inflation rate, creating a noticeable spike in 1973.⁷

The amendments to the Social Security Act enacted in 1972 were intended to automatically adjust benefits for cost-of-living increases. A flaw in the design of the law caused benefits to increase faster than the inflation rate, a situation commonly called double indexation. Double indexation resulted because average life-time earnings naturally increased with inflation and thus increased the AME, but Congress also mandated that the replacement rate attached to each bracket in the benefit formula increase commensurate with the inflation rate.⁸ Furthermore, since benefits were linked to nominal earnings, workers who postponed retirement could generally increase their benefits at a greater than actuarially fair rate because relatively high-earnings years displaced years of low earnings in the calculation of the AME.

It should be stressed that over indexation only affected workers who were not yet retired. The schedule that was applied to the AME was determined by the year in which an individual retired. Once retired, however, the current benefit level was only indexed to the annual CPI.

Amendments enacted in 1977 (Public Law 95-216) are designed to eliminate double indexation by indexing life-time earnings to overall

⁷See Myers (1985), pp. 316-320 for more details.

⁸The 1972 law also introduced a delayed retirement credit raising benefit levels for workers who retire after age 65 (up to a maximum at age 72).

average wage growth.⁹ Average indexed monthly earnings (AIME) are then applied to a new benefit formula that specifies benefit replacement rates for three earnings brackets. The new benefit formula is adjusted annually by widening the brackets to reflect changes in the average annual wage, but the replacement rates remain constant. Life-time earnings and the earnings brackets are indexed to the year in which the worker attains age 62.¹⁰ Thus, indexation is not affected by individuals' retirement age. After retirement, benefit increases are again based on changes in the CPI.

Because it was felt that double indexation conferred an unintended windfall on Social Security recipients, the new benefit formula lowered benefits compared to the prevailing law. The goal was to set the PIA for an average worker equal to 44% of his or her pre-retirement earnings. Workers very near retirement age were grandfathered by the old law: the 1977 amendments only covered those who were age 60 or younger when the amendments were passed (e.g., those born after 1916).

To phase in the lower benefits, a special five year transition period was adopted for individuals born 1917-1921, the notch babies. Retirees covered by the transitional rules could receive either the benefit they qualify for under the new 1977 law, or the benefit they qualify for under the special transitional guarantee, whichever is higher. The transitional guarantee operated like the pre-1977 law, with two key exceptions: Earnings after age 62 were not used in the calculation of the AIME; and the 1978 benefit formula for the notch group was not adjusted for price increases in

⁹See McKay and Schobel (1981) for details.

¹⁰Earnings after age 62 are counted in the AIME but not indexed.

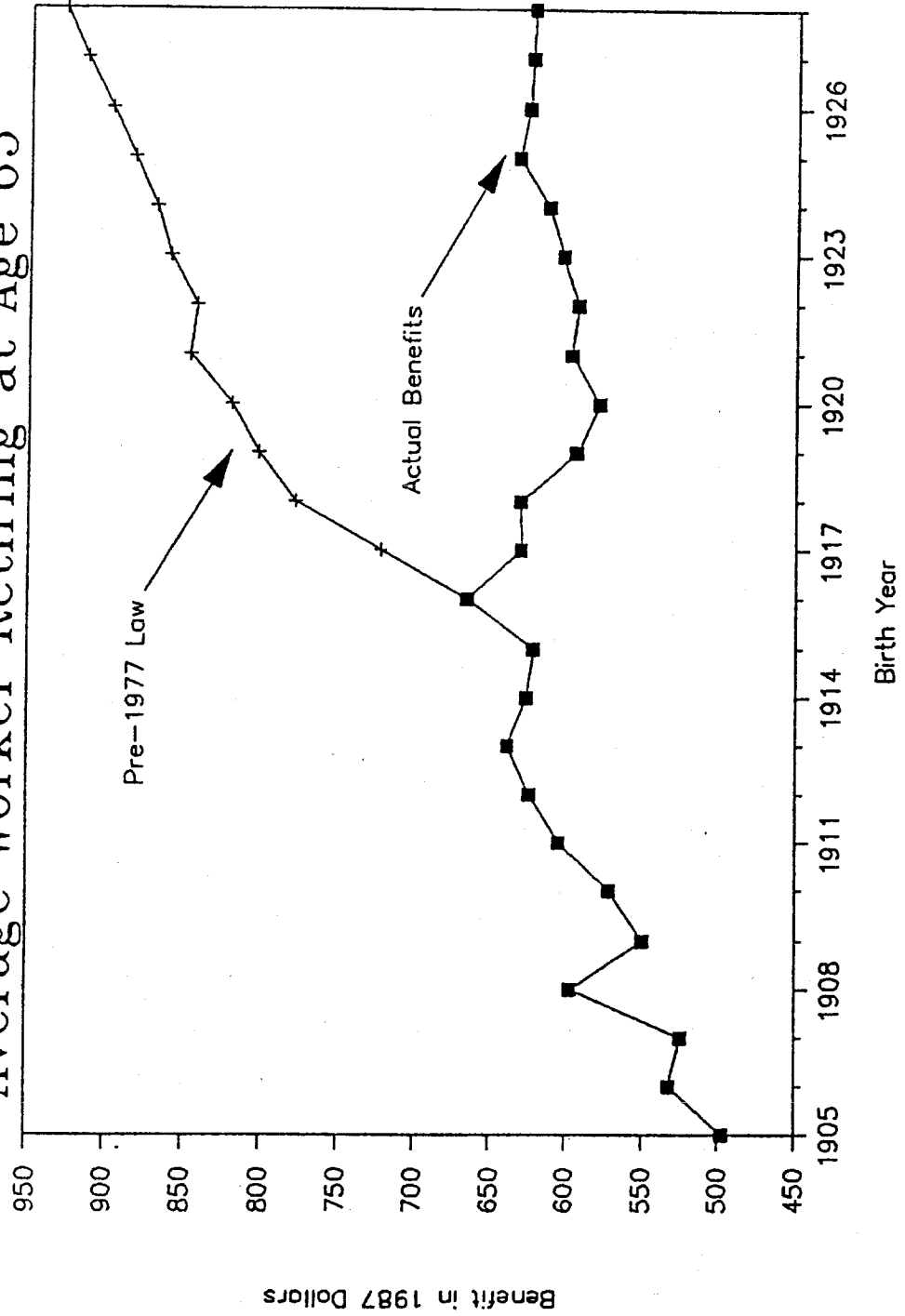
later years.¹¹ The transitional guarantee therefore produced declining real benefits for subsequent cohorts. Nevertheless, for most workers the transitional guarantee provided a higher benefit than the new 1977 law.

Although the transitional guarantee was designed to gradually phase in the provisions of the new law, the acceleration of inflation in the late 1970s caused a substantial increase in real Social Security benefits for the 1915-1916 cohort. Consequently, benefits were lowered rather quickly for the next cohorts to bring benefits down to the level desired by the new law within the five year transition period. For example, a worker who retired at age 65 after a career of earning the average wage would receive 13% lower Social Security benefits if he were born in 1920 as opposed to 1916. Notice also that Figure 1 shows a greater divergence in benefits across cohorts for men who retire at older ages. Importantly, the benefit notch created varying age paths in benefits for different birth years, which provides within-cohort-and-year variation in benefits.

Figure 2 displays the level of benefits that would have applied for workers who retired at age 65 had the pre-1977 law (double indexation) remained in effect. For example, benefits for an average individual retiring at age 65 would have grown by about 30% between 1980 and 1985 had the pre-1977 law remained in effect. Instead, benefits over this time period actually fell by 7%. If individuals in the notch generation formed their expectations for future Social Security wealth on the basis of the pre-1977 law, they would have experienced a large decline in anticipated retirement income as a result of the 1977 amendments.

¹¹ Once benefit payments begin, however, annual adjustments are made to keep pace with inflation.

Figure 2
 Monthly Social Security Benefits
 Average Worker Retiring at Age 65



The following example perhaps more vividly illustrates the kind of inter-cohort benefit differentials that were created by the notch problem:

Two sisters, Edith and Audrey, started work at the same book bindery in southern California on the same day in October 1957. Audrey was slightly older, having been born in March 1916, than Edith who was born in June 1917. The two worked together at similar pay for 25 years and in the summer of 1982, with Edith turning 65, went to the Social Security office to claim their benefits. They were told that since the older Audrey had worked about 18 months after her 65th birthday, there would be a slight difference in the benefit each received. The total lifetime earnings of the pair was almost identical differing only by about four percent (in favor of the younger Edith). To their surprise, when they received notification of their benefit award, the difference was not slight. Instead, Edith (born in 1917) received a \$512.60 monthly award or \$111.80 per month less than Audrey (born in 1916) who received a higher benefit of \$624.40 per month. (See GAO, 1988; p. 14.)

Much public attention has been devoted to the notch issue. As a result, some 36 bills and resolutions have been considered by Congress to deal with the notch in benefits. The public outcry over the notch suggests that it was a well known phenomenon that older workers were aware of and therefore could have taken into account in their retirement plans. Nonetheless, it is unlikely that Congress will pass legislation to eliminate the notch.¹² Thus, the notch in benefits probably should be considered a permanent wealth differential.

Moreover, since the reduction in prospective benefits occurred relatively late in individuals' work lives, on theoretical grounds one would expect it to have a greater effect on labor supply because there is less time for individual to re-optimize and alter their consumption plans.

¹²A report prepared by the National Academy of Social Insurance (1988) at the request of Senator Moynihan, for example, recommended that Congress make no changes in the law to eliminate the notch in benefits.

III. Data and Methodology

The Social Security system can influence labor supply in a variety of ways. In view of the coarseness of our aggregate data set, we adopt a very simple model of labor supply and focus on two features of Social Security: 1.) the wealth effect of benefits; 2.) the potential actuarial "non-neutrality" of benefits.¹³ Standard labor supply analysis would predict that the wealth effect will lead to a negative relationship between Social Security wealth and labor force participation (assuming leisure is a normal good), and that the substitution effect will lead a benefit structure that is more than actuarially fair to induce workers to postpone their retirement. These aspects of the program are particularly amenable to analysis in the time period we study because the 1977 Amendments provide exogenous, unanticipated variation in these parameters of Social Security.

Since no micro panel data set is available for the period and cohorts of interest, we have created an aggregate panel data set from the Current Population Survey.¹⁴ Using each March CPS from 1976 to 1988 we have derived average labor force statistics for single year birth cohorts of

¹³For instance, we do not consider the incentive effects of the earnings test, which reduces benefits for individuals who exceed a certain income limit, or the taxation of benefits introduced by the 1983 amendments. These omissions are likely to be of little consequence for our analysis because they will be captured by the time effects. It is also safe to ignore the payroll tax that finances the program because the benefit changes that we observe are not related to changes in tax liability of the cohorts in our sample. See Hanoch and Honig (1978) for a theoretical treatment of how these issues affect the labor supply function.

¹⁴See Deaton (1985) for an analysis of the use of repeated cross-sections to derive panel data estimates. The Retirement History Survey, which is the panel data set most commonly used to study retirement, is inappropriate for our purposes because it was discontinued in 1979 and does not include individuals born in the notch cohort. Although the National Longitudinal Survey of Mature Men samples individuals in the proper cohorts (born 1907-1921), it was discontinued in 1983.

males age 60-68. The CPS samples are restricted to males because they are more likely to be covered by the Social Security Act, and because their labor supply has shown the greatest downward tendency. The data set consists of average values for 117 birth year/calendar year cells.

There are a variety of ways to measure labor supply and retirement. Rather than focus on any one measure, we take an eclectic approach and examine three alternative indicators for labor force status: 1) labor force participation in the survey week; 2) self-reported retirement status in the survey week; and 3) the number of weeks worked last year.¹⁵

Social Security benefits depend critically on the calendar year in which an individual was born. Care must be taken to assign birth years to individuals when using the CPS because the public-use data sets only report the respondent's age as of the survey week. Since the survey is held in the middle of March, the majority of the sample will reach their birthday in the remainder of the calendar year. For example, an individual who reports his age as 65 in March 1982 is likely to turn 66 during 1982, and is therefore assigned to the 1916 birth cohort. Since the birth distribution is approximately uniform across quarters of the year, this procedure will correctly classify birth years for nearly 80% of the sample.

The weeks worked variable refers to the previous calendar year and is therefore treated differently. In the example above, the number of weeks reported refers to calendar year 1981, when the individual was likely to have attained age 65. This implies that the sample for our weeks variable

¹⁵ Labor force participation is inferred from the Employment Status Recode item on the data set. Individuals are classified as in the labor force if they worked for pay in the preceding week or were unemployed and searched for work in the past four weeks. Retirement status is determined from the respondents' "major activity" in the preceding week.

spans the years 1975 to 1987.

Tables 1, 2, and 3 contain the labor force participation rate, proportion retired, and average weeks worked for individuals in our sample by calendar year and age. Individual cohorts can be followed along the diagonals. For reference, observations on the 1917 birth cohort -- the first cohort covered by the 1977 amendments -- are underlined. Reading across the rows, all three measures show a decline in labor supply of older men over time which continues to hold for the cohorts affected by the benefit notch.

Derivation of Social Security Benefits

A great deal of information is required to impute Social Security benefits. Among other things, Social Security benefits depend on a worker's past earnings, marital status, and dependent children. To estimate Social Security benefits at the aggregate level we constructed an earnings history for a hypothetical worker assuming he earned the average taxable earnings in each year of his working life.¹⁶ Benefits for each cohort and potential retirement age were then calculated on the basis of this earnings history using a computer program provided by the Social Security Administration.¹⁷ Although it would be preferable to calculate average benefits using micro earnings data rather than average earnings data, the benefit we calculate is likely to be highly correlated with the

¹⁶Where assumptions about future wage increases are necessary our calculations use alternative II-B of the 1988 OASDI Trustees Report. It should be noted that we follow the same procedures the General Accounting Office used to derive Social Security benefits in its 1988 report.

¹⁷This 4,500 line program is described in McKay and Dickstein (1988). In calculating benefits we made the following assumptions: individuals were born on January 31 and retired in the month of February, had 120 quarters of covered work experience, and did not have a dependent spouse.

Table 1
Labor Force Participation Rate

Age at Survey	Year												
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
60	0.769	0.789	<u>0.747</u>	0.752	0.744	0.734	0.725	0.710	0.712	0.707	0.684	0.703	0.662
61	0.736	0.699	0.721	<u>0.704</u>	0.711	0.679	0.695	0.672	0.646	0.659	0.659	0.660	0.661
62	0.613	0.596	0.591	0.597	<u>0.607</u>	0.564	0.531	0.554	0.536	0.506	0.555	0.557	0.534
63	0.571	0.560	0.505	0.523	0.543	<u>0.540</u>	0.444	0.474	0.493	0.475	0.458	0.464	0.474
64	0.480	0.540	0.471	0.506	0.531	0.457	<u>0.476</u>	0.411	0.419	0.458	0.370	0.425	0.398
65	0.391	0.334	0.366	0.350	0.353	0.342	0.319	<u>0.317</u>	0.306	0.322	0.321	0.290	0.321
66	0.342	0.320	0.303	0.312	0.304	0.291	0.289	0.302	<u>0.260</u>	0.258	0.294	0.311	0.316
67	0.287	0.300	0.291	0.278	0.284	0.293	0.283	0.266	0.248	<u>0.232</u>	0.235	0.260	0.247
68	0.278	0.242	0.255	0.281	0.272	0.235	0.258	0.287	0.189	0.207	<u>0.217</u>	0.234	0.202
Column Mean	.554	.546	.532	.532	.541	.520	.504	.494	.486	.485	.479	.492	.486

Note: Observations for the 1917 cohort are underlined (note that birth year is current year minus age minus one). The sample consists of males in the March Current Population Survey (CPS).

Table 2
Proportion Retired

Age at Survey	Year												
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
60	0.115	0.103	<u>0.125</u>	0.129	0.136	0.159	0.149	0.164	0.157	0.187	0.189	0.177	0.217
61	0.129	0.156	0.154	<u>0.135</u>	0.190	0.206	0.191	0.202	0.225	0.240	0.239	0.249	0.233
62	0.263	0.266	0.283	0.276	<u>0.286</u>	0.328	0.326	0.317	0.369	0.367	0.336	0.341	0.362
63	0.314	0.310	0.377	0.334	0.346	<u>0.349</u>	0.424	0.393	0.398	0.438	0.410	0.424	0.442
64	0.385	0.332	0.381	0.384	0.387	0.407	<u>0.403</u>	0.488	0.449	0.431	0.484	0.472	0.475
65	0.503	0.558	0.513	0.472	0.533	0.533	0.545	<u>0.571</u>	0.578	0.564	0.565	0.591	0.571
66	0.539	0.565	0.578	0.546	0.558	0.561	0.600	0.598	<u>0.620</u>	0.637	0.610	0.614	0.602
67	0.593	0.560	0.591	0.570	0.606	0.574	0.576	0.606	0.634	<u>0.656</u>	0.645	0.638	0.658
68	0.609	0.625	0.622	0.584	0.618	0.631	0.609	0.612	0.667	0.648	<u>0.673</u>	0.656	0.657
Column Mean	.326	.326	.343	.328	.350	.360	.368	.385	.395	.407	.403	.403	.412

Note: Observations for the 1917 cohort are underlined (note that birth year is current year minus age minus one). The sample consists of males in the March Current Population Survey (CPS).

Table 3

Average Number of Weeks Worked

Age	Year													
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	
60	38.393	39.777	<u>37.956</u>	38.142	37.984	37.484	37.651	36.460	35.140	35.090	35.057	35.474	34.368	
61	37.161	35.925	36.717	<u>36.162</u>	36.408	35.398	35.460	34.070	33.221	34.290	34.481	33.966	33.144	
62	33.776	32.871	32.814	32.580	<u>34.018</u>	32.290	30.405	30.738	30.004	29.596	32.122	30.840	29.233	
63	30.848	30.034	26.374	27.769	29.474	<u>28.417</u>	24.318	25.756	25.227	25.268	24.704	26.365	25.337	
64	24.775	27.547	25.147	27.012	27.131	25.218	<u>25.258</u>	22.237	23.080	23.439	20.352	23.133	21.931	
65	22.896	20.996	21.278	20.898	20.558	20.068	19.629	<u>18.942</u>	16.589	16.808	17.761	16.432	17.127	
66	17.401	15.756	15.749	15.496	16.301	14.761	15.368	15.875	<u>13.234</u>	14.053	14.982	15.891	15.498	
67	14.166	14.784	13.348	13.742	13.652	15.064	14.941	13.899	12.863	<u>12.171</u>	13.058	12.429	12.975	
68	14.813	11.967	14.130	14.615	13.419	12.034	13.487	14.776	10.407	11.392	<u>12.239</u>	11.872	10.471	
Column Mean	26.025	25.517	24.835	25.157	25.438	24.526	24.058	23.639	22.196	22.456	22.751	22.933	22.232	

Note: Observations for the 1917 cohort are underlined. The sample consists of males in the March Current Population Survey (CPS).

average benefit received by each cohort, and thus should reflect the major changes in benefits that affected each cohort.

For each calendar year, age, and cohort, average Social Security wealth is calculated according to the laws that were in effect for that cohort and time period. Since Social Security benefits are adjusted for inflation once benefit payments begin, real Social Security wealth (SSW) is given by:

$$SSW_{c,a} = \sum_{i=a}^T B_{c,a} (1+r)^{a-i} \quad \text{for } a \geq 62$$

and

$$SSW_{c,a} = \sum_{i=a}^T B_{c,62} (1+r)^{a-i} \quad \text{for } a < 62$$

where T equals life expectancy, B is the real annual Social Security benefit, r is the interest rate, a is an indicator for age, and c is an indicator of cohort (i.e., birth year).

Given the nonlinearity of the Social Security law, it is difficult to accurately capture the change in Social Security wealth associated with postponing retirement. We approximate the inter-temporal structure of the Social Security law by the growth in wealth if retirement were delayed one additional year.¹⁸ This variable reflects changes in life expectancy, the automatic benefit recomputation following an additional year of work, and actuarial adjustments to benefits. Our measure of the growth in Social Security wealth for delaying retirement if the worker is initially age a

¹⁸ Burkhauser and Quinn (1983) and Fields and Mitchell (1984b) use a similar measure of the change in Social Security and pension wealth for postponing retirement.

is $G_{c,a} = \text{SSW}_{c,a+1} / (1+r) \text{SSW}_{c,a}$.

Figure 3 shows that there has been tremendous variation in the ratio of Social Security wealth for retirement at age 65 relative to retirement at age 62. As Blinder, Gordon and Wise (1980) have noted, the ad hoc changes in Social Security benefits enacted by Congress prior to 1975 and double indexation typically have resulted in more than actuarially fair growth in Social Security wealth for workers under 65 years old who postpone retirement. Moreover, as Blinder, Gordon and Wise predicted ex ante, the 1977 amendments substantially reduced the relative wealth advantage of delaying retirement.

Specification

The following reduced form labor supply equation allows for both time-series and inter-cohort variations in Social Security benefits:

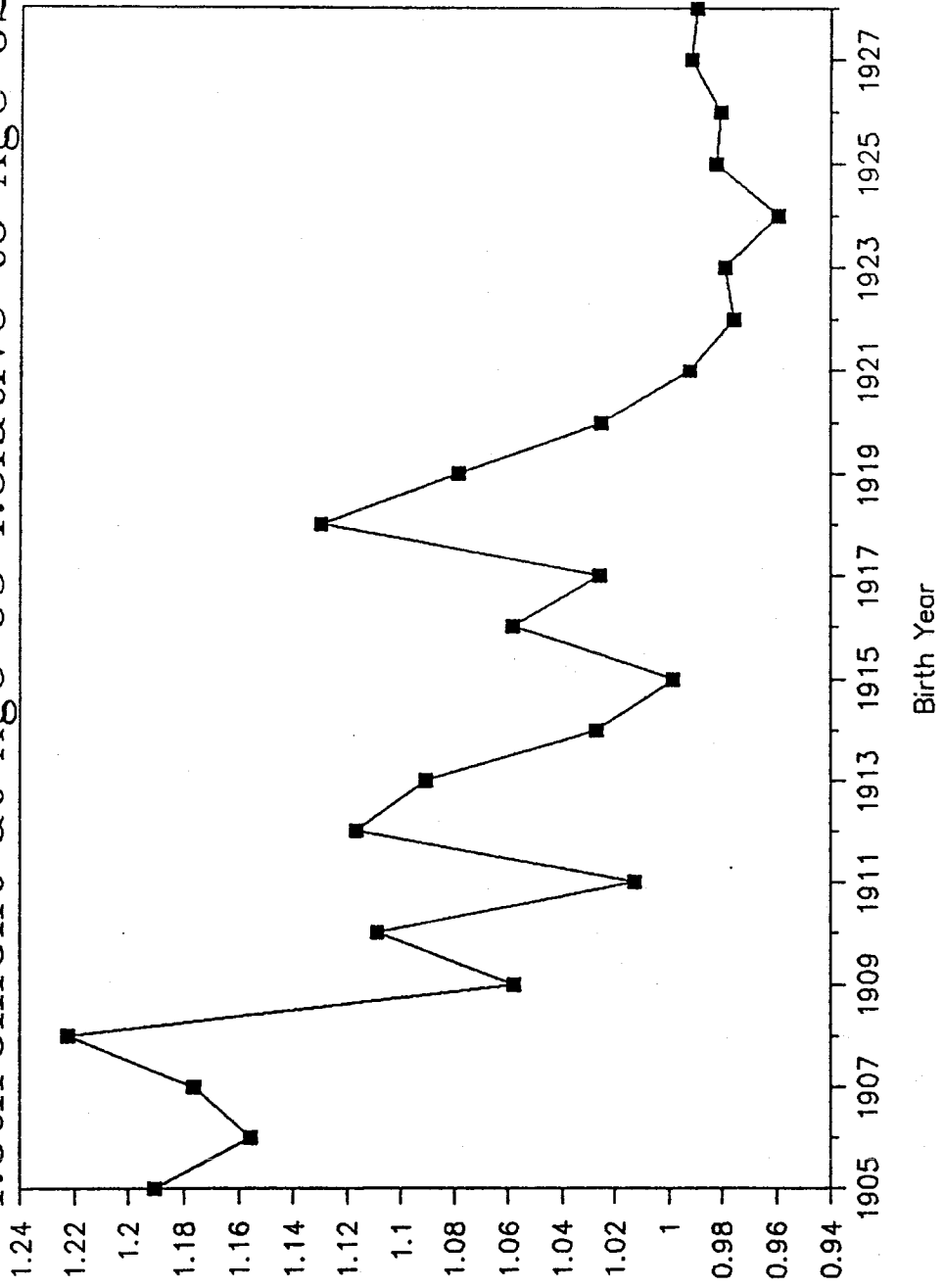
$$(1) \quad \ln (\bar{H}_{a,c}) = \alpha + \beta \ln \text{SSW}_{c,a} + \gamma \ln G_{c,a} + \sum_{a=61}^{68} \delta_a A_a$$

where \bar{H} is average weeks worked by cohort c at age a , A_a is a dummy variable that equals 1 if the workers is age a and 0 otherwise, and α , β , γ and δ are parameters.

Because of the log specification of SSW and G , the estimates of α and β are invariant to the choice of the discount rate (r) and life expectancy (T).¹⁹ This follows because any linear effect that varies with age will be absorbed by the set of age dummies.

¹⁹ It should also be noted that as a result of the log specification of benefits, α and β are independent of the proportion of male workers that have a dependent spouse, as long as that proportion is constant over time. This follows because a dependent wife may receive a benefit equal to 50% of her husband's benefit.

Figure 3
 Ratio of Social Security Wealth
 Retirement at Age 65 Relative to Age 62



In addition to equation (1), we estimate equations for each dependent variable that include year dummy variables:

$$(2) \quad \ln (\bar{H}_{a,c}) = \alpha + \beta \ln \text{SSW}_{c,a} + \gamma \ln G_{c,a} + \sum_{a=61}^{68} \delta_a A_a + \sum_{t=76}^{87} \xi_t T_t$$

where T_t is a dummy variable that equals 1 in year t and 0 in other years, and ξ_t is a period effect. The year dummies are included to partial out changes in aggregate economic conditions, such as inflation and unemployment, which have been shown to influence retirement (Parnes, 1988). With the inclusion of year effects, the variation in the benefit variables is due exclusively to differences among cohorts.

The estimation rests on the assumption that the cohorts under study are otherwise identical except for the benefit notch. This seems a plausible assumption given that there are likely to be only trivial differences in the average health, private wealth, and occupational mix among cohorts that are so close in birth year. In addition, since lifetime Social Security tax contributions are likely to be similar among the various cohorts, we treat variations in benefits as reflecting variations in net Social Security wealth.

Finally, since the labor force participation rate and the retirement rate are proportions we estimate logit equations for these dependent variables. That is, we assume:

$$p = 1 / (1 + e^{-X\beta + \epsilon})$$

where p is either the labor force participation rate or the retirement

rate, and X is a vector of explanatory variables.²⁰

IV. Results for 1968-1973

Before proceeding to the analysis of labor supply in the 1970s and 1980s, it is useful to examine the period considered in much of the previous literature. This digression replicates the findings of the earlier literature in an aggregate data set, and thus indicates the plausibility of an aggregate-level analysis for the notch period. Table 4 presents estimates of labor force participation equations for a sample covering the period 1968-1973. This period was selected to correspond to the first three waves of the Retirement History Survey, which was the data set examined in much of the previous literature. The dependent variable is expressed as the log-odds ratio of the labor force participation rate.²¹

The first two columns of Table 4 are identified by both time-series and inter-cohort variation in benefits. These equations indicate that increased Social Security wealth has a sizable, statistically significant

²⁰There are two sources of residual variation in the logit equations. First, p_i is a proportion estimated from cell means. Second, omitted variables are captured by the error term ϵ_i . This yields a regression equation of the form $\ln p_i/(1-p_i) = X_i'\beta + \mu_i$ where μ_i contains the two error components and $\sigma_{\mu_i}^2 = \sigma_{\epsilon}^2 + (n_i p_i (1-p_i))^{-1}$ (see Amemiya and Nold, 1975). We use the two-stage GLS estimator proposed by Amemiya and Nold to estimate the logit equations. The equations for weeks worked were estimated by weighted least squares using $n_i^{-1/2}$ as weights.

²¹The labor force participation rates are drawn from Ronces (1985). Since Ronces does not report sample sizes for the cell means, to estimate logit regressions we used age-group sample sizes from the March CPS, 1976-19

Table 4

The Effect of Social Security on the Log Odds Ratio
of the Labor Force Participation of Older Men 1968-1973^a

Independent Variable	Coefficient ^b			
	(1)	(2)	(3)	(4)
Log Social Security Wealth	-1.291 (.111)	-1.421 (.112)	.161 (.190)	.089 (.291)
Growth of Social Security Wealth	---	-.450 (.153)	---	-.087 (.261)
Age 61	-.215 (.046)	-.218 (.043)	-.191 (.026)	-.192 (.027)
Age 62	-.618 (.046)	-.580 (.044)	-.590 (.025)	-.583 (.032)
Age 63	-.764 (.046)	-.717 (.046)	-.862 (.028)	-.850 (.047)
Age 64	-.846 (.049)	-.792 (.049)	-1.066 (.038)	-1.048 (.065)
Age 65	-1.382 (.052)	-1.345 (.050)	-1.714 (.050)	-1.695 (.074)
Age 66	-1.596 (.053)	-1.559 (.051)	-1.947 (.052)	-1.929 (.077)
Age 67	-1.783 (.053)	-1.742 (.052)	-2.148 (.054)	-2.128 (.081)
Age 68	-1.875 (.054)	-1.833 (.053)	-2.260 (.057)	-2.240 (.085)
Year 1969	---	---	-.060 (.020)	-.052 (.033)
Year 1970	---	---	-.114 (.024)	-.102 (.046)
Year 1971	---	---	-.200 (.033)	-.187 (.050)
Year 1972	---	---	-.289 (.033)	-.266 (.077)
Year 1973	---	---	-.460 (.052)	-.444 (.071)
σ_{ϵ}	.079	.073	.042	.042

Notes:

- a. Data consist of group means for men ages 60-68. Sample size is 54.
b. Standard errors are shown in parentheses. Each equation also includes an intercept.

negative relationship with labor force participation. To account for the change in Social Security wealth that results from working additional years, the growth in SSW associated with postponing retirement is included in the equation presented in column 2. Although we expected this variable to have a positive coefficient, it is found to have a negative and statistically significant effect. In estimates not reported in the paper, however, we found that the sign of this variable is sensitive to whether the growth of Social Security wealth is measured over longer intervals.

The partial derivative of the labor force participation rate with respect to log Social Security wealth in the log-odds specification is: $\partial p / \partial \ln \text{SSW} = p(1-p)\beta$, where β is the coefficient on log SSW in the regression. At the mean participation rate, the elasticity of the labor force participation rate with respect to Social Security wealth is -0.53 for column 1 and -0.58 for column 2.

The following calculation indicates that the estimated Social Security wealth effects in the first two columns of Table 4 account for a large share of the decline in labor force participation between 1968 and 1973. In this period, real Social Security wealth increased by 29% for workers retiring at age 65, and the labor force participation rate of this group decreased from .534 to .415. The coefficient on SSW in column 1, for example, implies that the labor force participation rate would have decreased to .441, which would account for most of the observed decline in labor force participation for this age group.

The last two columns of Table 4, however, suggest that these high elasticities may merely reflect the coincidence of declining labor force participation in a period of increasing Social Security wealth. Columns 3

and 4 add a set of calendar-year dummies to the equations. The estimates show that removing time effects causes the Social Security wealth variable to change sign and become statistically insignificant.²²

Including age and time effects removes all of the variation in the Social Security wealth variable that is linear in birth cohorts. Since variation in Social Security wealth during this period is primarily due to an upward trend across cohorts that had roughly a constant slope for all age groups within cohorts, the identification of the effect of Social Security wealth in the within-age-and-year estimates is rather tenuous for this sample. This is less of a problem in the period containing the notch cohort, as social security wealth first increased and then decreased across birth years, and the age path of benefits varied across cohorts (see Figure 1). In fact, the residual variance in benefits (after removing age and year effects) is nearly twice as great in the period containing the notch.

Finally, we note that the age dummies in either specification estimated show a precipitous reduction in the labor force participation rate for workers upon attaining age 62 and 65. Boskin (1977) and Kahn (1988) have observed that this fact is consistent with the view that workers are liquidity constrained, and therefore retire upon becoming eligible for Social Security benefits.

V. Results for the Period Surrounding the Benefit Notch

Table 5 summarizes the differences in the three labor supply measures between the cohorts covered by the 1977 amendments and those exempted from the amendments. Although the 1977 amendments created a large,

²²A similar result is obtained by just adding a linear time trend.

Table 5
 The Effect of the 1977 Amendments to the
 Social Security Act on Male Labor Supply^a

Independent Variable	Dependent Variable ^b								
	Log-Odds Ratio IFP Rate			Log-Odds Ratio Proportion Retired			Log Weeks Worked		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Covered by 1977 Amendments (1=yes)	-.212 (.023)	-.022 (.033)	-.008 (.034)	.287 (.026)	.046 (.034)	.007 (.032)	-.111 (.013)	-.036 (.019)	-.044 (.019)
Mandatory Retirement ^c Dummy	—	—	-.070 (.050)	—	—	.196 (.041)	—	—	.035 (.022)
12 Year Dummy Variables	no	yes	yes	no	yes	yes	no	yes	yes
8 Age Dummy Variables	yes	yes	yes	yes	yes	yes	yes	yes	yes
R ²	.977	.986	.986	.978	.987	.989	.999	.999	.999

Notes:

- Data consist of group means by age (60 - 68) and year derived from the Current Population Survey, Labor force participation and retirement data cover the period 1976-1988, and annual weeks cover the period 1975-1986. Sample size is 117. Equations also include an intercept.
- Standard errors are shown in parentheses.
- This variable equals 1 for age groups that were subject to mandatory retirement in years in which mandatory retirement was legal, and 0 otherwise.

unanticipated reduction in prospective Social Security wealth for the covered cohorts, the results indicate that on average these cohorts tend to have lower labor supply than exempt cohorts, regardless of the labor supply measure used. Including time dummy variables tends to greatly reduce the effect of being covered by the 1977 amendments.

We include a dummy variable that equals one for age groups that were subject to mandatory retirement in years in which mandatory retirement was legal. Consistent with the predictions of Burkhauser and Quinn (1983), we find that mandatory retirement reduces labor force participation and increase the retirement rate for covered groups. As will be shown below, mandatory retirement typically has the opposite sign when the year dummies are omitted from the equation. Since the mandatory retirement variable takes on the value one in the earlier years of our sample, the sign reversal is due to the downward trend in labor supply.

Columns 1 and 2 of Table 6 present estimates of the effects of the Social Security system on the log-odds ratio of the labor force participation rate for all cohorts in 1976-1988. The effect of Social Security wealth is negative but statistically insignificant. Perhaps more important, the magnitude of the coefficient is less than one-sixth as large as was found for the 1968-1973 period. In addition, the results indicate that the return for postponing retirement an additional year has a positive effect on the labor force participation rate.²³

Figure 4 displays the average Social Security wealth and labor force participation rate for each cohort after removing age effects from both

²³Sickles and Taubman (1986) obtained a similar result for the growth of Social Security wealth for the 1970s.

Table 6
 The Effect of Social Security on the Log-Odds Ratio of
 the Labor Force Participation Rate of Older Men in the Notch Period^a

Independent Variable	Sample					
	1976-1988		Notch Pd. ^b		1976-1988	
	(1)	(2)	(3)	(4)	(5)	(6)
Log Social Security Wealth	-.199 (.231)	-.191 (.223)	.178 (.268)	.105 (.265)	.004 (.166)	.036 (.173)
Growth of Social Security Wealth	--	1.562 (.503)	--	1.318 (.711)	--	.546 (.787)
Mandatory Retirement Dummy	.124 (.055)	.170 (.055)	--	--	-.072 (.047)	-.084 (.050)
8 Age Dummy Variables	Yes	Yes	Yes	Yes	Yes	Yes
12 Year Dummy Variables	No	No	No	No	Yes	Yes
σ_e	.148	.143	.120	.117	.093	.094
F-statistic ^c [p-value]			2.889 [.003]	2.390 [.014]		
Sample Size	117	117	51	51	117	117

Notes:

a. Equations also include an intercept. Standard errors are shown in parentheses. The mean labor force participation rate for columns 1, 2, 5 and 6 is .453, and .457 for columns 3 and 4.

b. The notch period consists of observations from cohorts born between 1916 and 1921.

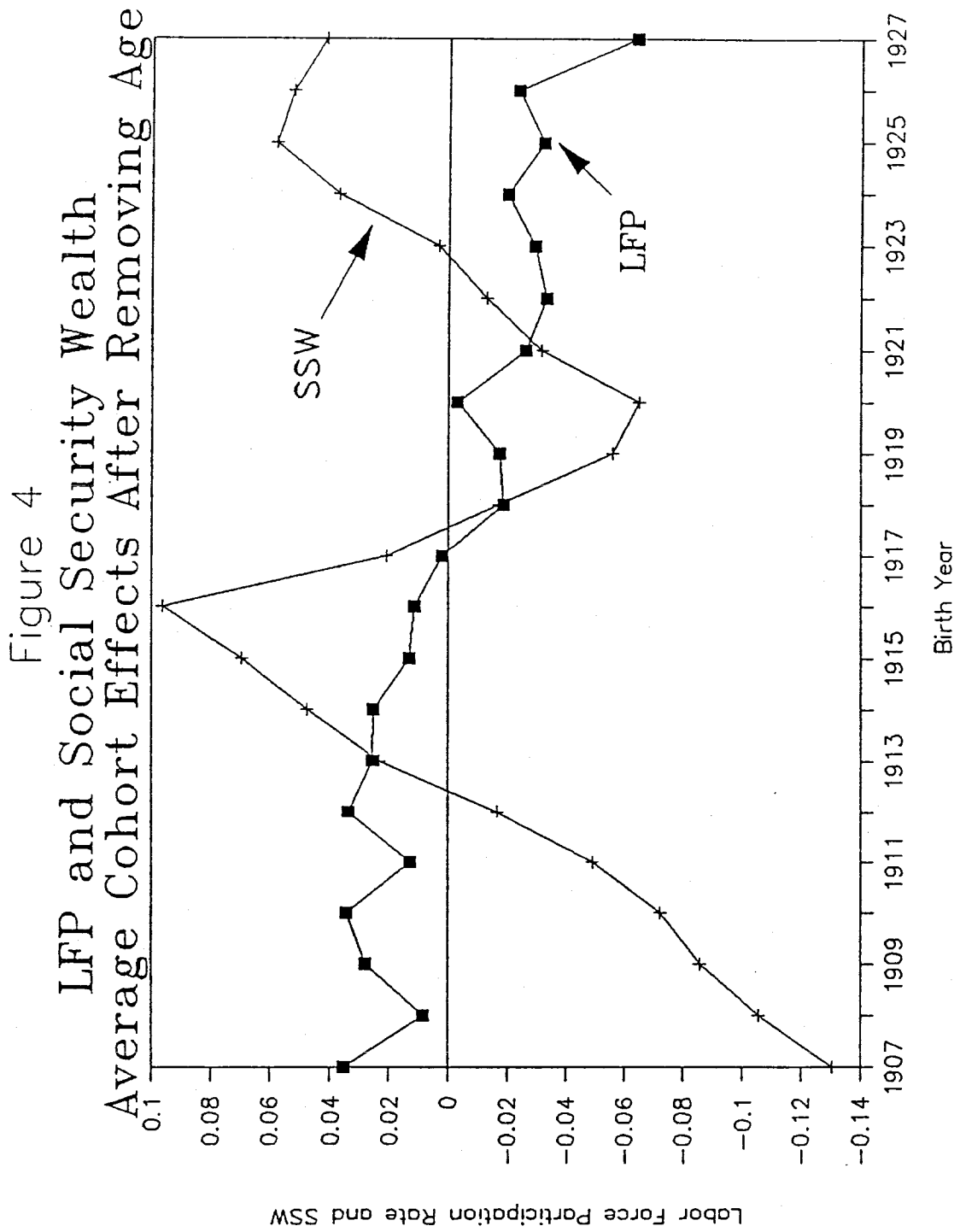
c. F-statistic for Chow test of parameter constancy between the sample composed of the notch cohorts and the sample composed of the other cohorts.

variables.²⁴ This graph shows that the labor force participation rate has generally declined for successive cohorts in this sample, while the Social Security wealth variable initially increased (largely due to double indexation), and then declined due to the 1977 amendments. The decline in labor force participation continued unabated for the cohorts that experienced declining Social Security wealth.

Columns 3 and 4 of Table 6 estimate the same models as those presented in the first two columns, but the sample is narrowed to the cohorts in which Social Security benefits were falling for succeeding generations (1916-1921). As would be expected from the relationship depicted in Figure 4, Social Security wealth is found to have a positive but statistically insignificant effect on the labor force participation rate for this sample. This finding suggests that the negative relationship between Social Security wealth and labor supply found in time periods when benefits are rising for succeeding generations is spurious. The effect of the growth in wealth associated with postponing retirement, on the other hand, is robust to this change in the sample.

Finally, the estimates presented in columns 5 and 6 are based on observations from the entire sample and include a set of calendar year dummy variables to partial out time effects. These results also indicate an insignificant relationship between Social Security wealth and the labor force participation rate, supporting a conclusion that the observed negative time-series relationship between labor supply and Social Security wealth is due to a factor other than increasing Social Security wealth. In

²⁴Both Social Security wealth and the labor force participation rate are expressed as logs in these plots.



addition, the growth variable is greatly attenuated once year effects are included.

We have also performed a similar analysis using three alternative measures of labor supply as the dependent variable: the retirement rate, weeks worked, and the hazard rate into retirement. These estimates support a similar conclusion. Notably, the Social Security wealth variable has a statistically significant and negative effect on the self-reported retirement rate when the sample is narrowed to the 1916-1921 cohort. We also find that the coefficient on the Social Security wealth variable changes sign in the weeks worked equations when the sample is limited to the notch cohorts, but is statistically insignificant. In the retirement hazard rate equations we find that the effect of Social Security wealth is positive, but small and statistically insignificant.²⁵

VI. Conclusion

The Social Security benefit notch has been described as "a matter of a difference in benefits between two individuals who by accident of birth fall on different sides of an arbitrary date set in the 1977 amendments."²⁶ This "accidental" differential provides an unusual natural experiment to test the effect of Social Security on retirement. Our empirical analysis has turned up little evidence linking fluctuations in Social Security wealth during the notch period to the labor supply of older men. However,

²⁵The retirement hazard rate is defined as $(q_a - q_{a-1}) / (1 - q_{a-1})$, where q_a is the fraction of the population of a cohort retired at age a . These estimates are available upon request.

²⁶This statement was made by Congressman J.J. Pickle at the House Committee on Ways and Means, Subcommittee on Social Security Hearings on Employer Payment of Social Security Taxes, Sept. 27, 1979.

the changes in Social Security wealth for postponing retirement seem to affect labor supply in the expected way. Our calculations suggest that wage indexation introduced by the 1977 amendments has reduced the reward for remaining in the workforce, hastening the trend toward early retirement.

The largest estimate of the Social Security wealth-labor supply effect that we find would imply that the growth in Social Security benefits in the 1970s could explain less than one-sixth of the decline in the male labor force participation rate over that time period. On the other hand, we find that labor supply continued to fall for successive cohorts in the notch generation even though they experienced declining Social Security wealth. These findings suggests that previous time-series estimates of a large Social Security wealth effect are an over estimate, resulting from an incidental, negative correlation between Social Security wealth in the 1970s and steadily declining labor force participation rates.

There are several explanations for why the reduction in Social Security wealth initiated by the benefit notch has not reversed the downward trend in labor force participation. First, it is possible that the benefit changes mandated by Congress in 1977 were anticipated by the notch cohort. Although Bernheim (1988) shows that it is difficult to infer whether a benefit change is anticipated, the public outrage over the benefit notch and the abruptness with which it took effect suggest that the 1977 amendments were not fully anticipated. Second, pension offsets smooth fluctuations in Social Security benefits for some retirees. Kotlikoff and Smith (1981) report, for example, that 49% of private sector employees were covered by pension plans in 1979, and 15.6% of these plans had offset

provisions for Social Security benefits. Thus, less than 8% of workers in this time period would have had a reduction in Social Security wealth dampened by a pension offset. Third, the benefit differential for the notch cohort may not have had a measurable impact on their labor supply because Social Security wealth is a modest component of lifetime wealth. Finally, wealth elasticities may not be very large for the cohort of workers under study.

From a policy perspective, our findings indicate that it will be difficult to diminish the trend toward earlier retirement by legislating reductions in Social Security benefits. Even if one believes that the increase in Social Security wealth in the 1970s contributed to the decline in labor supply, there is no evidence that reducing Social Security benefits slows down the trend to earlier retirement.

The conclusion to this paper raises a major question: If the Social Security system is not responsible for the decline in labor supply of older workers, then what is? There are several alternative explanations that have been explored in the literature. Among these are: the growth and structure of private pensions; increasing private wealth; changing preferences regarding work and retirement; and a possible reduction in the average health among the elderly. Clearly, empirical work aimed at distinguishing among these and other hypotheses should be a priority for future research.

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