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# Financial Incentives in the Austrian PAYG-Pension System: Micro-Estimation*

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**Abstract**

The scope of this paper is to investigate the impact of financial incentives on the retirement decision of private sector workers in Austria. How do financial incentives embedded in the Austrian pension system impact individual retirement behavior? We are using a unique dataset of individual social insurance spells. Micro-estimating the impact of financial incentives on the probability of retirement shows that the behavioral response to financial incentives in Austria is relatively large in international comparison. Also, there are striking behavioral differences between men and women. Using the estimates to simulate the response to reform shows that actual retirement ages could be most successfully brought up by a 6 percentage point deduction in pension benefits per year of early retirement.



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*Key-Words:* Models with Panel Data, Discrete Regression and Qualitative Choice Models, Social Security and Public Pensions, Time Allocation and Labor Supply, Retirement; Retirement Policies.

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## 1. Introduction

Austria is often left out in comparative studies. However, it is a very interesting country in many aspects. Austria has a long tradition of early retirement and hence a very low labor force participation of older workers. Moreover, the granting of disability pensions is very generous. So a huge share of Austrian retirees retires on disability pensions unlike in most other countries. Furthermore, public pensions are the only source of old age income for most Austrians. There hardly exist occupational and private plans. Finally, Austria belongs to the few countries in the OECD featuring different statutory retirement ages for men and women. Retirement behavior and the institutional setup of public pension plans vary largely across countries. This study analyzes the Austrian case using a unique administrative micro-data set.

This paper deals with the financial incentives to retire for Austrian private sector workers. Older workers retire relatively early compared to other OECD countries. Therefore, labor force participation of older workers in Austria belongs to the lowest in the OECD. Generous retirement rules as well as old age unemployment account for retirement at the earliest possible point in time. In particular, financial incentives embedded in the Austrian PAYG-pension system do not provide a reason to postpone retirement until the statutory retirement ages. On the other hand, politicians attempted to address old-age unemployment by opening various channels of early retirement. The key issue of Austrian pension reform is to close the gap between actual and statutory retirement ages.

The major issue in the older Austrian labor force is a participation rate 20 to 30 percentage points lower than in similar countries. In the age group from 55 to 59, the participation rate is 51.9 percent, sharply dropping to only 14.0 percent in the age group 60 to 65. In contrast, Sweden has participation rates of 82.2 percent and 60.9 percent in these age groups. Also, Germany, Switzerland,

and the United States have significantly higher participation rates of older workers[1]. As the mirror image, there is a significant difference between statutory and actual retirement ages in Austria. Men and women retire on average at ages 59.6 and 58.9, while they are supposed to retire at 65 and 60, respectively. So, men retire 5.4 years, women 1.1 years before the statutory ages.

How do financial incentives embedded in the Austrian private sector pension plan (ASVG) affect individual retirement behavior? How does reform impact retirement behavior? The analysis of retirement behavior grounds on the *Life Cycle Hypothesis* by Modigliani and Brumberg (1954), as well as the *Permanent Income Hypothesis* by Friedman (1957). Stock and Wise (1990) used a reduced-form estimation to show that forward looking agents consider dynamic changes in lifetime wealth in their retirement decision. For some stylized cases, Hofer and Koman (2006) find that these dynamic incentives to retire early are relatively strong in Austria. Adopting the framework portrayed in Gruber and Wise (2004), this study expands the analysis in Hofer and Koman (2006). We are micro-estimating the response of Austrian private sector workers to changes in the financial incentives to retire. Then, we evaluate the impact of illustrative reforms on retirement behavior. Also, we are looking at important behavioral differences between men and women.

We find that Austrians respond relatively strong to changes in the financial incentive structure. Furthermore, there are some striking behavioral differences between men and women. Micro-simulations show that a 6 percentage point deduction in pension benefits for each year of early retirement would be the most successful scenario to bring actual retirement ages up.

The organization of this paper is as follows. Chapter 2 provides institutional particulars of the Austrian pension system and current reforms. Chapter 3 puts retirement behavior into a

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[1] Looking at younger ages shows no big deviation of Austrian labor force participation rates from other countries according to ILO (2005). In the age group 40-44, Austria has a participation rate of 89 percent, Germany 89.6 percent, Sweden 90.6 percent, Switzerland 88.9 percent, and the US 84 percent. The rates for age group 45-49 are 87.4 (Austria), 88.6 (Germany), 89.6 (Sweden), 90.1 (Switzerland), and 79.4 (US).

theoretical context. Chapter 4 discusses the data and the empirical strategy. In chapter 5, we specify a reduced-form model of retirement and discuss regression results. Chapter 6 uses the estimates in order to micro-simulate the impact of different reform options on retirement behavior. Chapter 7 summarizes the main results of this study and concludes with policy recommendations.

## 2. Institutional Setup of the ASVG Pension Plan

The Austrian pay-as-you-go (PAYG) pension system targets comprehensive income maintenance rather than minimum old-age income. The current pension law for private sector workers was implemented by Austria (1955). There are special pension plans for civil servants, self-employed, farmers, miners, and notaries. The financing comes from a payroll tax with any deficit covered by the federal government. The following 1998 numbers are based on the law[2] Austria (1996).

Generally, there are three pathways to exit the labor force: the old-age pension, early retirement, and a disability pension. For old-age pensions, the statutory retirement age is 65 for men, and 60 for women. Eligibility additionally requires 15 years of contributory service,[3] or 15 years of insurance coverage over the last 30 years, or 25 years of insurance coverage over the whole working life, whatever applies first. Qualifying conditions for an early pension are long contributory service, unemployment, or reduced working capacity. Early retirement can be granted to men at a minimum

[2] A comprehensive summary of European social security programs can be found in Administration (2004).

[3] The pension law distinguishes between contributory and qualifying periods in insurance coverage. Typical examples of qualifying periods are years of schooling, unemployment, military service and maternity leave.

age of 60, and to women at a minimum age of 55. Prior to these minimum ages, retirement is open to disabled persons only. In this case, regulations about insurance coverage are relaxed.

The pension formula consists of two components, pensionable income PE and a replacement rate k. The initial year of retirement decides about the amount of pension benefits B according to

$$B = PE \cdot k, \tag{1}$$

where PE is defined as

$$PE = \frac{\sum_{t=1}^{n} Annual\ Gross\ Income_t \cdot Valuation\ Factor_t}{n}. \tag{2}$$

PE is the average of the “$n$ best income years”. Annual gross income is the sum of gross earnings and unemployment compensations with an upper threshold of 42,732 Euros. In order to correct for inflation, annual gross income is multiplied by a valuation factor according to Hauptverband (Various years-b). Replacement rate k, is defined as

$$k = Increment\ Factor \cdot Insurance\ Years. \tag{3}$$

This rate accrues by an increment factor for each qualifying year, i.e., 1.83 percentage points for the initial 30 years, and 1.675 percentage points for any subsequent year. Maximum k is 80 percent, 60 percent in case of a disability pension. Also, k decreases by an early retirement penalty if a person retires before the statutory age. If retirement is postponed beyond the statutory age, a bonus is added to k. For pensions lower than 8,131 Euros per year, a means-tested income supplement (“Ausgleichszuglage”) can be claimed from the federal government. B is subject to individual income taxation and mandatory health insurance.

Targeting an increase in actual retirement ages, incremental reforms[4] were implemented by the laws Austria (1997), Austria (2000), Austria (2003a), and Austria (2003b). This brought an increase in minimum early retirement ages for men from 60 to 61.5 and from 55 to 56.5 for women. Until 2017, early retirement will be completely phased out. Due to a sentence of the Austrian Constitutional Court, the statutory retirement age of women will be raised to age 65 between the years 2024 and 2033. Also, the deduction for each year of early retirement was raised from 2 to 4.2 percentage points. However, there is an upper ceiling of 15 percentage points overall. The loss compared to legislation 2000 cannot exceed 5 percent in 2004, gradually increasing to 10 percent in 2024. Before 2004, replacement rate k including deductions for early retirement was capped at 80 percentage points. Effective 2004, these deductions are applied to a maximum replacement rate k of 80 percentage points, resulting in a lower k in many cases. The increment factor in the calculation of k is reduced from 2 to 1.78 percentage points. The assessment period for PE will be gradually increased until the year 2028 from the "15 best income years" to the "40 best income years". There is one exemption from reform 2000. Men born before October 1, 1945, and having accrued at least 45 contributory years, as well as women born before October 1, 1950, and having accrued at least 40 contributory years, can still retire at conditions of Austria (1997).

Therefore, new regulations imply very long phasing-in times as well as exemptions for large groups of retirees. Importantly, linear benefit cuts can weaken the financial incentives to remain in the labor force. Even if the expected pension wealth decreased at each age, the increment in pension wealth until next year could become smaller resulting in a weaker incentive to postpone retirement. Thus, we are neither able to expect immediate effects nor desired changes in behavior following Austrian pension reform.

[4] See Knell et al. (2006) for a detailed summary of pension reforms in Austria.

## 3. Theoretical Model

We need to relate the retirement decision to the financial incentives embedded in the pension system. The natural framework to deal with retirement behavior is the life cycle hypothesis. Individuals have a lifetime perspective in their decision to retire. In a model proposed by Samwick (1998), an agent *t* years of age plans to retire at age *s* = R, and expects to survive until age *T*. He receives earnings or unemployment benefits before *R*, and pension benefits after *R*. The agent maximizes lifetime utility subject to a lifetime wealth constraint

$$\begin{aligned} &\max_{\{R,C_s\}} \int_t^R e^{-\delta(s-t)} u\left(C_s,0\right) ds + \int_R^T e^{-\delta(s-t)} u\left(C_s,1\right) ds \\ &s.t.\ A_t + \int_t^R e^{-r(s-t)} Y_s ds + \int_R^T e^{-r(s-t)} B_s\left(R\right) ds = \int_t^T e^{-r(s-t)} C_s ds \end{aligned} \quad (4)$$

$C_s$ is consumption at age *s*, $Y_s$ is expected real net income at age *s*; $B_s(R)$ is the amount of net pension benefits from retiring at age *R*. Parameter $\delta$ represents the rate of time preference, *r* the discount rate; $A_t$ is net wealth at age *s* = *t*. The second argument in the utility function captures the effect of retirement leisure on utility.

The first-order condition with respect to *R* is

$$u(C_R,1) - u(C_R,0) = \lambda\left[(Y_s - B_R(R)) + \int_R^T e^{-r(s-R)} \frac{\partial B_s}{\partial R} ds\right]. \quad (5)$$

The behavioral prediction for an agent's retirement decision comes from (5). He compares the difference in utility induced by retirement at age *s* = R. This difference depends on potential earnings from work until R and on the increment in expected social security wealth (*SSW*) by postponing retirement until *R*.

$$SSW = \int_{R}^{T} e^{-r(s-t)} B_s(\mathrm{R}) ds \tag{6}$$

is a basic incentive measure of retirement. It is the present discounted value of net pension benefits received over the expected duration of life. As *SSW* increases, agents are more likely to retire. They can consume more goods including retirement leisure.

The One-Year Accrual is

$$ACC = \frac{\partial SSW}{\partial \mathrm{R}} = \int_{R}^{T} e^{-r(s-t)} \frac{\partial B_s}{\partial \mathrm{R}}(\mathrm{R}) ds - e^{-r(\mathrm{R}-t)} B_{\mathrm{R}}(\mathrm{R}). \tag{7}$$

It represents the increment in *SSW* by postponing retirement for one year. This is in other words just the marginal lifetime wealth from postponing retirement. Increasing accruals make it less likely to retire. The relative price of taking retirement leisure now increases. So, there is a wealth and a price effect[5] representing the financial incentives to retire. In the empirical specification, we use a reduced-form approach following Stock and Wise (1990) to capture these two financial incentive effects.

## 4. Data and Empirical Strategy

In order to estimate the impact of the financial incentives on the retirement decision, we need to look at the data and empirical strategy. Therefore, we discuss the data, the treatment of income histories, and the construction and age profiles of the financial incentive measures to retire.

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[5] Fields and Mitchell (1984) provide detailed comparative statics of the life cycle model.

### 4.1. Data and Descriptive Statistics

We are using the detailed administrative Databank (2006) mainly containing micro-data from the Austrian Social Security Administration (*Hauptverband*). The databank consists of approximately 5 million beneficiaries. Earnings as well as individual characteristics are included in great detail. The time frame of the earnings records is 1997 to 2004.

However, the data has some important shortcomings. First, there is no information on marriage status, which would be useful in order to control for spouses' characteristics. Second, there is no data on an individual's lifetime income history. Therefore, we have to impute pre-1997 income histories in order to calculate pension benefits. For the same reason, we have to make assumption about labor force entry. Third, the data only includes information about earnings from work. Pension benefits and unemployment compensations are missing. Fourth, no information on property and private savings is available. Therefore, we are facing the issues of omitted variables and measurement errors. In order to correct for these omitted variables, we will use a fixed effects estimator. To minimize a bias arising from measurement errors in the income histories, a fixed effects estimator is the best choice, too.

The insurance-spell format of the data requires the transformation into a person-year format. From the original data universe, we are taking a twenty percent random sample. We only consider individuals participating in the labor force. Persons reentering the labor force after their first retirement are also dropped. Then, we exclude persons not employed in the private sector, i.e., farmers, civil servants, self-employed. We also exclude widowers and orphans due to special taxation rules and special earnings patterns. Furthermore, we are dropping workers with more than 2 years of unemployment. Since income histories need to be imputed, we exclude persons who did not work or were already retired in 1997. Also, we are excluding persons who did not retire in any of the years between 1998 and 2004.

The resulting data sets are person-year observations over the time interval 1998 to 2003. The first and the last year is lost, since we have to look forward one year in the accrual calculation, and one year backwards in the earnings history imputation. The male panel consists of 20,612 persons with 75,494 observations and the average observation duration of 3.7 years. The female panel consists of 15,108 persons with 47,153 observations, and the average observation duration of 3.1 years. Birth cohorts range from 1938 to 1945. This implies that in 1998, a person is between 53 and 60 years of age. In 2003, individuals are between 58 and 65 years of age.

[Table 1 about here]

Table 1 shows summary statistics of the variables used. 24 percent of male and 27 percent of female observations are initial retirement years. Since earlier years of the panels include earlier ages, the share of initial retirement years increases in the year of the observation. Females earn roughly 68 percent of male net earnings. Moreover, women accumulate pensionable income of only 59 percent of the average level for males. The share of sick days during employment is 3.2 percent for males and 1.8 percent for females. 41.4 percent of the observations in the male panel and 30.3 percent in the female panel represent employment in blue collar occupations. Roughly 26 percent of both sexes are working in the Austrian capital city Vienna, between 14 percent (males) and 11 percent (females) in Eastern Austria, 11 percent work in Southern Austria, and the remainder in Western Austria. The mean year of observation is 1999 for both sexes.

[Table 2 about here]

The share of retirees of each age group given that one not already retired (table 2) shows some striking behavioral differences between men and women. On average, men retire at age 59, women at age

57. Men are using the early retirement option more frequently than women. One year before the statutory retirement age, 22.6 percent of men and only 13.2 percent of women retire. These huge differences persist through all ages up to the statutory retirement age. Moreover, women are making largely less use of disability pensions than men. In the year prior to initial early retirement entitlement, 12.3 percent of men, but only 1.7 percent of women choose this pathway of labor force exit. This suggests that women adapt their retirement behavior to the statutory retirement age to a greater extent than men. A possible explanation might be that men are working in more health deteriorating jobs than women. Also, the later legal retirement ages and the shorter life expectancy might discourage men to stay in the labor force until age 65. Men would also want to coordinate retirement decisions with their wives. Moreover, it is often criticized that disability pensions are granted too generously in Austria[6]. Thus, different retirement ages for men and women seem to induce unintended effects on retirement behavior. Though not intended, reform 2000 increased the share of early retirees at each age for both sexes. Moreover, there is a sharp increase in male disability pensioners following reform 2000. This suggests that particularly men use disability pension as a form of early retirement.

### 4.2. Treatment of Income Histories and Pension Benefit Calculation

In order to calculate pension benefits, we need the best 15 years in a person's income history. Pensionable income consists of earnings from work and unemployment compensations. Unfortunately, the data does not feature pre-1997 earnings, pension benefits, and unemployment

[6] In Germany, disability pensions are also granted very generously. According to Boersch-Supan et. al. (2004), 29 percent of German private sector workers retire on a disability pension, while only 20 percent retire statutorily. Moreover, 40 percent of German civil servants enter retirement on a disability pension.

compensations. Therefore, we need to impute the missing information. Our imputation approach distinguishes 4 cases to complement the data.

The first case concerns the backwards imputation of earnings and unemployment compensations in the years prior to our data window 1997 to 2004. Using earnings in 1997, pre-1997 earnings are assumed to grow at the annual aggregate growth rate of nominal earnings.[7] Then, for each year pre-1997, we impute the amount of pensionable unemployment compensations according to the method portrayed in Raab (2008). Pensionable income is then the sum of annual earnings and unemployment compensations corrected by a predicted share of unemployment days at a certain age.

The second case is the treatment of observed data in years of employment from 1997 to 2004. Earnings are observed, unemployment compensations are not. The pensionable unemployment compensation is calculated and prorated for the observed time of unemployment. Both components, earnings and pensionable unemployment compensation, add up to pensionable income.

Third, there is a special treatment of the retirement year. In case someone retires in a year having worked parts of this year, the pre-retirement earnings are projected to a whole year's earnings. In case someone retires on January 1st, his potential earnings in the retirement year are projected forward from the earnings in the year before retirement.

Fourth, we need projected earnings from the last working year until year 2004. Adopting the same method used in the backwards earnings calculation, the earnings after the last working year

[7] In order to determine the growth of earnings as age increases, we have to look at the age earnings profile in Austria. In contrast to many OECD countries, salaries in Austria grow according to seniority until retirement. This implies an age-earnings profile strictly increasing in age rather than being concave in age near-retirement as described on page 129 in OECD (2005) Also, all wage increases are bargained on the federal level by labor unions and employer organizations of an industry. Consequently, all employees in an industry will have an identical salary growth rate. Under these circumstances, the "best 15 years" for pension computation are most likely to be the last 15 years before retirement. We will therefore, adopting the method portrayed in Brugiavini and Peracchi (2004), and on page 300 in Hofer and Koman (2006), assume that earnings pre-1997 and prospective future earnings between 1998 and 2004 grow at the annual aggregate growth rate of earnings as found in Databank (2007a).

grow at the annual aggregate growth rate of nominal earnings. However, after observed retirement, it would be irrational to be unemployed. Therefore, we are not projecting pensionable unemployment compensations for these years.

For the calculation of the replacement rate, we need the number of insurance years of a person which is unknown. Therefore, considering the economic activity rates by sex in 1950 as described in Databank (2007c), this study will assume that men start their insurance career at the age of 20, women at the age of 17.[8]

Another problem of identification arises from pension entitlements exempt from reform 2000. It is observable, that people who retired at ages 55/60 (females/males) in 2001, 2002, and 2003 are exempt from reform 2000. If they were not exempt, they would not have been able to take an early retirement pension at ages 55/60, since reform 2000 increased the early retirement ages to 56.5/61.5. However, it is unknown whether people who retired in ages later than 55/60 were exempt from reform 2000. This study is treating them as exempt, because they could have already retired at the earliest age possible. However, this might give rise to a measurement error.

Thus, important information on income histories is not available from the data. The limitations of the data force us to make some strong assumptions. This is a very common issue in research having a life cycle perspective in mind.

[8] An investigation of average statutory retirement ages in 1998 in the data supports this assumption: going back 45 years from the mean age of retirement by sex results in the maximum replacement rate if insurance careers started at ages 20 and 17, respectively.

### 4.3. Calculation of Incentive Variables

The main variables of interest are the financial incentives of retirement. Once becoming eligible for a pension, workers consider benefit streams as well as potential earnings from delayed retirement in their participation decision. The basic magnitude for calculating the incentive measures is social security wealth (*SSW*). *SSW* is the present discounted value of the sum of expected future pension benefits. One would expect that persons with a higher level of social security wealth can consume more of all goods including retirement leisure. Therefore, the probability of retirement should increase in the level of *SSW*. It would also be natural to expect that a pension system provides a higher or at least non-decreasing level of *SSW* the longer retirement is postponed. If *SSW* though decreases in the age of retirement, a pension system is actuarially not fair, since it financially punishes to stay longer in the labor force.

In formulae, adapting the definition of gross social security wealth in Feldstein (1974), *SSW* is:

$$SSW_t(\mathrm{R}) = \sum_{s=\mathrm{R}+1}^{T} B_s(\mathrm{R}) p(s \mid t) \delta^{s-t} \,. \tag{8}$$

$SSW_t(\mathrm{R})$ is the present discounted value in year *t* of all future net pension benefits from retiring at age R. $B_s(R)$ is the net pension benefit in year *s* from retiring at age R, where $s \geq R+1$; $p(s \mid t)$ is a conditional probability of survival until year *s* given survival until year *t*. $\delta = \dfrac{1}{1+r}$ is a discount factor, *r* is the nominal rate of interest, and *T* is the age of certain death.

Since future pension benefits $B_s(R)$ are unknown, we have to adapt an indexation rule that represents the current practice. According to Hofer and Koman (2006) we assume a pension benefit growth in line with the long term projected rate of wage growth of 1.6 percent per year. The pension benefit of each single year is corrected by a conditional survival probability $p(s \mid t)$. To this end, we are using life tables provided from Databank (2007b). In order to discount future pension benefits to current year *t*, we are using a 4.6 percent nominal interest rate *r*. It is the sum of a 3 percent real interest rate and a 1.6 percent long term projected inflation rate.

The dynamic incentive measure is the accrual in social security wealth, *ACC*. This is the difference in *SSW* if a worker delays retirement by one year.[9] The *ACC* gives an incentive to stay in the labor force if it is positive or at least non-negative. By postponing retirement by one year, a worker will be rewarded if he received a higher level of *SSW* compared to retiring now. If the accrual is negative, there is no incentive to postpone retirement for another year, because this would penalize a worker by providing a lower level of *SSW* compared to retiring now. We calculate *ACC* according to

$$ACC_t(\mathrm{R}+1) = SSW_{t+1}(\mathrm{R}+1) - SSW_t(\mathrm{R}). \qquad (9)$$

### 4.4. Social Security Wealth and the One-Year Accrual in Austria

Summary statistics of the incentive variables for Austria are provided in table 3 (referring to the base case). Financial incentives to delay retirement are rather weak. For males, *SSW* increases in

[9] There are various types of accrual measures throughout the literature. We might be interested in the maximum of social security wealth compared to now (*peak value* accrual). Also, we might consider the gain in social security wealth and potential earnings from work by postponing the retirement date (*option value* accrual if added, *implicit tax on work* if taken as a ratio). However, for a discussion of the Austrian case, we will limit the analysis to the one-year accrual. Moreover, Raab (2008) shows that there is no important insight by extending the Austrian analysis to further incentive measures.

the age of retirement, spiking at age 60. For the early retirement ages from age 60 to 64, *SSW* strictly decreases. After spike age 60, there is no more incentive to delay retirement. Therefore, the incentive structure of *SSW* suggests for men to retire at the age of 60 at latest, but not to delay retirement until the statutory age of 65.

[Table 3 about here]

For females, *SSW* increases in the age of retirement, spiking at age 63. However, in the range of early retirement entitlement, there is a local spike at age 56. Therefore, this incentive structure of *SSW* suggests for women to retire before the statutory retirement age of 60, too.

The Austrian pension system has in principle an actuarially unfair *ACC* age profile. For males, the accrual spikes at age 64. For females, the *ACC* spikes at age 62. These spikes would imply the incentive to retire at age 64 for men, and 62 for women. However, once becoming eligible for early retirement, the *ACC* decreases with each year of postponement until age 63 for men and age 58 for women. Also, the accrual is positive at almost all ages of retirement. Though, the magnitudes are often very small. This raises the question if a slightly positive accrual can provide a strong incentive to stay in the labor force for another year. Moreover, the magnitudes of the accrual incentives are particularly small in the range of disability pension entitlement.

Therefore, we would expect Austrian private sector workers to retire early, since they respond rationally to the financial incentives in the ASVG pension system.

## 5. Empirical Model and Results

### 5.1. Regression Framework

Empirically, we are looking at the effect of the incentive variables on the probability of retirement. The main hypothesis to be tested is that Austrians responds to the financial incentives embedded in the ASVG pension system. In particular, one would expect an increase in the level of *SSW* to have a positive impact on the probability of retirement. Also, we expect an increase in the *ACC* to have a negative impact on the probability of retirement. We also put the outcomes into a cross-country context.

The incentive effects on the probability of retirement are twofold. First, there is a *wealth effect*, represented by a variation in the level of *SSW*. A higher level of *SSW* would induce the consumption of more goods, including retirement leisure. This effect is similar to an income effect. The second effect is the *accrual effect*. Increasing consumption in the retirement period resulting from an additional year of work is compared to an additional year of leisure. The *accrual effect* can be interpreted as a substitution effect. It represents the effect of the change in the relative price of retirement leisure over time on the decision to retire.

We are estimating a linear probability model with fixed effects. The dependent variable *R* is a binary choice variable of retiring at age *t* conditional on being in the labor force in year *t*-1. Retirement is an absorbing state, so for each individual, only the initial year of retirement is included. The regression equation for the *i*-th individual observed in year *t* is

$$R_{it} = \beta_0 + \beta_1 SSW_{it} + \beta_2 ACC_{it} + \beta_3 INCOME_{it} + \beta_4 AGE_{it} + \beta_5 X_{it} + \beta_6 Y_{it} + a_i + u_{it}. \qquad (10)$$

$SSW$ is social security wealth, $ACC$ is the accrual in social security wealth by postponing retirement for one more year. $INCOME$ is a set of income controls, including potential earnings next year as well as pensionable earnings, and their squares. The reason for using income controls is that higher income should increase the probability of retirement. Then, individuals can buy more goods including retirement leisure. $AGE$ is a set of age dummies, $X$ is a matrix of individual characteristics affecting the retirement decision. It includes control variables for health, industry affiliation, occupation, and location. Due to the fixed effects estimation, a separate dummy for academic degree is not included. $Y$ is a set of year dummies, and $a_i$ is an individual fixed effect. Table 1 provides an explanation of all variables used.

In order to capture the effect of reforms, we assume that individuals do not have foresight about pension reforms. Therefore, they adapt their expectations about the dynamics of the financial incentives according to the current year legislation. Once a reform is implemented, individuals change their expectations following the reform. This approach enables us to simulate the effect of retirement incentives on the probability of retirement, both before and after the reform.

### 5.2. Results

Regression results show some internationally remarkable findings. In general, there is a strong response of Austrians to financial incentives to retire. Also, we find striking differences between men and women. Austrians respond much stronger to a change in financial incentives than older workers in other countries. Also, unlike in most other countries, women respond stronger to accrual incentives than men.

[Table 4 about here]

We report regression results for males and females in table 4. Estimates are separate by men and women. In the regression, *SSW*, *ACC*, and the income controls are expressed in units of 10,000 Euros. The interpretation of a coefficient estimate in a linear probability model is straight forward. The coefficient represents *ceteris paribus* the percentage point change in the probability of retirement following a unit increase in the explanatory variable.

The coefficient estimate for *SSW* is highly significant for men and gets the expected positive sign. A 10,000 Euro increase in the level of *SSW* increases the probability to retire by 9.6 percentage points. For females, the estimate for *SSW* is significant and gets the expected positive sign as well. Therefore, a 10,000 Euro increase in the level of *SSW* increases the probability of retirement by 0.9 percentage points. The magnitude of the coefficient on *SSW* is smaller for women than for men.

Also, the coefficients of the *ACC* are significant and get the expected negative sign. For men, a 10,000 Euro increase in the *ACC* decreases the probability of retirement by 1.1 percentage points, for females by 2.1 percentage points. This is relatively surprising, since the response to a change in the *ACC*, as found for most country-studies in Gruber and Wise (2004), should be stronger for men than for women. The reason for that is the higher share of household income originating from men rather than from women. However, there is a special situation in Austria concerning legal retirement ages. Women in Austria have earlier retirement ages than men. Also, couples are to a certain degree making joint retirement decisions. Therefore, the joint retirement decision seems to be driven by women. They react to relative price incentives in the pension system stronger than men, since they become eligible for retirement at earlier ages. Falkinger et al. (1996) support this hypothesis. They present evidence that the cross-effect on men's participation rates, resulting from a rise in the women's early retirement age, is almost one half of the direct effect on the women's participation rates. Another country facing a similar situation is Italy. Brugiavini and Peracchi (2004) found that, like in Austria, men respond stronger to changes in *SSW*, while women respond stronger to changes in the *ACC*. So, there seems to be a correlation between different retirement ages for men and women and the relative magnitudes of the *wealth-* and *accrual effects*.

Pension reform attempted to provide incentives for delayed retirement in an increasingly aging population. However, our findings show that this is not straight forward. *Wealth-* and *accrual effects* are working against each other. Also, they work differently for males and females. Therefore, it crucially depends on the particular design of the pension benefit formula to ensure that retirement probabilities do decrease in the age interval of early retirement eligibility.

Let us finally turn to an international comparison of our findings. In order to illustrate the comparative strength of response to financial incentives in Austria, we use the results in Coile and Gruber (2004), Boersch-Supan et al. (2004), Mathieu and Blanchet (2004), and Palme and Svensson (2004). Even though there is no completely uniform technique used across these studies, comparisons allow us to obtain a sufficiently correct ranking. The response to an increase in *SSW* on the probability of retirement in Austria is 107 times higher than in the US, 96 times higher than in France, and 48 times higher than in Sweden. An increase in the *ACC* in Austria changes the probability of retirement by percentage points 2.75 times higher than in the US, 10 times higher than in France, 2.75 times higher than in Sweden, and 1.5 times higher than in Germany. An explanation for this high responsiveness of Austrians is most likely linked to the number of pension pillars. Austrians only rely on the one public pension pillar. Their whole retirement income comes out of this unique source. The United States, on contrary, have a long tradition of 3 or even more pension pillars, so Americans will not respond that strongly to changes in Social Security. France has a state plan and a complementary occupational scheme. Sweden relies on a public plan, a private defined benefit plan, and a private defined contribution plan. Only Germans also heavily rely on the public pillar only. Their responsiveness comes therefore very close to that of Austrians.

Results for control variables largely show expected signs. In line with financial incentives, age and health play a crucial role in the decision to retire.

There are 3 dimensions to our findings for Austria. First, financial incentives to retire work in the expected way: an increase in *SSW* causes an increase in the probability of retirement; an increase in the *ACC* causes a decrease in the retirement probability. Second, there is a difference in response to financial incentives between men and women. Men respond stronger to changes in *SSW* than in the *ACC*. For women, the opposite is true. This internationally reversed pattern points at a joint retirement decision among couples. The decision is driven by the female part, which is likely due to the different legal retirement ages. Third, financial incentives in Austria work stronger than in most OECD countries. There seems to be a correlation between the number of pension pillars and the response to changes in the public pension system. Overall, Austria has a pension system with internationally unique features and behavioral implications.

## 6. Policy Simulations

### 6.1. Simulation Methodology and Scenarios

We are using the estimates to simulate the impact of illustrative reform scenarios on retirement behavior. Therefore, we recalculate the incentive measures for each observation and report them for mean representative agents separate by sex and age (see table 3). Then, we recalculate predicted retirement probabilities (see figure 1).

Each scenario alters the pension formula, inducing changes to the incentive variables *SSW* and *ACC*. Therefore, the predicted retirement probability $\hat{R}$ for a representative agent of age *a* is

$$\hat{R}(a,x) = \beta_1 \overline{SSW(a,x)} + \beta_2 \overline{ACC(a,x)} + \sum \beta_n \overline{Control_n(a)}, \qquad (11)$$

where scenario *x* is either the base case, pre-reform 2000, post-reform 2000, S1 or S2. An over-bar indicates the mean of a variable at a certain age *a*. The betas are the estimated coefficients (table 3). We assume the control variables to be constant and at means by age across all of the simulation scenarios.

There are 3 reform scenarios. First, we are looking at the impact of reform 2000, comparing pre- and post-reform differences. Reform 2000 increased minimum early retirement ages from 60 to 61.5 for men and from 55 to 56.5 for women. The penalty for retiring before the statutory retirement age was raised from 2 to 3 percentage point deduction per year in the replacement rate. Early retirement due to reduced working capacity was abolished. Reform scenario S1 is a hypothetical reform that delays all eligibility ages for early and statutory retirement by 3 years. This implies statutory retirement ages to increase from 65 to 68 for men, and from 60 to 63 for women. All other retirement regulations remain unchanged. The basic idea simulating this reform scenario is a 3 year shift in the distribution of predicted retirement probabilities. Third, scenario S2 is called "common reform" following Gruber and Wise (2004). Therefore, S2 is the most direct way to compare the incentive effects in Austria to other OECD countries, even though it is a highly unrealistic scenario. Early retirement age is 60 for men, 55 for women. The statutory ages are 65 and 60, respectively. There is no disability pension. The replacement rate is fixed at 60 percent of age 65/60 earnings. For each year of early retirement, the pension benefit decreases by 6 percent. Minimum and maximum benefit rules according to Austrian legislation are preserved.

### 6.2. Simulation Results

Figure 1 compares predicted retirement probabilities. In the base case, males have spikes in predicted retirement probabilities at ages 57, 61, and 65. Women have those spikes at ages 56 and 60. The predicted probability of retirement sharply inclines once the early retirement option becomes available. However, men have higher retirement probabilities than women at ages where only a disability pension is available. Most studies in Gruber and Wise (2004) show no or only one pronounced spike at early retirement ages. However, Brugiavini and Peracchi (2004) find in the Italian case multiple spikes similar to Austria.

[Figure 1 about here]

Reform 2000 failed in strengthening the incentives to delay retirement. On contrary, it accomplished an adverse effect increasing all retirement probabilities for both sexes. This failure is partly due to decreasing accruals making it less advantageous to postpone retirement. If for instance the age-60 *ACC* decreases from Euros 12,009 pre-reform to Euros 5,349 post reform, then there is no reason to believe that retirement will be postponed to age 61 to a greater extent. Reform 2000 decreased *SSW* for all retirement ages of men. Therefore, we would expect a negative probability effect for the male *wealth effect*. On the other hand, the *ACC* decreased at most ages. This would imply a positive probability effect for the male *accrual effects*. Overall, the probability of retirement increases for almost all ages compared to the pre-reform 2000 case. This represents a situation in which the positive *accrual effect* dominates the negative *wealth effect*. Thus, reform 2000 failed in providing stronger incentives for delayed retirement for men, mainly because diminishing accruals. For women, *SSW* decreased at all ages, which caused the probability of retirement to decrease. The

*ACC* declines for most ages. Therefore, we would expect the retirement probability to increase. Overall, the *wealth effect* is much smaller than the *accrual effect*. Therefore, the probability of retirement increased at all ages for females.

Simulation S1, a 3 year delay in eligibility ages for early and statutory retirement would have strong effects on the retirement probabilities. It shifts the probability distribution to later ages, but is only effective in postponing retirement at certain ages. For males, *SSW* has no unique direction at all ages. This implies a negative or positive *wealth effect*. Also, the *accrual effect* has not unique direction at most ages, inducing positive or negative *accrual effects*. Between ages 60 to 63 and at age 65, the probability of retirement decreases compared to the base case. In this case, *SSW* goes up or down and *ACC* goes up. The bigger negative *accrual effect* outweighs the *wealth effect*, resulting in a declining probability of retirement. Also, S1 is successful in shifting the peak of the probability of retirement to a later age. For females, *SSW* declines at ages 56, 57, and 60. Hence, the probability of retirement decreases. The *ACC* at these ages inclines, implying a decrease in retirement probabilities. Combined *wealth*- and *accrual effects* working in the same direction cause the probability of retirement to decrease. At all other ages, S1 fails in decreasing retirement probabilities.

Simulation S2, the common reform, is most successful in decreasing the retirement probabilities. It reduces the level of *SSW* by a huge amount compared to all other scenarios. The *ACC* has no unique direction. Therefore, the huge negative *wealth effect* outweighs a smaller *accrual effect*. Hence, the probability of retirement decreases for all ages. Moreover, there are no spikes at early retirement ages for males. For women, S2 shows smaller retirement probabilities at all ages, too. *SSW* decreases strongly, the *ACC* also decreases, but not to a big extent. Therefore, the huge negative *wealth effect* outweighs the weaker positive *accrual effect*. This results in an overall decreasing retirement probability at all ages. The only difference in S2 compared to males is a local spike at age 56 for women.

Simulations show that the particular features of pension plans can yield very different behavioral responses. For legislature, it is important to consider the levels of *SSW*. However, to a greater extent it is even more crucial to consider the *ACC*. This dynamic incentive measure determines the relative price of retirement leisure. In Austria, particularly women respond very strongly to changes in the *ACC*.

**7. Conclusions**

In Austria, the response of older workers to retirement incentives is significant and high in magnitude. Austrian private sector workers respond stronger to financial retirement incentives than workers in comparable OECD countries. Also, Austrians are forward looking in their retirement decision. Changing retirement incentives can be decomposed into a wealth and an *accrual effect*. Both effects work in opposite directions. An increase in *SSW* (*wealth effect*) increases lifetime wealth. Therefore, one can buy more goods including retirement leisure. An increase in the *ACC* (*accrual effect*) makes retirement now more expensive compared to retiring later. For men, the *wealth effect* is greater than the *accrual effect*. For women, in contrast, the *accrual effect* is stronger than the *wealth effect*. The effect of an increase in *SSW* on the probability of retirement is positive and 10 times stronger for men than for women. The effect of an increase in the *ACC* on the retirement probability is negative. Women respond 2 times as strong as men to an increase in the *ACC*. This is remarkable compared to other OECD countries, and most likely due to the different legal retirement ages of men and women in Austria.

The different retirement ages for males and females seem to have unintended consequences for retirement behavior among couples. Though not observable, there seems to be a joint retirement decision driven by the woman's decision to retire. Men who have later legal retirement ages than women do not respond to accrual incentives to the extent women do. They seem to adapt their retirement timing to the decisions of the female part. The similar case of Italy studied in Brugiavini and Peracchi (2004) supports this conclusion. Aside from financial incentives and joint decision making among couples, further important factors of the retirement decision are a person's age and health status.

Illustrative policy simulations show that a change in financial incentives has huge behavioral consequences. In case pension reform targets a delay in actual retirement ages, it is important to increase the accruals. Reform 2000 is an example of shrinking accruals having the adverse effect. Simulation S1, a 3 year delay in all eligibility ages, is partly successful in decreasing the probability of retirement at some ages. Simulation S2, the "common reform" is an extreme policy scenario. Therefore, the decline in the probability of retirement happens at all ages for men and women. This is mainly due to a huge negative wealth effect.

What are the main policy recommendations for Austrian pension reform? Overall, the Austrian pension system needs further reform. Reform so far was not effective in providing incentives to delay retirement. The main directions of change should concern the benefit calculation rules, in particular higher deductions for each year of early retirement. There is also need for action regarding the differences in legal retirement ages for men and women, as well as the handling of disability pensions. Around the millennium, gradual reforms made some steps in the right direction. However, there are numerous exemptions from reform. Also, the time horizon to implement the new regulations to the full extent is more than one decade. It is very difficult to reform a system in which virtually all citizens of a country are beneficiaries. So, it would be urgent to introduce elements of private retirement savings. In contrast to the past practice of gradual reform, legislature in Austria should consider a "Big Bang" reform.

## Appendix of Tables

### Table 1. Summary statistics, birth cohorts 1938-1945

| Variable | Explanation | Males | Females |
|---|---|---|---|
| *R* | Dummy dependent variable, 1 if retired in year *t* conditional on being in the labor force in year *t*-1, 0 otherwise | 0.244 | 0.272 |
| *year* | Year of observation | 1999.740 | 1999.495 |
| *RetYear* | Year of retirement | 2001.656 | 2001.249 |
| *Sex* | Sex | 1 | 0 |
| *YBirth* | Year of birth | 1941.733 | 1942.866 |
| *YearDeath* | Year of death | 2095.167 | 2097.971 |
| *RNEARNNY* | Prospective real net earnings in year *t*+1 (in 1996 Euros) | 17,816 | 11,491 |
| *RNEARNNY2* | RNEARNNY squared | 384,000,000 | 189,000,000 |
| *PE* | Pensionable income according to pension formula (in 1996 Euros) | 411,350 | 281,364 |
| *PE2* | *PE* squared | 196,000,000,000 | 109,000,000,000 |
| *Age53* | Dummy, 1 if aged 53 in year *t*, 0 otherwise | 0.014 | 0.046 |
| *Age54* | Dummy, 1 if aged 54 in year *t*, 0 otherwise | 0.042 | 0.120 |
| *Age55* | Dummy, 1 if aged 55 in year *t*, 0 otherwise | 0.077 | 0.187 |
| *Age56* | Dummy, 1 if aged 56 in year *t*, 0 otherwise | 0.113 | 0.149 |
| *Age57* | Dummy, 1 if aged 57 in year *t*, 0 otherwise | 0.153 | 0.134 |
| *Age58* | Dummy, 1 if aged 58 in year *t*, 0 otherwise | 0.167 | 0.133 |
| *Age59* | Dummy, 1 if aged 59 in year *t*, 0 otherwise | 0.174 | 0.126 |
| *Age60* | Dummy, 1 if aged 60 in year *t*, 0 otherwise | 0.163 | 0.104 |
| *Age61* | Dummy, 1 if aged 61 in year *t*, 0 otherwise | 0.065 | |
| *Age62* | Dummy, 1 if aged 62 in year *t*, 0 otherwise | 0.017 | |
| *Age63* | Dummy, 1 if aged 62 in year *t*, 0 otherwise | 0.009 | |
| *Age64* | Dummy, 1 if aged 64 in year *t*, 0 otherwise | 0.005 | |
| *Age65* | Dummy, 1 if aged 65 in year *t*, 0 otherwise | 0.002 | |
| *HEALTH* | Fraction of time sick or on rehab during work in current year | 0.032 | 0.018 |
| *Production* | Dummy, 1 if working in production sector, 0 otherwise | 0.458 | 0.158 |
| *Blue* | Dummy, 1 if blue collar worker, 0 otherwise | 0.414 | 0.303 |
| *Vienna* | Dummy, 1 if work in Vienna, 0 otherwise | 0.268 | 0.263 |
| *EAustria* | Dummy, 1 if work in Eastern Austria, 0 otherwise | 0.149 | 0.111 |
| *SAustria* | Dummy, 1 if work in Southern Austria, 0 otherwise | 0.119 | 0.101 |
| *Y1999* | Dummy, 1 if observation occurs in year 1999, 0 otherwise | 0.241 | 0.261 |
| *Y2000* | Dummy, 1 if observation occurs in year 2000, 0 otherwise | 0.190 | 0.185 |
| *Y2001* | Dummy, 1 if observation occurs in year 2001, 0 otherwise | 0.133 | 0.115 |
| *Y2002* | Dummy, 1 if observation occurs in year 2002, 0 otherwise | 0.099 | 0.075 |
| *Y2003* | Dummy, 1 if observation occurs in year 2004, 0 otherwise | 0.065 | 0.044 |
| Obs. | | 75,494 | 47,153 |
| Indiv. | | 20,612 | 15,108 |

**Table 2. Share of retirees, by sex and age, birth cohorts 1938-1945**

| *Age* | Males | | | Females | | |
|---|---|---|---|---|---|---|
| | *Base case* | *Pre-2000* | *Post-2000* | *Base case* | *Pre-2000* | *Post-2000* |
| 53 | 0.058 | 0.058 | | 0.015 | 0.015 | |
| 54 | 0.053 | 0.053 | | 0.017 | 0.017 | |
| 55 | 0.071 | 0.071 | | 0.431 | 0.431 | |
| 56 | 0.071 | 0.068 | 0.109 | 0.315 | 0.295 | 0.435 |
| 57 | 0.194 | 0.182 | 0.241 | 0.202 | 0.177 | 0.263 |
| 58 | 0.174 | 0.159 | 0.209 | 0.178 | 0.155 | 0.211 |
| 59 | 0.123 | 0.121 | 0.126 | 0.132 | 0.133 | 0.131 |
| 60 | 0.558 | 0.631 | 0.468 | 0.708 | 0.626 | 0.775 |
| 61 | 0.661 | 0.563 | 0.709 | | | |
| 62 | 0.440 | 0.323 | 0.478 | | | |
| 63 | 0.335 | | 0.335 | | | |
| 64 | 0.226 | | 0.226 | | | |
| 65 | 0.789 | | 0.789 | | | |

*Notes:* Table shows the share of retirees of an age group given that one has not already retired. For males and females, 3 cases are distinguished: the base case representing the whole panel from 1998 to 2003, the panel pre-reform 2000, and the panel post-reform 2000. The statutory retirement age is 65/60 (men/women), the minimum early retirement age is 60/55 (men/women). Prior to early retirement, the only retirement option is a disability pension.

**Table 3. Age profile of *SSW* and *ACC*, birth cohorts 1938-1945**

*SOCIAL SECURITY WEALTH (SSW)*

| *Age* | Males | | | | | Females | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Base case* | *Pre-2000* | *Post-2000* | *S1* | *S2* | *Base case* | *Pre-2000* | *Post-2000* | *S1* | *S2* |
| 53 | 255,425 | 255,425 | | | 0 | 234,909 | 234,909 | | | 0 |
| 54 | 270,665 | 270,665 | | | 0 | 232,398 | 232,398 | | | 0 |
| 55 | 275,810 | 275,810 | | | 0 | 238,683 | 238,683 | | | 149,510 |
| 56 | 277,419 | 279,400 | 256,576 | 277,419 | 0 | 243,624 | 244,933 | 235,796 | 235,868 | 168,786 |
| 57 | 275,453 | 276,840 | 270,063 | 276,207 | 0 | 242,416 | 248,397 | 228,230 | 236,038 | 177,017 |
| 58 | 281,327 | 283,752 | 275,425 | 278,952 | 0 | 240,142 | 248,697 | 227,594 | 249,305 | 186,472 |
| 59 | 283,301 | 284,776 | 280,652 | 278,722 | 0 | 238,531 | 246,876 | 229,828 | 251,255 | 193,726 |
| 60 | 295,759 | 296,029 | 295,425 | 281,278 | 90,520 | 242,726 | 242,282 | 243,090 | 257,010 | 198,299 |
| 61 | 285,613 | 306,399 | 275,278 | 284,837 | 93,445 | 260,750 | 255,465 | 264,315 | | |
| 62 | 281,134 | 314,334 | 270,180 | 305,399 | 141,404 | 271,347 | 276,285 | 269,720 | | |
| 63 | 260,236 | | 260,236 | 319,260 | 191,154 | 302,902 | | 302,902 | | |
| 64 | 253,110 | | 253,110 | 310,329 | 245,165 | 293,048 | | 293,048 | | |
| 65 | 274,149 | | 274,149 | 325,692 | 263,819 | 287,084 | | 287,084 | | |

*ACCRUAL (ACC)*

| *Age* | Males | | | | | Females | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Base case* | *Pre-2000* | *Post-2000* | *S1* | *S2* | *Base case* | *Pre-2000* | *Post-2000* | *S1* | *S2* |
| 53 | 1,893 | 1,893 | | | 0 | 1,463 | 1,463 | | | 0 |
| 54 | 3,986 | 3,986 | | | 0 | 11,860 | 11,860 | | | 0 |
| 55 | 3,619 | 3,619 | | | 0 | 14,659 | 14,659 | | | 8,262 |
| 56 | 2,063 | 2,368 | -1,143 | 2,533 | 0 | 13,234 | 15,656 | -1,253 | 3,187 | 7,193 |
| 57 | 3,456 | 4,966 | -2,413 | 1,381 | 0 | 9,051 | 13,316 | -1,067 | 19,137 | 6,240 |
| 58 | 1,992 | 2,869 | -144 | 1,618 | 0 | 6,914 | 11,512 | 171 | 10,939 | 5,806 |
| 59 | 14,682 | 21,743 | 2,006 | 5,069 | 0 | 13,517 | 9,210 | 18,009 | 14,718 | 5,890 |
| 60 | 9,034 | 12,009 | 5,349 | -1,174 | 4,878 | 6,085 | 5,934 | 6,208 | 7,558 | 5,394 |
| 61 | 5,484 | 12,108 | 2,189 | 22,891 | 4,573 | 4,596 | 3,550 | 5,302 | | |
| 62 | 1,234 | -1,480 | 2,130 | 22,995 | 4,331 | 20,198 | -3,840 | 28,119 | | |
| 63 | 1,419 | | 1,419 | 1,738 | 5,441 | -7,061 | | -7,061 | | |
| 64 | 35,157 | | 35,157 | 32,857 | 7,592 | -1,600 | | -1,600 | | |
| 65 | 17,797 | | 17,797 | 10,606 | 7,810 | 6,667 | | 6,667 | | |

*Notes*: Numbers show age profiles of the incentive measures for mean representative agents in 1996 Euros. The table compares 4 different scenarios: the base case (basic data as observed and used in the regressions), pre- and post-reform 2000, simulation S1 (delay in all retirement eligibility ages by 3 years), and simulation S2 (common reform; no disability option, replacement rate for men/women at ages 65/60 is sixty percent, each year of early retirement reduces the age 56/60 benefit by 6 percent).

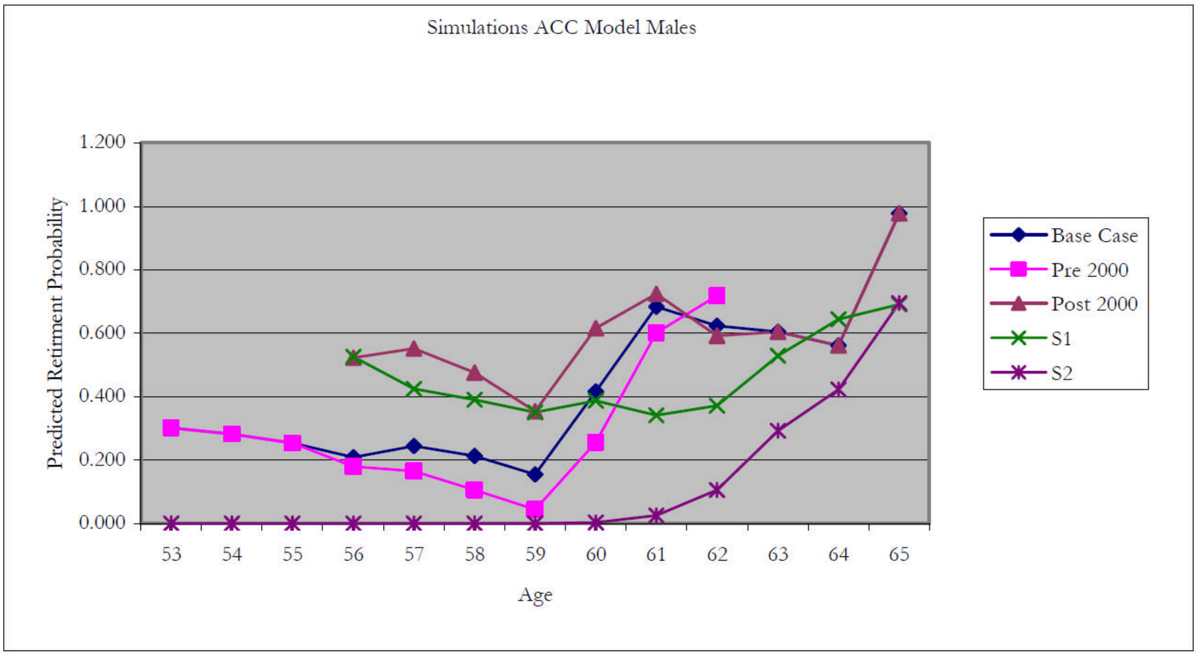
**Table 4. Linear probability model (fixed effects)**

| Variable | Males | Females |
|---|---|---|
| *SSW* | 0.096 | 0.009 |
| | (57.18)** | (3.91)** |
| *ACC* | -0.011 | -0.021 |
| | (9.39)** | (10.86)** |
| *RNEARNNY* | 0.107 | 0.022 |
| | (13.28)** | (1.38) |
| *RNEARNNY2* | 0 | 0 |
| | (8.46)** | (0.59) |
| *PE* | -219.589 | 29.249 |
| | (8.96)** | (1.37) |
| *PE2* | 0 | 0 |
| | (14.41)** | (1.72) |
| *Age54* | -0.092 | -0.166 |
| | (7.69)** | (19.59)** |
| *Age55* | -0.201 | 0.04 |
| | (17.09)** | (5.08)** |
| *Age56* | -0.317 | -0.013 |
| | (25.94)** | (1.74) |
| *Age57* | -0.307 | -0.162 |
| | (23.27)** | (22.70)** |
| *Age58* | -0.41 | -0.289 |
| | (28.03)** | (43.39)** |
| *Age59* | -0.537 | -0.444 |
| | (32.80)** | (67.49)** |
| *Age60* | -0.356 | |
| | (19.42)** | |
| *Age61* | -0.094 | |
| | (4.61)** | |
| *Age62* | -0.167 | |
| | (7.12)** | |
| *Age63* | -0.103 | |
| | (3.84)** | |
| *Age64* | -0.202 | |
| | (6.69)** | |

**Table 4 continued**

| Variable | Males | Females |
|---|---|---|
| *HEALTH* | 0.436 | -0.07 |
| | (28.93)** | (2.42)* |
| *Production* | -0.222 | -0.177 |
| | (22.97)** | (7.28)** |
| *Blue* | 0.015 | 0.001 |
| | (1.39) | (0.05) |
| *Vienna* | 0.25 | 0.166 |
| | (19.12)** | (8.52)** |
| *EAustria* | 0.053 | -0.054 |
| | (2.79)** | (1.55) |
| *SAustria* | -0.105 | -0.05 |
| | (4.41)** | (1.16) |
| *Y1999* | 0.272 | 0.304 |
| | (59.30)** | (49.66)** |
| *Y2000* | 0.447 | 0.446 |
| | (65.06)** | (60.89)** |
| *Y2001* | 0.635 | 0.606 |
| | (66.96)** | (88.53)** |
| *Y2002* | 0.841 | 0.81 |
| | (69.10)** | (94.03)** |
| *Y2003* | 1.122 | 1.074 |
| | (77.81)** | (95.43)** |
| *Constant* | -0.975 | -0.301 |
| | (13.85)** | (5.65)** |
| R-squared (within) | 0.51 | 0.48 |
| Correctly predicted R=1 | 0.452 | 0.405 |
| Observations | 75,494 | 47,153 |
| Number of Persons | 20,612 | 15,108 |

*Notes*: Coefficient estimates of retirement probability, linear probability model. *SSW*, *ACC*, *RNEARNNY* (2), and *PE* (2) are in units of 10,000 Euros. Units are in real terms. Absolute value of t-statistics in parentheses. * Significant at 5 percent; ** significant at 1 percent.



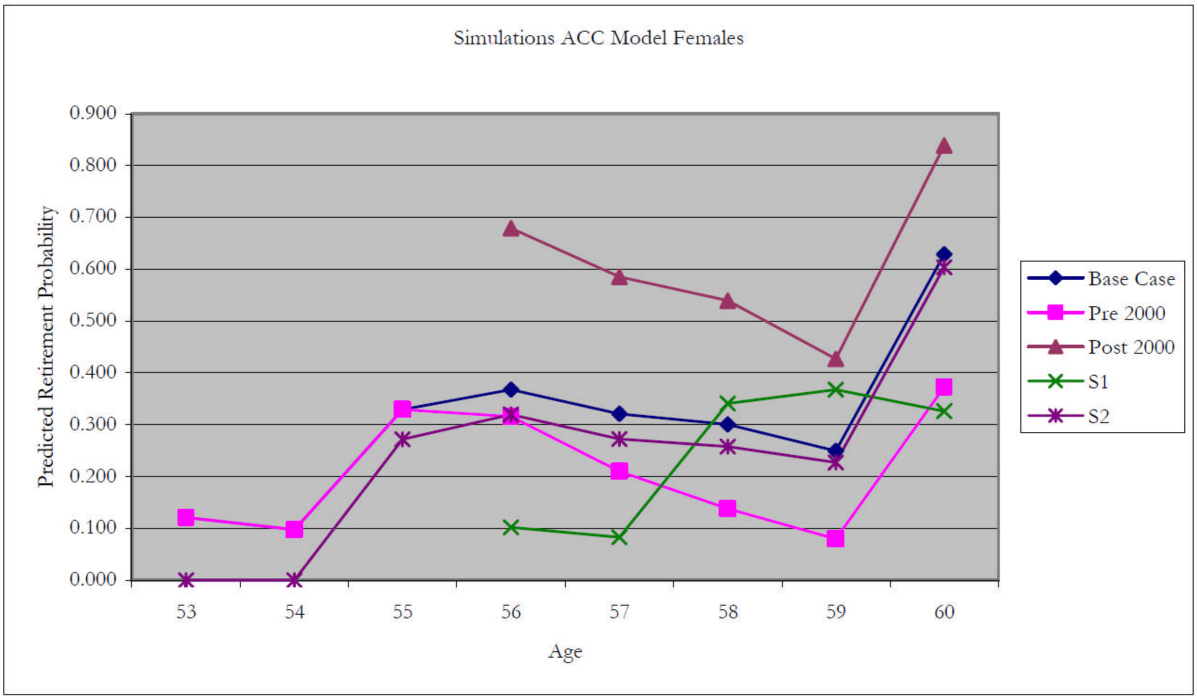




**Figure 1. Age profile of predicted retirement probabilities, by sex.**

*Notes:* Predicted retirement probabilities at various ages. The table compares the age profiles for mean representative agents. There are 4 different scenarios: the base case, pre- and post-reform 2000, simulation S1 (delay in all retirement eligibility ages by 3 years), and simulation S2 (common reform; no disability option, replacement rate for men/women at ages 65/60 is sixty percent, each year of early retirement reduces the age 56/60 benefit by 6 percent). The retirement probabilities are calculated by predicting the probability of retirement for each observation, then averaging these probabilities by age. For each observation, incentive measures are recalculated according to pension formula in S1 and S2.

**References**


Administration, U.S. Social Security. 2004. *Social security programs throughout the world: Europe, 2004*. Washington D.C.: United States Social Security Administration.

Austria, Republic of. 1955. Allgemeines Sozialversicherungsgesetz [General Social Insurance Act], Bundesgesetzblatt. no. 189/1955.

________. 1996. Strukturanpassungsgesetz [Structural Adaption Act], Bundesgesetzblatt. no. 201/1996.

________. 1997. Arbeits- und Sozialrechts-Aenderungsgesetz [Labor- and Social Law Amendment Act], Bundesgesetzblatt. I no. 139/1997.

________. 2000. Sozialversicherungs-Aenderungsgesetz [Social Insurance Amendment Act ], Bundesgesetzblatt. I no. 43/2000.

________. 2003a. Erstes Sozialversicherungs-Aenderungsgesetz [First Social Insurance Amendment Act], Bundesgesetzblatt. I no. 8/2003.

________. 2003b. Zweites Sozialversicherungs-Aenderungsgesetz [Second Social Insurance Amendment Act], Bundesgesetzblatt. I no. 145/2003.

Boersch-Supan, Axel, Reinhold Schnabel, Simone Kohnz, and Giovanni Mastrobuoni. 2004. Micro-modeling of retirement decisions in Germany. In *Social security programs and retirement around the world: Micro estimation*, ed. Jonathan Gruber and David A. Wise: 285-344. Chicago: University of Chicago Press.

Brugiavini, Agar, and Franco Peracchi. 2004. Micro-modeling of retirement behavior in Italy. In *Social security programs and retirement around the world: Micro estimation*, ed. Jonathan Gruber and David A. Wise: 345-398. Chicago: University of Chicago Press.

Coile, Courtney, and Jonathan Gruber. 2004. The effect of Social Security on retirement in the United States. In *Social security programs and retirement around the world: Micro estimation*, ed. Jonathan Gruber and David A. Wise: 691-730. Chicago: University of Chicago Press.

Databank. 2006. Labor market databank of the Austrian Labor Market Service and the Federal Ministry of Economics and Labor. Available from http://arbeitsmarktdatenbank.at, accessed August 22, 2006.

________. 2007a. Austrian Chamber of Commerce: Pro-Kopf-Einkommen der Arbeitnehmer [Per capita income of employees]. Available from www.wko.at/Extranet/Langzeit/Lang-Einkommen.pdf, accessed July 1, 2007.

________. 2007b. Statistics Austria: Jaehrliche Sterbetafeln seit 1947 [Annual life tables since 1947]. Available from http://www.statistik.at/web_de/statistiken/bevoelkerung/demographische_masszahlen/sterbetafeln/index.html, accessed September 10, 2007.

________. 2007c. United Nations Statistics Division, Common Database: Economically active population by sex, 13 age groups. Austria 1950-2010. Available from http://ezproxy.gsu.edu:5051/unsd/cdb/cdb_series_xrxx.asp?series_code=4230, accessed July 12, 2007.

Falkinger, Josef, Rudolf Winter-Ebmer, and Josef Zweimueller. 1996. Retirement of spouses and social security reform. *European Economic Review* 40, no. 2: 449-472.

Feldstein, Martin. 1974. Social security, induced retirement, and aggregate capital accumulation. *The Journal of Political Economy* 82, no. 5: 905-926.

Friedman, Milton. 1957. *A theory of the consumption function*. Princeton: Princeton University Press.

Fields, Gary S., and Olivia S. Mitchell. 1984. *Retirement, pensions, and social security.* Cambridge, Mass.: MIT Press.

Gruber, Jonathan, and David A. Wise, eds. 1999. *Social security and retirement around the world*. A National Bureau of Economic Research conference report. Chicago: University of Chicago Press.

________. 2004. *Social security programs and retirement around the world: Micro estimation*. A National Bureau of Economic Research conference report. Chicago: University of Chicago Press.

Hauptverband. Various years-a. Beitragsrechtliche Werte in der Sozialversicherung [Social security contributions], ed. Austrian Social Security Administration. Vienna: Hauptverband der Sozialversicherungstraeger.

________. Various years-b. Veraenderliche Werte gemaess § 108 Abs. 4 ASVG [Valuation factors according to § 108 Abs. 4 General Social Insurance Act], ed. Austrian Social Security Administration. Vienna: Hauptverband der Sozialversicherungstraeger.

Hofer, Helmut, and Reinhard Koman. 2006. Social security and retirement incentives in Austria. *Empirica* 33, no. 5: 285-313.

ILO. 2005. LABORSTA: Labor Force Survey 2005. Available from http://laborsta.ilo.org, accessed May 15, 2008.

Knell, Markus, Walpurga Koehler-Toeglhofer, and Doris Prammer. 2006. The Austrian pension system: How recent reforms have changed fiscal sustainability and pension benefits. *Monetary Policy and the Economy* (Austrian National Bank) 3, no 2: 69-93.

Mathieu, Ronan, and Didier Blanchet. 2004. Estimating models of retirement behavior on French data. In *Social security programs and retirement around the world: Micro estimation*, ed. Jonathan Gruber and David A. Wise: 235-284. Chicago: University of Chicago Press.

Modigliani, Franco, and Richard Brumberg. 1954. Utility analysis and the consumption function: An interpretation of cross-section data. In *Post Keynesian economics*, ed. Keneth K. Kurihara: 388-436. New Brunswick: Rutgers University Press.

OECD. 2005. *Ageing and employment policies: Austria*. Paris: OECD.

Palme, Marten, and Ingemar Svensson. 2004. Income security programs and retirement in Sweden. In *Social security programs and retirement around the world: Micro estimation*, ed. Jonathan Gruber and David A. Wise: 579-642. Chicago: University of Chicago Press.

Raab, Roman. 2008. *Pension reform and retirement incentives: Evidence from Austria*. Georgia State University: Electronic Theses and Dissertation Database. Available from http://etd.gsu.edu/theses/available/etd-07312008-120625/.

Samwick, Andrew A. 1998. New evidence on pensions, social security, and the timing of retirement. *Journal of Public Economics* 70, no. 2: 207-36.

Stock, James H., and David A. Wise. 1990. Pensions, the option value of work, and retirement. *Econometrica* 58, no. 5: 1151-1180.