Federal Reserve Bank of Chicago

Public Pensions and Labor Supply Over the Life Cycle

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August 31, 2010

WP 2010-09

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I. Introduction

Virtually all developed countries face projected budget shortfalls for their public pension programs. The shortfalls arise for two reasons. First, populations in developed countries are aging rapidly. Second, until recently older individuals in developed countries have been retiring earlier. These two developments have created serious strains on public pension programs. In order to remain fiscally solvent, many governments have reformed their public pension schemes to encourage labor supply at older ages. These reforms include reductions in the generosity of public pensions and reduced penalties for working past the normal retirement age.

Figure 1 shows labor force participation rates by gender, for individuals aged 50-54 and individuals aged 60-64, for the OECD over the period 1970-2008. Figure 1 reveals that while participation by men aged 50-54 has fallen less than five percentage points over the past four decades, participation by men aged 60-64 fell over 20 percentage points, before rising 6 percentage points in the past 8 years. The sustained decline in participation occurred during a period when public pensions encouraged early retirement, and the recent rise coincides with the recent public pension reforms. Similarly, participation by older women increased significantly since 2000.

The participation rates in Figure 1 suggest that recent public pension reforms are leading older individuals to increase their labor supply. In this paper, we consider how reforms to public pension systems affect labor supply over the life cycle. We put the recent empirical evidence on the effect of government pensions on labor supply in a life cycle context, and we present evidence on the effectiveness of tax reforms for stimulating labor supply over the life cycle.

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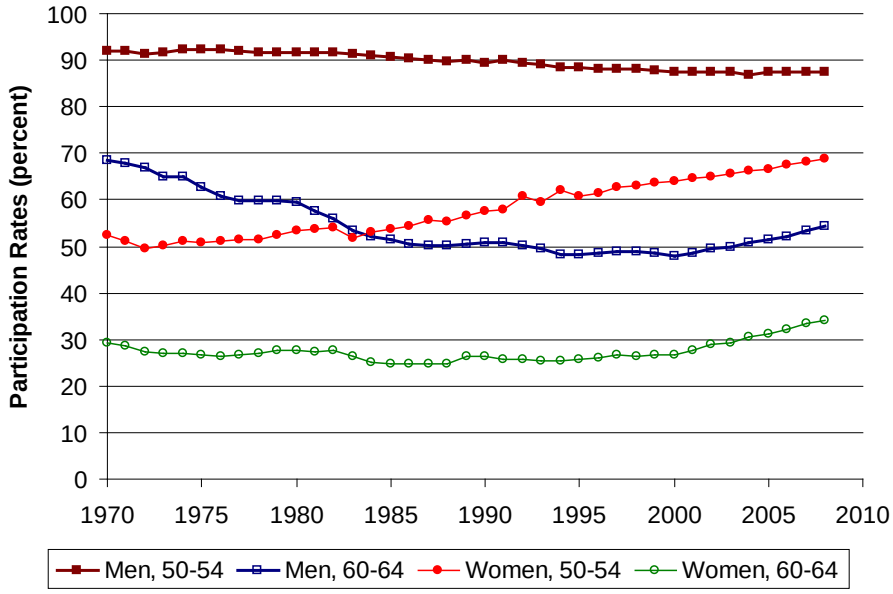
Figure 1. Labor force participation rates by gender, 1970-2008, OECD



Source: OECD.

Our main conclusion is that the labor supply of older workers is responsive to changes in retirement incentives. The labor supply of younger workers is less responsive. Thus the trend towards lower taxes on older workers in many developed countries is likely to continue to fuel the recent trend towards later retirement. This, in turn, is likely to reduce the financial strain on public pension schemes.

The rest of the paper is organized as follows. In Section II, we briefly review why public pension programs generate incentives for early retirement, and discuss some of the specific incentives found in US and European programs. In Section III, we describe life cycle labor supply patterns and discuss some of their implications. In Section IV, we review the evidence on the sensitivity of labor supply to public pension programs. In Section V, we conclude and offer some policy recommendations.

II. Why do public pension programs affect retirement?

A. Overview

Public pension programs often create incentives that affect retirement decisions, for three main reasons:[2]

1. *Substitution effects*: Public pension programs are funded by taxes on labor. Furthermore, pension schemes often generate high implicit tax rates on labor income after a certain age. Both types of taxes encourage households to work less, especially when old.

2. *Wealth effects*: All public pension schemes have an insurance aspect, which implies redistribution between individuals. Moreover, most public pension plans are pay-as-you-go systems, where taxes collected from the working young are used to finance current retiree benefits. Even if a system lacks an insurance aspect, the actuarial value of a retiree's benefits rarely equals the actuarial value of the taxes he paid while working. Public pensions can thus increase (decrease) a household's lifetime wealth, allowing it to finance its retirement with fewer (more) years of work.

3. *Liquidity effects*: Public pension benefits tend to be illiquid, in that households cannot borrow against future benefits. As a result, many households cannot finance their retirement until pension benefits become available. If public pensions crowd out private savings that would have been more liquid, they may delay retirement.[3]

Understanding the quantitative importance of these incentives is difficult because the programs are complex. Moreover, other public and private programs generate retirement incentives. Before considering the empirical evidence, it is worth discussing what public pension programs look like in practice.

[2] Other mechanisms have been suggested. One such mechanism is the ability of public pension rules to generate behavioral "norms". For example, workers may choose to retire at the normal retirement age simply because it is a natural focal point. Mastrobuoni (2008) argues that ignoring these norm effects will lead researchers to understate the effects of changing public pension rules.

[3] If households are short-sighted, the tendency of public pensions to leave them liquidity-constrained will be amplified.

B. A detailed example: public pension programs in the US

The American public pension program is a pay-as-you-go pension scheme called Social Security. On average, Social Security replaces about 40% of pre-retirement earnings; the replacement rate is higher for those with *low* lifetime income. Private pensions also replace a large share of pre-retirement earnings; replacement rates tend to be higher for those with relatively *high* lifetime income. Scholz et al. (2006) and Gustman and Steinmeier (1999) both find that mean private pension wealth and mean Social Security wealth (the expected discounted value of the pension benefits) are just over $100,000 each, although median private pension wealth is much smaller than median Social Security wealth.

Social Security distorts labor supply in four ways.

First, Social Security benefits depend on total contributions to the system during the worker's 35 highest earnings years. Once a worker has paid into the Social Security system for 35 years, additional years of work increase his benefits only if earnings in these years exceed earnings from earlier years. Thus an important work incentive may disappear after 35 years in the labor force.

Second, Social Security is financed by a payroll tax of 5.3 % on both workers and firms (so the total tax is 10.6%). In addition, workers and firms each pay a 0.9% tax for disability insurance and 1.45% for Medicare, resulting in a 7.65% tax on both workers and firms. These taxes reduce the after-tax wage and thus the incentive to work. Although tax payments into the Social Security system usually lead to higher benefits, the links are indirect and variable. For example, tax payments made by younger workers translate into higher benefits only after they retire, a substantial delay; tax payments made by older workers translate into higher benefits much more quickly. In short, the net tax rate imposed by Social Security is higher for younger workers (see e.g., Feldstein and Samwick, 1992).

Third, until recently the basic benefit formula encouraged workers to claim benefits by age 65. The age at which the individual applies for Social Security affects the size of the annual benefit. Most individuals can begin drawing benefits at age 62. Between 62 and the Normal Retirement Age (which was 65 until 2000, and is currently 66) benefits are reduced 6.7% for every year before the Normal Retirement Age that benefits are drawn. This is roughly actuarially fair for single men; the reduction in the annual benefit is offset by the additional years of benefits.

However, until recently the annual benefit increase from waiting past the Normal Retirement Age was small. For those retiring in the 1980s, delaying benefits past 65 would increase the annual benefit by only 3% for each year of delay. This is less than actuarially fair, and provides strong incentives to draw benefits by age 65.

Fourth, until 2000, individuals drawing benefits faced the Social Security Earnings Test, which discouraged work. The Earnings Test is basically a tax on earnings above a certain threshold, or "test" level. Between the early and normal retirement ages, benefits were reduced by $1 for every $2 in income above the threshold level ($9,600 in 1999), and between the Normal Retirement Age and 70 benefits were reduced $1 for every $3 in income above the threshold level ($15,500 in 1999). Although benefits lost through the Earnings Test increased future benefits, these adjustments were relatively modest after age 65.

Thus, until recently, the Social Security System provided strong incentives to begin drawing benefits by age 65. When coupled with the Earnings Test, it yielded strong incentives to leave the labor market by age 65. Recent rule changes, however, have eliminated most of these incentives. Under current rules, annual benefits now increase by 8% for each year benefits are delayed past the Normal Retirement Age, up until age 70. Moreover, in 2000 the Earnings Test was repealed for those above the Normal Retirement Age.

It is important to note that the basic benefit formula does not apply to all workers; there is a great amount of idiosyncratic variation in how benefits accrue by age, and thus potentially a great deal of variation in retirement incentives. For example, Coile and Gruber (2004) point out that for married men, Social Security accrual is large and positive between ages 62 and 65, because Social Security provides a widow's benefit. Although men tend to die early (providing an incentive to get benefits as early as possible), their wives typically live much longer, providing an incentive to draw benefits late. In addition, the standard benefit rules do not necessarily apply to individuals with low labor earnings. These individuals can receive a minimum benefit called Supplemental Security Income (SSI), which is available at age 65. However, because delaying receipt of SSI does not increase the future level of SSI, low-income workers also face an incentive to apply for benefits by age 65.

Many workers exit the labor market at the Early Retirement age (62), even though actuarial calculations suggest that there are no incentives to draw benefits before age 65. The main

explanation for the high job exit rates between 62 and 65 is liquidity (Kahn, 1988; Rust and Phelan, 1997; Gustman and Steinmeier, 2005). Many people younger than age 62 have few liquid assets. If these people wish to retire in advance of receiving Social Security benefits, they would have to borrow against their future benefits. Because it is illegal to borrow against future Social Security benefits, these individuals must work until age 62 before they can finance their retirement.

Measuring the importance of Social Security on retirement is difficult because Social Security is not the only source of retirement incentives at ages 62 and 65. The US government provides Medicare, which is nearly universal health insurance coverage, beginning at age 65. Medicare provides an important retirement incentive because many individuals younger than 65 obtain group health insurance only while they continue to work. However, once individuals become eligible for Medicare at age 65, the health insurance incentive for work largely vanishes. Rust and Phelan (1997) and French and Jones (2010) document the importance of Medicare on retirement patterns. French and Jones (2010) find that Medicare was about as important as Social Security in determining retirement for the cohort that turned 65 in the late 1990s.

Another potentially important retirement incentive is the Disability Insurance program. If an individual is determined to be disabled, her benefits replace about 50% of her income when she was working. Qualifying for Disability Insurance is difficult. Except in extreme cases (such as blindness or multiple sclerosis), the application process takes multiple years (French and Song, 2010). Nonetheless, the fraction of US workers receiving Disability Insurance has grown rapidly in recent years (Autor and Duggan, 2006).

Furthermore, many firms provide defined benefit pensions, some of which also provide incentives to leave the labor market at ages 62 and 65. Defined benefit pension plans work in a way similar to Social Security. Benefits are typically a function of earnings on the job, years of service at the job, and age. They usually have an early retirement age (typically 55, 60, or 62), before which benefits cannot be drawn. They also have a normal retirement age (often 65), after which benefit accrual becomes negative, and induces retirement. Until recently, about 50% of all jobs in America had these types of pensions; for younger workers, defined benefit pension plans have been largely replaced with defined contribution plans, the most common type being called a 401(k). Defined contribution pension plans are largely just subsidized savings plans. These plans

do not provide strong incentives to exit the labor market. Just as public pensions are discarding early retirement incentives, private pensions are discarding early retirement incentives as well.

C. Public pension programs in Europe

In this section, we briefly discuss European public pension plans. Summaries of individual countries can be found in Gruber and Wise (2007), a source we draw upon heavily here. In many ways, European plans are similar to the US Social Security program. The plans typically have a normal retirement age, and delaying benefit receipt past this age tends to be actuarially unfair. Some plans have an earnings test, above which benefits are taxed at a high rate.[4] Moreover, in many countries, individuals draw private as well as government pensions. There are several dimensions, however, along which European plans have traditionally differed from those in the US. These features tend to induce earlier retirement than in the US.

First, many European systems raise annual benefits little, if at all, when someone chooses to delay claiming benefits past the normal retirement age. For example, there are no actuarial adjustments for Spain after the normal retirement age of 65; workers that delay retirement one year past the normal retirement age simply lose one year of benefits. Duval (2003) calculates the decrease in lifetime benefits and additional payroll taxes that workers incur when they delay claiming their public pensions. Expressing these losses as income tax rates, he finds that implicit tax rates "are high in most Continental European countries, compared with Japan, Korea, English-speaking and Nordic countries".

Second, European public pension schemes tend to be more generous than their American counterparts. European pensions typically provide higher replacement rates (Duval, 2003, Figure 2). For example, in Spain public pensions replace on average 80% of pre-retirement income, whereas it is closer to 40% for the US.

Third, public pension benefits in Europe tend to be tied less tightly to earnings histories than in the US. The UK, Spain, and the Netherlands all have a minimum benefit level that is higher than in the US.

[4] Not all countries have an earnings test. In these countries, the decision to retire is largely divorced from the decision to draw benefits, and public pensions affect labor supply only through the wealth and liquidity channels.

Fourth, European social insurance programs, such as disability or unemployment insurance, tend to provide more generous pathways to early retirement. Duval (2003, footnote 24) finds that unemployment benefits can finance early retirement in Belgium, Finland, France, Germany, the Netherlands, Portugal, Spain, and the United Kingdom. In contrast, US unemployment benefits replace a relatively small fraction of pre-unemployment income, and expire after one-half year. Furthermore, the eligibility criteria for European disability insurance programs are often less stringent than in the US. For example, in the Netherlands in 1996, 34% of all men and 14% of all women aged 60-64 were drawing disability benefits (de Vos and Kapteyn, 2004), whereas the corresponding rate for the US was 12% for men and 9% for women.

Partly in response to the low levels of labor supply amongst those over age 55, in recent years many European governments have changed the rules of their social insurance programs. For example, in Britain the earnings test on benefits was repealed in 1989 (Disney and Smith, 2002). In the Netherlands, screening standards have been tightened for disability benefits, reducing inflows into the system. There have also been changes to employer-based pensions, so as to make them more generous for later retirement. Furthermore, the Netherlands tax code now directly depends on age; those at older ages receive a tax credit that encourages work (Euwals et al., 2009). These reforms appear to have significantly increased the labor supply of older individuals.

III. Labor supply over the life cycle

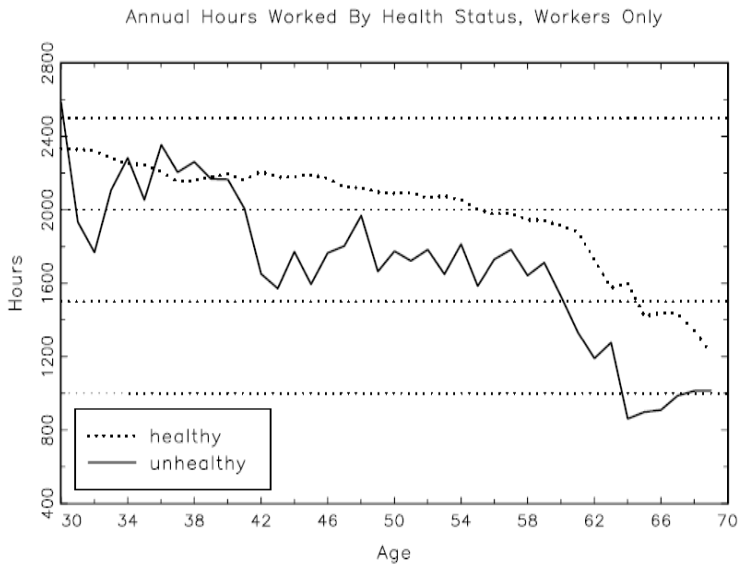
Any quantitative measure of the effect of public pensions on labor supply is the product of two elements: a measure of the incentives generated by the pensions; and a measure of how sensitive workers are to these incentives at different points in their lives. We have already discussed the incentives produced by public pensions, albeit in qualitative terms. We turn now to labor supply elasticities. The key finding is that the labor supply elasticity of older workers is much higher than that of younger workers. This difference in elasticities is in turn driven by the fixed cost of working.

A. Life-cycle profiles

We begin by considering the life-cycle pattern of hours in the US, using data from the Panel Study of Income Dynamics (PSID). The PSID is a panel data set, covering 1968 to the present,

which allows us to track individuals over extended periods. We employ a fixed effects procedure, discussed in greater detail in French (2005) that allows us to consider how wages and hours change for the same people over the course of their lives. In order to abstract away from the effect of fertility on wages and labor supply, we focus only on men.

Figure 2. Life cycle profiles for annual hours worked by men in the US, by health status

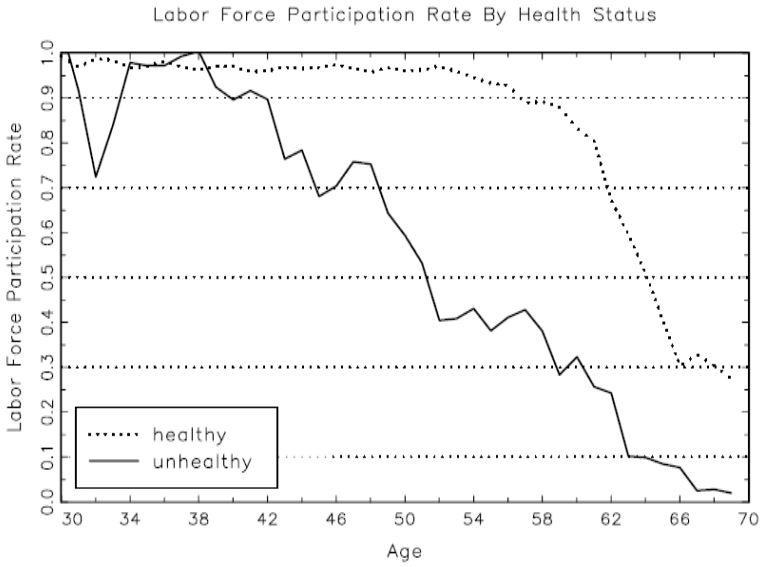


Source: Reproduced from French (2005).

Figure 2 shows the life-cycle profiles of hours worked, conditional on working, for men in good and bad health. Hours begin to decline rapidly after age 59. This is true even when conditioning on health status, so it appears that health status cannot be the main reason why hours decline as workers approach retirement.

Figure 3 shows life-cycle profiles for labor force participation, with participation measured as employment. Health appears to affect labor force participation rates more than hours worked. Nonetheless, the effect of health on aggregate participation rates is modest. The fraction of individuals who report bad health rises from 20% at age 55 to 37% by age 70. French (2005) shows that this decline in health would, with the participation profiles shown in Figure 3, lead to a 7% drop in labor force participation. Thus, of the drop in participation rates from 87% to 13% between ages 55 and 70, only a small fraction can be attributed to the (admittedly crude) health measure.

Figure 3. Life cycle profiles for labor force participation of men in the US, by health status



Source: Reproduced from French (2005).

The ages at which hours and labor force participation rates decline most rapidly coincide with the ages at which wages decline and at which there are large pension and Social Security work disincentives. Wages for both health groups peak near age 55, and then decline rapidly. Moreover, labor force participation drops 9 percentage points (or 13 percent) at 62, the Early Retirement Age for Social Security, and 7 percentage points (or 18 percent) at 65, the Normal Retirement Age in effect for the sample period. The data thus suggest that wages, pensions, and Social Security play a strong role in determining the age of retirement.

B. Fixed costs and life-cycle labor supply elasticities

Much of the literature on the labor supply response to tax reforms has considered only the decision of whether or not to work, sometimes called the "extensive margin". Other papers assume that everyone works until a fixed and exogenous retirement age, and focus on the number of hours worked by workers, sometimes called the "intensive margin". Figures 2 and 3 show that even though both margins are important, most changes in life cycle labor supply occur along the extensive margin. While participation rates drop dramatically between 62 and 65, hours worked drop much more modestly. Table 1 shows the distribution of hours worked by older men and women in the US. The table reveals that even at ages 60-64, most working men are working full

time. This finding is corroborated by other studies. For example, Cogan (1981) finds that, on average, women will not work below 1,300 hours per year.

Table 1: Distribution of Hours Worked in the US, by Age and Gender (HRS Data)
Share of individuals working listed number of hours

	Men		Women	
	Ages 50-54	Ages 60-64	Ages 50-54	Ages 60-64
0 hours	16.8%	44.7%	30.8%	59.0%
1-500 hours	0.4%	0.9%	0.9%	1.1%
501-1000 hours	0.9%	2.2%	2.3%	2.4%
1001-1500 hours	1.7%	2.4%	4.2%	3.7%
1501-2000 hours	43.1%	30.0%	40.0%	24.0%
2001-2500 hours	21.1%	12.4%	16.2%	7.8%
2501-5000 hours	15.9%	7.8%	5.5%	2.0%

Why does there appear to be so little labor supply variability along the hours of work margin? Perhaps the most important reason is that there are fixed costs to working. It takes time to get dressed and commute to work. For example, estimates of mean commuting time in several countries range from about 7% to 10% of market work time (Juster and Stafford, 1991). Furthermore, work involves extra monetary costs, such as food at restaurants and work clothes. Spending falls on average by about 20% at retirement in Britain (Banks, Blundell, and Tanner, 1998), and similar declines in spending have been documented in other countries is well. There is reason to believe that these spending declines do not lead to any decline in the retirees' standard of living. Aguiar and Hurst (2005) show that even though spending on food declines after retirement, the nutritional quality of the food actually rises, as individuals replace the fast food they ate when working with more nutritious home-cooked meals. The ability of households to reduce spending after retirement without any drop in material well-being is additional evidence that working imposes fixed costs on workers.

Furthermore, there might be fixed costs of work on the part of employers. Employers might incur fixed costs to recruit, hire and train employees, and they might have to pay fixed administrative costs to keep records on each worker. Desk and office space is costly as well. Because these fixed costs must be spread over fewer hours of work for part-time employees, firms are likely to pay lower wages to part-time workers. In fact, Aaronson and French (2004) find that a part-time worker makes about 25% less per hour than a full time worker. Rogerson

and Wallenius (2009) stress the importance of this issue in their analysis of participation and life cycle labor supply.

Figure 4. The Labor Supply Decision with Fixed Costs to Working

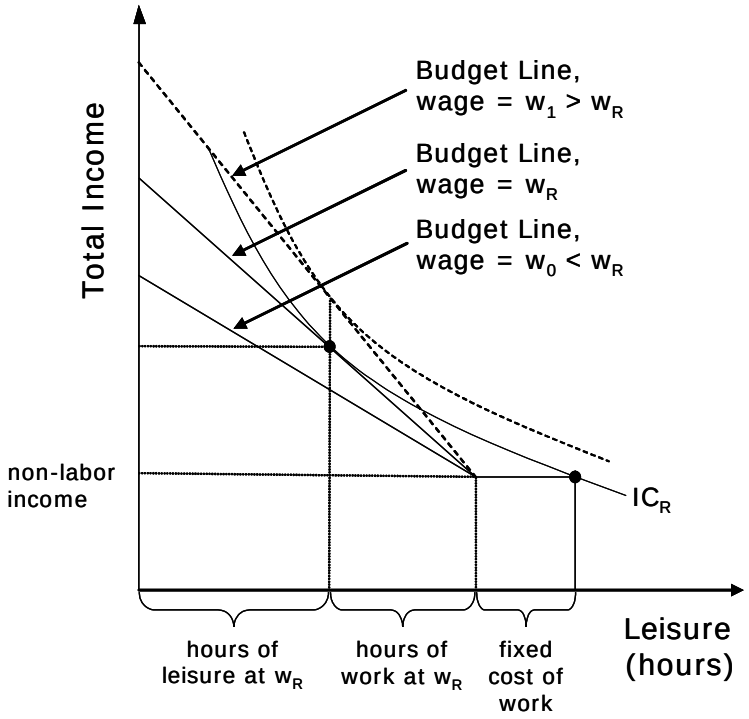


Figure 4 shows the labor-leisure tradeoff that arises (in a static model) when there are fixed costs to working. The vertical axis shows the individual's total income, while the horizontal axis shows hours of time, which are divided between leisure and work. The indifference curve IC_R shows that at the reservation wage w_R the individual is indifferent between working 0 hours and the amount "hours of work at w_R". If the wage falls below w_R, the individual will not work. If the wage rises, the individual will work for sure and, moreover, work a large number of hours. For those who are almost indifferent between working and not, small changes in the wage can induce large changes in hours. However, once wages are high enough to justify work, further wage increases will cause much smaller increases in hours. In Figure 1, raising the wage from w_R to w_1 yields higher utility, but leaves hours of work unchanged.

The importance of participation decisions in determining labor supply and the apparent importance of fixed costs in affecting participation leads us to believe that labor supply

elasticities are not constant over the life cycle. Instead, they are likely higher at ages when individuals are nearest the participation margin. Given that the decision to retire by definition implies that the participation margin has been crossed, it is almost surely the case that older workers are nearer the participation margin than younger workers, whose participation varies much less. It is thus plausible that labor supply elasticities are higher at older ages.

C. Estimated life cycle labor supply elasticities

In order to better understand how labor supply elasticities vary over the life cycle, we estimate elasticities with the model in French (2005). French develops and estimates a realistic life cycle model of labor supply, retirement and savings behavior in which future health status and wages are uncertain. In the model, individuals face a fixed cost of work and cannot borrow against future labor, pension, or Social Security income. The model's parameters are chosen so that the model's predictions for hours worked by workers, labor force participation, and asset profiles match the data. The model matches the data extremely well. French shows that in this realistic environment, groups closer to the participation margin have higher labor supply elasticities, because of the fixed cost of work. Because those near retirement are nearer to the participation margin, the model can reconcile the low labor supply elasticities typically estimated for young workers with the large observed responses to changes in private and public pension rules.

Table 2 shows the labor supply elasticities. To calculate the elasticities, we first use the model to simulate average hours of work across all individuals. We then repeat the simulation with wages increased by 20% at certain ages, but being held at their baseline values at all other ages, and calculate how total hours of work changes at each age.

Table 2 shows that labor supply elasticities increase significantly over the life cycle. For temporary (one-year) wage changes, the elasticity rises from 0.36 at age 40 to 1.28 at age 60. When workers are young, the benefits of working are typically far above the fixed cost of working. Young workers have few assets, and work to build up a buffer stock of wealth (Benitez-Silva, 2000; Low, 2005). As a result, changes in wages do not change the participation decision, and have little effect on labor supply. As workers near retirement, the benefits of work begin to shrink. Their wages begin to fall, their health worsens, and their wealth increases. Thus,

older workers are closer to the participation margin.[5] Because those near the participation margin have more elastic labor supply, as workers near retirement, their labor supply elasticities rise.

Table 2: Labor supply responses to a 20 percent increase in wages

	Temporary wage change		Permanent wage change	
Age	At age 40	At age 60	At age 40	At age 60
	Labor supply elasticities			
Hours in year of wage change	0.36	1.28	0.17	1.17
Hours over entire life	-0.01	0.01	0.11	0.14
Hours in years prior to change	-0.01	-0.01	-0.21	-0.04
Hours in years after the change	-0.03	-0.11	0.26	2.24
	Change in hours of work			
Hours in year of wage change	155	377	74	346
Hours over entire life	-183	167	1,432	1,906
Hours in years prior to change	-39	-111	-923	-519
Hours in years after the change	-300	-99	2,281	2,079

Table 1 and Figure 3 show why a labor supply elasticity that rises with age is consistent with the data. Table 1 shows that very few workers work less than 1500 hours a year; in the model, such behavior implies a significant fixed cost to work. Figure 3 shows that the labor market participation of healthy people is more or less constant until age 60, at which point it drops dramatically over just a few years. For the model to replicate these facts, reservation wages must rise and/or after-tax wages fall after age 60; with a fixed cost to work, these shifts move workers to the participation margin, where labor supply elasticities are higher.

Table 2 also shows that when wage changes are temporary, individuals are more willing to shift hours across the life cycle than to change total lifetime hours. For example, the elasticity of hours with respect to a transitory wage change is 0.36 at age 40. Because the wage is higher at age 40, agents work more hours at that age. However, hours after age 40 fall significantly, so much so that total lifetime hours of work actually fall. Agents feel richer throughout their lives, and thus consume more of everything, including leisure. Similarly, when future wage increases

[5] The value of the buffer stock is increased by the assumption that individuals cannot borrow against their future income. Borrowing provides workers with a mechanism for maintaining consumption levels when earnings are low. With borrowing cut off, the only way young workers can guard against negative earnings shocks is to accumulate assets. Allowing young people to borrow would make their labor supply more elastic.

are anticipated, individuals will adjust current hours in response. Younger workers will need to work and save less when young, knowing they will work until an older age. A temporary wage increase at age 60 increases age-60 hours by 377, but decreases hours prior to age 60 by 111. Total lifetime hours increase by only 167. Thus the labor supply response to a transitory wage change is not so much an increase in total lifetime hours as it is a reallocation of hours over the life cycle.

Lastly, Table 2 shows that the contemporaneous hours response is smaller for permanent wage changes than for temporary ones. When a wage change is permanent, the scope for reallocating hours over the life cycle is smaller, and the wealth effect, which reduces hours, is larger. Table 2 shows that for a permanent wage change at age 40, the elasticity of hours at age 40 is 0.17; the corresponding elasticity for a temporary wage change was 0.36. Permanent wage changes also lead workers to reallocate their labor, as they shift hours from before the wage change to afterward. It is still likely that total lifetime hours will rise in response to increased labor supply incentives when old. Table 2 shows when there is a permanent wage increase at age 60, total lifetime hours increase by 1,906. However, Table 2 also shows that the labor hours of younger workers fall by 519, partly offsetting the labor supply responses of older workers.

In short, Table 2 suggests that for the cohort of workers nearing retirement, changes in public pension plans could lead to significant changes in labor supply, especially if the changes are unanticipated. Younger cohorts, however, will respond in part by adjusting labor supply at earlier ages, so that lifetime (and ultimately aggregate) labor changes less.

To the best of our knowledge, we are the first to quantify the extent to which labor supply elasticities change with age because of the participation margin, while also accounting for the intensive margin of labor supply. There is relatively little other evidence on how labor supply elasticities vary over the life cycle. Keane and Imai (2004) argue that because work at young ages increases future wages, the labor supply of young workers is not very sensitive to changes in their current wages, leading to elasticities that rise over the life cycle (also see Wallenius, 2009). Conversely, Gomme et al. (2004) find that at business cycle frequencies, the elasticity of labor supply follows a U-shaped pattern over the life cycle, highest at young ages, then falling and rising slightly at older ages. Thus the evidence is not definitive, but it suggests that labor supply elasticities rise at older ages.

IV. How sensitive is life cycle labor supply to changes in public pension programs?

Over the last 30 years there has been a growing appreciation of the effect of private and public pension systems on labor supply. This is the result of three strands of economic research: (1) non-structural analyses that use micro data to document associations between pension incentives and the timing of retirement; (2) structural analyses, also using micro data, that produce formal models of labor supply amenable to policy simulations; (3) applied general equilibrium models that incorporate features of the micro-level structural models.

A. Non-structural evidence

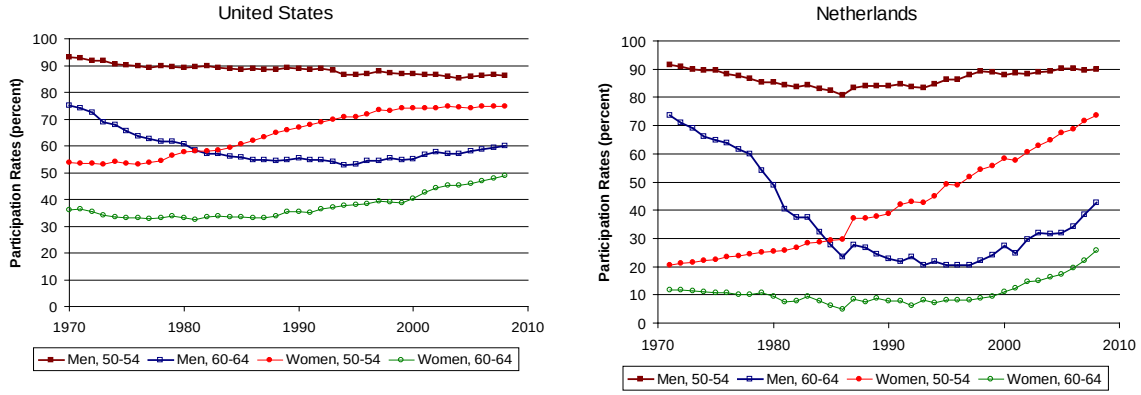
There is an extensive body of empirical work that, using micro data, documents the association between pension incentives and the timing of retirement. Much of this research is summarized in Gruber and Wise (2004, 2007). These studies have shown that many individuals exit the labor market when the incentives to leave the labor market are greatest. For example, the studies show that for many countries, major reforms to government pension plans are often followed by major changes in retirement patterns. In the United States in 1960, there was no early retirement age for men, and the normal retirement age was 65. Furthermore, the retirement hazard for men was extremely low at age 62 in 1960. In 1961, the early retirement age was changed to 62. By 1980 job the retirement hazard was higher at age 62 than it was at 65.

Furthermore, different countries have different early and normal retirement ages for their pension plans, and retirement hazards are highly correlated with these retirement ages. For example, in France the normal retirement age is 60 (there is no early retirement age). The retirement hazard for French workers is close to 60% at this age, whereas at 58 or 62 the hazard is less than 10%. A similar cross-country analysis appears in Duval (2003), who regresses participation at older ages on his measure of implicit tax rates. He finds that countries that provide larger incentives to delay retirement—countries with lower implicit tax rates—have higher participation rates.

The flavor of these analyses is illustrated by Figure 5, which shows participation rates, calculated by the OECD, for the Netherlands and the US. Figure 5 reveals sharp cross-country differences in the participation rates of men aged 60-64. Although the two countries started with similar participation rates for men in the early 1970s, by 1995 the participation of 60-64 year-old

men in the US was 53%, whereas in the Netherlands it was only 21%. Since then, the differences have narrowed: while participation in the Netherlands almost doubled by 2008, to 43%, participation in the US has risen much more modestly, to 60%. These patterns in participation mirrored differences in retirement incentives. In the 1980s and early 1990s, programs in the Netherlands, especially unemployment and disability insurance, provided stronger incentives for early retirement than in the US. Since that time, the Netherlands has introduced sweeping changes aimed at encouraging work at later ages; reforms in the US have been more modest.

Figure 5. Labor force participation rates by gender, 1970-2008, US and Netherlands



Source: OECD.

Although these non-structural analyses provide compelling evidence that government pension plans are important for understanding retirement patterns, they face two important limitations. First, there are many sources of retirement incentives besides public pensions – these include private pensions and disability programs – and when all these competing incentives are not modeled explicitly, they are difficult to disentangle. Second, studies that do not use formal models cannot provide quantitative measures of how labor supply would respond to policy reforms.

B. Structural evidence

A second strand of research is from structural models of retirement. Some good recent examples include Heyma (2004) for the Netherlands, Jiménez-Martín and Sánchez-Martín (2007) for Spain, Manoli et el. (2010) for Austria, and French (2005), French and Jones (2010) and Casanova (2010) for the US. These papers also use micro data, but have the added advantage that they can more explicitly quantify the importance of the work disincentives. Furthermore, they

can allow for the fact that people potentially consider multiple programs at once. For example, older workers may consider alternative pathways to retirement, such as applying for disability insurance benefits.

However, few of these studies are in an explicit life cycle setting. This limits what can be learned from these studies, because it makes it makes it difficult to link the studies to the life cycle models that are now used to evaluate the fiscal cost of tax and Social Security reforms (e.g., Nishiyama and Smetters, 2007).

A significant benefit of developing structural models is that they can predict the effect of policy reforms that have not yet occurred. Table 3 presents findings from French (2005), who uses a structural model to assess how changes in the US Social Security rules would affect both consumption and labor supply over the entire life cycle. The first row of Table 3 shows predicted years worked, hours worked per year among workers, the present discounted value of labor income and consumption, and assets at age 62 for the cohort of men that neared retirement age in 1987, under the Social Security rules faced by these workers. The second row shows what would happen to their labor supply and savings if their benefits were cut by 20% and they anticipated these lower benefits.

Table 3: Responses to a 20 percent reduction in Social Security benefits

	Total years worked	Hours worked per year	PDV of labor income	PDV of consumption	Assets at age 62
Benchmark model	32.60	2,097	$1,781	$1,583	$190
Benefits reduced by 20%	32.83	2,099	$1,789	$1,569	$200
Early retirement age raised to 63	32.62	2,096	$1,781	$1,584	$190
Earnings test eliminated from age 65 onward	33.62	2,085	$1,799	$1,594	$188

PDV denotes present discounted value.
Consumption, labor income, and assets are measured in thousands.

Source: French (2005)

The second row of Table 3 shows that reducing Social Security benefits by 20% causes individuals to work more hours throughout their lives and increase their assets in order to offset reduced benefits. To understand the magnitude of these effects, note that the average present value of Social Security benefits at age 62 is equal to about $132,000. Cutting benefits 20% thus

reduces the present value of Social Security wealth by $26,000. Individuals respond to this wealth loss by reducing both consumption and leisure, that is, by working and saving more. As a result, age-62 asset levels are $9,800 greater when benefits are reduced. About two-thirds of this increase is from reduced consumption, while the other one-third is from increased labor supply. This highlights the importance of forward-looking behavior when considering effects of changing the Social Security rules.

Nevertheless, most of the effects are seen after age 62. Increased years in the labor market after age 62 replace $5,500 of the lost income. One reason for this is that most of the life cycle variability in hours occurs at the participation margin at older ages, implying that the flexibility of labor supply is highest after age 62. A second reason is that reducing Social Security benefits also effectively reduces the Social Security Earnings Test, and thus reduces the tax imposed by the Earnings Test. If an individual receives no Social Security benefits, there are no Social Security benefits to be reduced by the Earnings Test. Therefore, the substitution effect associated with a benefit cut causes individuals to work more hours when eligible for Social Security benefits and fewer hours at younger ages.

In short, reducing Social Security benefits generates substitution and wealth effects that both encourage workers to supply more labor, especially after age 62. It is not immediately obvious which of these effects is stronger. French (2005) uses additional simulations to show, however, that the substitution effect is much stronger.

Another potential reform to the Social Security system is to shift the early retirement age from 62 to 63. Recall that increases in future benefits almost fully replace benefits lost through the Earnings Test at age 62. Therefore, if borrowing constraints do not bind, there should be little if any work disincentive imposed by Social Security at age 62, and thus there should be little if any effect of shifting the Social Security early retirement age to 63. French (2005) finds that very few individuals face borrowing constraints at age 62. Not surprisingly, the third row of Table 3 shows that the effects of shifting the early Social Security retirement age to 63 are very small.

Finally, the fourth row of Table 3 shows results from eliminating the Social Security Earnings Test for individuals aged 65 and older. This has large effects. Years in the labor force rise from 32.60 to 33.62, a full year, although average hours worked by workers are largely

unchanged. Given that eliminating the Earnings Test increases lifetime wealth, which decreases hours of work, the observed increase in labor supply is completely due to substitution effects.

This final experiment allows us to test the model's forecasting ability, because the Earnings Test was in fact abolished for individuals older than 64 in 2000. Given the value of structural models as forecasting tools, it is reasonable to test their forecasting ability through out-of-sample validation exercises. The basic structure of a validation test is to estimate a model with data drawn from one observed policy regime, and then use the model to predict outcomes in another observed policy regime (see, e.g., Keane and Wolpin, 2007, and the references therein).

Because the model used to produce Table 3 was estimated on a sample of individuals who faced the Earnings Test until age 70, its predictions regarding the elimination of the Earnings Test are out-of-sample forecasts. The final row of Table 3 shows that the model predicts that once the Earnings Test is eliminated, labor force participation rates should rise sharply in the years that follow. As it turns out, labor force participation rates for men over 65 have risen rapidly over the last 20 years, from 16% in 1987 (the central year of analysis in French, 2005) to 18% in 2000, when the earnings test was repealed, to 22% in 2009.

This comparison of labor supply in 1987 and 2009 might not cleanly identify the true effect of the repeal of the earnings test however, because many other changes occurred between 1987 and 2000, when the earnings test was repealed. Furthermore, the results on Table 3 are based on the assumption that the change was known in advance – from age 20. This allows workers to reallocate hours and consumption over their entire life cycle.

In order to isolate the effect of the earnings test more cleanly, we consider a somewhat different validation exercise, using a different model that appears in French and Jones (2010). We estimated this model on a cohort of individuals who were 57-61 (with an average age of 59) in 1992, and thus faced the Earnings Test. We then tested the model by predicting the labor supply of individuals who were 51-55 (with an average age of 53) in 1992, and thus did not face the test. In both cases, we started the model simulations in calendar year 1992, so that individuals had only a limited time to respond to the changes. This exercise also differs from the exercise in Table 3 in that the simulations allow the in-sample and out-of-sample cohorts to differ in their initial endowments of financial, Social Security and private pension wealth; in Table 3 the same people are subjected to different policy regimes. Table 4 presents the results from this out-of-

sample comparison. The model predicts the observed increase in participation rates reasonably well. For example, we found that the younger cohort that did not face the earnings test worked an additional 0.341 years between ages 60 and 65, whereas the model predicts an additional 0.447 years. The estimated increase in labor supply at ages 62-67 is similar to the estimated increases in labor supply reported in Song and Manchester (2007).

Table 4: Participation Rates by Birth Year Cohort

	Data			Mode1		
	Age in 1992			Age in 1992		
Age	59	53	Difference	59	53	Difference
60	0.657	0.692	0.035	0.650	0.706	0.056
61	0.636	0.642	0.006	0.622	0.677	0.055
62	0.530	0.545	0.014	0.513	0.570	0.057
63	0.467	0.508	0.041	0.456	0.490	0.035
64	0.408	0.471	0.063	0.413	0.449	0.037
65	0.358	0.424	0.066	0.378	0.459	0.082
66	0.326	0.382	0.057	0.350	0.430	0.080
67	0.314	0.374	0.060	0.339	0.386	0.047
Total, 60-67	3.696	4.037	0.341	3.721	4.168	0.447

Source: French and Jones (2010)

C. General equilibrium analyses

A third strand of research on the effects of public pensions utilizes applied general equilibrium models. Recent papers include Conesa and Krueger (1999) and Fuster, İmrohoroğlu and İmrohoroğlu (2007), and Heathcote et al. (2010). These models have two attractive features. First, they take a life cycle perspective on labor supply. The results in Tables 2 and 4 showed that public pension rules can affect not only the age of retirement, but labor supply at younger ages as well. For example, reducing the pension benefits received at older ages may cause an increase in savings and work hours at younger ages. Because these general equilibrium models typically model workers of all ages, they can assess these offsetting life cycle effects. The second attractive feature of applied general equilibrium models is that they account for general equilibrium feedback effects that applied micro studies explicitly ignore. One such set of feedback effects are price changes: applied micro studies that hold wages and interest rates fixed may significantly overstate the extent to which hours and saving respond to policy changes.

Other feedback effects may be subtler. For example, more generous public pension schemes may crowd out private savings, and reduce the economy's capital stock. This in turn would reduce wages.

A drawback to these studies is that the predicted values depend critically upon the parameters of the model, and these parameters are often calibrated without sufficient empirical justification. At best, the parameters are taken from empirical papers on the labor supply patterns of prime age workers. Most of these studies also assume that the labor supply elasticity is constant over the life cycle. As a result, the studies usually ignore participation decisions in general, and ignore the way in which labor supply elasticities rise as workers approach retirement.

V. Conclusions and recommendations

In this paper we have examined labor supply and public pensions from a life cycle perspective. We find that labor supply decisions are mainly participation decisions, and that these participation decisions are most sensitive to financial incentives when workers are old. Several forms of evidence suggest that public pension plans have large effects on the labor supply of older workers. This suggests that recent pension reforms encouraging later retirement should significantly increase work at older ages.

Our findings suggest that labor income should be taxed at different rates over the life cycle. One of the key insights from the theory of optimal taxation is that elastically supplied goods should be taxed less than inelastically supplied goods. Thus, if labor supply elasticities rise with age, labor income earned when old should be taxed at a lower rate than income earned when young. As Banks and Diamond (2008) argue in their review, "the gains from age-dependent labour income taxes may not be trivial."[6]

We conclude by considering how to implement such an age-dependent tax structure. Public pension reform—the motivation for this paper—is the obvious starting point. Several proposals for reducing effective tax at older ages have been put forth in the academic literature. Laitner and

[6] The conclusion that tax rates should vary with age need not imply that they fall with age. For example, Weinzierl (2008) studies age-dependent taxes in a dynamic Mirleesian framework with no retirement. He finds that when workers cannot borrow or save, younger workers should face lower income tax rates than older workers.

Silverman propose (2008) eliminating Social Security payroll taxes on workers aged 60 and older. They find that this tax cut, coupled with higher taxes at younger ages, would increase labor supply and would be welfare-improving for most people. Goda, Shoven, and Slavov (2009) propose that Social Security benefits depend on the worker's 40 highest earning years, rather than 35, to increase the return to work late in life.

The effective tax on work at older ages can also be lowered by modifying other public programs. Goda, Shoven, and Slavov (2007) recommend eliminating the Medicare as a Secondary Payer requirement, which forces employers to provide primary payer health insurance to workers that would otherwise be covered by Medicare. They estimate that this requirement imposes a tax rate that rises from 15-20% percent at age 65 to 45-70% by age 80. They argue that because the labor supply of older workers is so elastic, "[e]liminating this implicit tax by making Medicare a primary payer for all Medicare-eligible individuals could significantly increase lifetime labor supply … The extra income tax receipts from such a policy would likely offset a large percentage of the estimated costs of making Medicare a primary payer."

Another important channel is income taxes. In the Netherlands, older workers now receive a tax credit: in 2009 this credit was 5% of gross wages for 62-year-olds and 10% of gross wages for 64-year-olds (Euwals et al. 2009). Conesa, Kitao and Krueger (2009) describe the optimal combination of capital and labor income taxes in a dynamic general equilibrium model. They conclude that that in a life cycle environment with age-invariant tax rates, the optimal tax on capital income is positive, because it lowers the effective tax on labor income earned at older ages, or, equivalently, causes labor income earned at younger ages to be taxed at a higher rate.[7] Such differential treatment is efficient because it allows labor income to be "taxed more heavily when it is supplied less elastically," namely at younger ages.

One caveat is that there is relatively little evidence on how labor supply elastiticies change over the life cycle. To the best of our knowledge, we are the first to quantify the extent to which labor supply elasticities change with age because of the participation margin, while also accounting for the intensive margin. The other evidence currently available also suggests that labor supply elasticities rise at older ages (e.g., Keane and Imai, 2004, and Gomme et al., 2004). Future research will hopefully lead to firmer conclusions.

[7] In a present-value setting, increasing the capital tax rate lowers the after-tax interest rate a worker uses to discount future earnings. This in turn increases the value of future earnings relative to current earnings.

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