Published in final edited form as:
J Pension Econ Financ. 2014 April ; 13(2): 145–171. doi:10.1017/S1474747213000292.

Male Labor Force Participation and Social Security in Mexico

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Abstract

Labor-force participation among Mexican males in their early retirement years (60 to 64 years of age) has decreased in recent decades, from 94.6 percent in 1960 to 65.2 percent in 2010. Similar trends are evident elsewhere in Latin America, and have occurred in the developed world. Such trends pose challenges to financial sustainability of social security systems as working-age populations decrease and those in retirement increase both because of demographic trends and decisions to take early retirement. In this study, we find that the Mexican social security system provides incentives to retire early. The retirement incentives of the Mexican social security system affect retirement behavior, and may be one of the main contributors to early retirement decisions, particularly for lower-income populations. We simulated the effect of the reform from a Pay-As-You-Go (PAYG) to the new Personal Retirement Accounts (PRA) system and we find that the PRA system also provides incentives to early retirement. Further analysis is needed to assess the financial sustainability of the social security system and financial security in old age for the largest cohorts in Mexico that will begin to retire by 2040.

Keywords

Retirement Incentives; Labor Force Participation; Social Security System

1. Introduction

According to the Mexican Census Bureau (the Instituto Nacional de Estadística y Geografía, INEGI), labor force participation for males aged 60 to 64 has decreased from 94.6 percent in 1960 to 65.2 percent in 2010. A similar shift in early retirement is evident in other Latin American countries (CISS, 2005; Alvarez et al., 2009). Previous literature indicates that these trends are similar to those experienced in developed countries, which have also seen a sharp decline in labor force participation among men of retirement age from the 1960s

*Acknowledgements: I am grateful for the advice and support of Costas Meghir. I also wish to thank Orazio Attanasio, James Banks, Arie Kapteyn, Gabriel Martinez, James P. Smith, Arthur Van Soest, Shelley Wiseman, and anonymous referees for their valuable comments, Beth Soldo and Rebeca Wong for access to, and their advice on, the MHAS data sets, and Nelly Mejia and Alfonso Rivera for their excellent research assistance. This study was supported by CONACYT and the National Institute of Aging (NIA) funded program project "International Comparisons of Well-Being, Health and Retirement" 2P01AG022481-06.

[18]See articles 78, 79, and 80 of the Income Tax Law (SCHP, 2000; SHCP, 2001); articles 110, 112, and 113 of the Income Tax Law (SHCP, 2002; SHCP, 2003); and articles 27, 28, and 32 of the Social Security Law (IMSS, 1994) for the definitions of taxable income and deductibles.

[24]We assume the same life expectancy for lower- and higher-income individuals. The World Bank and the International Monetary Fund (2006) provide a detailed description of the annuities market in Mexico and mentions that insurance companies use a specific mortality table prepared by the government Insurance Supervisory Authority (CNSF) for males and another one for females based on population averages. In our simulations, we use the same mortality table for males.

through the late 1980s (cf. e.g. Mitchell and Fields, 1982; Costa, 1998; Blöndal and Scarpetta, 1999; Gruber and Wise, 1999).

One of the causes for the sustained decline in male labor force participation has been incentives for early retirement in the design of social security systems and employer-provided retirement plans (Hurd, 1990; Ruhm, 1995; Rust and Phelan, 1997; Lumsdaine and Mitchell, 1999; Gruber and Wise, 1999; Gruber and Wise, 2004; French 2005). Gruber and Wise (2004) in particular note that social security systems have contributed to the decline in male labor force participation around retirement age in the U.S.[1], the UK, Belgium, Canada, Denmark, France, Germany, Italy, the Netherlands, Spain, Sweden, and Japan.

This article examines how the social security system affects retirement behavior in Mexico. We use data from the Mexican Health and Aging Study (MHAS), a survey of Mexicans at least 50 years of age and equivalent to the U.S. Health and Retirement Study (HRS). In particular, we analyze retirement behavior of men aged 50 to 69 who work in the formal sector and are enrolled to the Mexican Social Security Institute (IMSS). We assess transitions to retirement using MHAS panel data from 2000 to 2003 to understand whether incentives of the social security system affect retirement decisions.

IMSS undertook a major pension reform in 1997, switching the pay-as-you-go (PAYG) system to a fully funded system with personal retirement accounts (PRAs). Individuals 50 years old or above in the MHAS who retired between 2000 and 2003 only contributed between three and six years to the PRA system and prefer to claim PAYG benefits. We analyze effects of the PAYG social security system on retirement decisions and simulate the impact of a pension reform to a PRA system on retirement behavior, assuming individuals had contributed to such a system throughout their working life. The MHAS data allow us to construct social security wealth and retirement incentive measures for individual respondents. We estimate single-year accrual, peak-value (Coile and Gruber, 2007), and option-value (Stock and Wise, 1990) retirement-incentive measures. We use these to compare the opportunity cost of retiring today with that of retiring in the future for each individual.

The few studies on this topic for Latin American countries include Miranda-Muñoz (2004), Cerda (2005), Lanza Queiroz (2007), Alvarez et al. (2010), Miranda-Muñoz (2011), and Sauré et al. (2011). Miranda-Muñoz (2011) used 1991 to 2000 data from Mexico's cross-sectional National Employment Survey (ENE) to construct a pseudo-panel using cohort techniques. She found that the youngest cohorts have the fewest incentives to delay retirement. She attributed this decline in incentives to the decrease in real wages and social security wealth resulting from economic downturns in Mexico during the 1990s. Social security wealth is linked to wages prior to retirement in the PAYG system. Hence, changes to real wages affect retirement decisions. Sauré et al. (2011) find that for OECD countries, occupation also influences retirement behavior. They do not find such evidence for the Mexican case.

[1]Recent studies for the 1990s and 2000s have found that this trend is reversing in the United States. For example, Blau and Goodstein (2010) find that current cohorts reaching retirement age have higher levels of education than previous cohorts, and better-educated workers tend to retire later.

Our analysis indicates that the Mexican social security system induces early retirement. This is in part because of a replacement rate, that is, the proportion of pre-retirement income that the social security benefits replaces, which is effectively fixed higher for lower-income individuals not yet 65. This is the minimum pension guarantee (MPG) of the system, equal to the minimum wage in Mexico City. As soon as a worker's retirement benefits are above the MPG, the replacement rate increases as long as the worker contributes to the system. As a result, higher-income individuals may have an incentive to work longer.

We find that a worker's social security wealth increases his probability of retiring, but that incentive measures can encourage delaying retirement. These results are consistent with the findings in Gruber and Wise (2004). Our simulations of changes in retirement behavior resulting from the 1997 reform in Mexico also indicate that the PRA system provides incentives to retire early as individuals become eligible at age 60 to claim the MPG. Overall, we expect the PRA system to reduce the average retirement age only slightly. And, indeed, we find that the average retirement age changes from 62 in PAYG to 60 in the PRA system.

Analyzing retirement patterns is essential to understanding early retirement trends affecting the financial sustainability of social security systems, especially in countries where populations are aging and living longer. The older population in Mexico is expected to increase 232 percent by 2040—a higher rate of growth than that expected in 10 other Latin American countries, including Brazil, Peru, and Guatemala. The number of persons aged 65 or older to those 15 to 64 years of age, that is, the old-age dependency ratio, is also expected to increase from 8 percent in 2000 to 30 percent in 2050, a level which would approach that year's projected U.S. ratio of 34 percent. This is in large part because a large cohort born in Mexico between 1980 and 2005 will begin to retire by 2040 (Aguila et al., 2011). Our results suggest that the reform of the PAYG to a PRA system will also induce many individuals of those large cohorts enrolled in the social security system to retire early.

In the next section of this paper, we describe the Mexican labor market and explain in detail the design and eligibility plans of the social security system. In Section 3, we provide an overview of the data used in this study. In Section 4, we describe how we estimated retirement incentives for each year after a worker becomes age-eligible. In Section 5, we present the results of a probit regression model, which includes social security wealth and the estimates of the incentives to retire as its explanatory variables for assessing the effects of PAYG system rules and incentives on retirement decisions in Mexico. In Section 6, we present simulations of changes in retirement behavior due to the 1997 shift from a PAYG to a PRA system. In Section 7, we present our conclusions.

2. Mexico's labor market and institutional context

2.1 Overview

Most Mexican workers—58 percent—work in the "informal" employment sector (Perry et al., 2007) and do not make mandatory contributions to a social security system. They work part time, or independently, or for noncompliant private-sector firms—more often in rural areas and in small firms with one to five employees. Government-paid non-contributory pension programs were introduced in 2001 for the growing segment of the population that

reaches retirement without social security coverage. The government non-contributory pension is much smaller than the social security benefits received by workers in the formal sector. In 2001, about one-third of income for people in their 70s and nearly one-fifth for those 80 or older still came from wages, bonuses, or business income—a possible consequence of the social security system not being mandatory for the self-employed (Aguila et al., 2011).

In contrast, the 42 percent of Mexican workers in the "formal" sector are private-sector and government workers who contribute to social security and receive social security and health care benefits when they retire. Private-sector workers contribute to the IMSS, which covered 32.9 percent of all Mexican workers in 2011 (INEGI, 2012; IMSS 2012). Government and other public-sector workers contribute to the Social Security and Services Institute for State Workers (ISSSTE). ISSSTE covered 5.8 percent of all Mexican workers in 2011 (ISSSTE, 2012). Other institutions in Mexico, such as the army, navy, state governments, and municipalities, provide their own social security services but enroll smaller numbers of workers. There is no portability of retirement and health care benefits across social security institutions.

In 1997, IMSS reformed the PAYG plan and replaced it with a fully funded system of PRAs. The "new-generation" of workers who entered the labor market after the reform can only claim social security benefits under the PRA rules. The "transition-generation" of workers who contributed previously to PAYG and then to the new PRA system has a choice. When they retire, they can choose to receive social security benefits under *either* the PAYG or PRA rules;[2] individuals choose the plan that pays the highest benefits. Those individuals that do not satisfy PRA requirements for 25 years of contribution but do satisfy the 10-year contribution requirement for the PAYG system may only choose social security benefits under the PAYG rules.

Aguila (2011) finds that transition-generation individuals choose to retire under PRA rules only when they have made contributions for at least 22 years to the PRA (and thus 3 years to the PAYG to satisfy the PRA's minimum contribution requirement). Those with fewer than 22 years of contributions in the PRA but at least 25 years of contribution to both systems combined choose to retire under the PAYG rules because the PAYG system has higher benefits. The cohorts of workers we analyze in this study were born between 1931 and 1951 and have contributed most of their working life to the PAYG and only from 3 to 6 years to the PRA system. The rules setting retirement incentives for these cohorts are those of the PAYG system. We will describe the rules of the IMSS PAYG system that affect retirement behavior for men.[3]

[2]Individuals that contributed to the social security system between 1992 and 1997 also have retirement funds accumulated at SAR (Retirement Savings System), complementary personal retirement accounts introduced in 1992. The 1992 Mexican pension reform is described in more detail in Aguila (2011). The SAR awarded funds as a one-off payment at retirement. We do not consider any SAR retirement incentives.

[3]We did not include workers with social security benefits from ISSSTE because the data available do not allow us to identify some of the components needed to estimate their social security benefits.

2.2. Normal and early retirement under the PAYG system

The PAYG system is a defined-benefit system and benefits can be claimed through "normal" or "early" retirement. Normal retirement age in Mexico is 65. IMSS requires at least 10 years of contributions to retire under PAYG rules. Social security benefits are computed as a proportion of the average wage in the five years before retirement, and benefits increase for each year of contribution beyond the required 10 years. Under the PAYG rules, the minimum pension guarantee (MPG), that is the minimum social security benefits individuals can receive, social security benefit is equal to the minimum wage in Mexico City.

For transitions to and from the formal sector during working life, IMSS recognizes previous contributions to the PAYG system.[4] Retirement is "early" if taken from age 60 to 64. Under PAYG rules, benefits are reduced by 5 percent for each year below the normal retirement age. For example, an individual who retires at age 60 will receive 75 percent of the normal retirement social security benefits.

We present in Figure 1 the old-age pension replacement rate, i.e., the pension or social security benefits as a proportion of the wage previous to retirement, from ages 60 to 70 for various levels of labor income expressed as a multiple of the minimum wage. The old-age pension replacement rate measure shows the effectiveness of the social security system at replacing pre-retirement wages with retirement income. The pension replacement rate is computed assuming 10 years of contributions at age 60 and one additional year of contribution for each additional year in the labor force.

The replacement rate is 100 percent for individuals earning the minimum wage, as they receive the MPG. The replacement rate is flat before age 65 for lower-income workers claiming the MPG. Higher-income individuals do not claim the MPG and the replacement rate increases the longer they stay in the system. Higher-income individuals have fewer incentives to retire early because the replacement rate increases the longer they stay in the system in comparison to lower-income workers that claim the MPG.[5]

The penalty for retiring below the normal retirement age is actuarially equivalent to retiring at 65, because the present value of the early retirement social security benefits is equal to the social security benefits at age 65 except for those that claim the MPG. After age 65, social security benefits increase with additional years of contribution; Mexico has no mandatory retirement age.

2.3. Other retirement benefits and eligibility criteria

In the U.S. and the UK, dependent benefits induce couples to retire jointly. In Mexico, retiring male workers, including those that claim the MPG, obtain additional benefits

[4]When a worker returns to work in the formal sector within three years of having left it, all of his previous social security contributions to IMSS are recognized. If the worker returns to work within a period of three to six years, all previous contributions are recognized after the worker spends at least six months making contributions. If the worker re-enters after six years, all previous contributions are recognized after the worker spends at least one year making contributions to the system. See Article 151 of the Social Security Law, IMSS (1994).

[5]This design of the social security system is valid since 1994.

equivalent to 15 percent of their social security benefits. But the male worker receives these benefits whether or not he has a wife and independent of whether the wife is still working or receives social security benefits. The bottom line: every male retiree receives an extra benefit in the amount of 15 percent of his social security benefits.[6]

In the Mexican system, survivor benefits are paid to the wife if a male worker dies while working or drawing retirement benefits. These benefits are paid independent of whether the male worker retired early or at normal retirement age. There are no survivor benefits for a husband unless he was financially dependent on his wife's income.[7]

Also, when a formal-sector transition-generation worker retires and claims benefits under PAYG rules, and then begins working again, he continues to receive his benefits. There is no earnings test in Mexico. If he takes a job in the informal sector after claiming benefits, he will not contribute to a social security system and the job in the informal sector will not affect his PAYG benefits. If he takes a job in the government, he will contribute to the public-sector social security system (ISSSTE) and receive benefits later if he qualifies, without regard to PAYG benefits, because the two social security systems are unconnected.

Fewer than 10 percent of private firms in Mexico offer an optional pension benefit in addition to the IMSS social security system (Hewitt Associates, 2005). There is, however, no official information on the number of workers enrolled in private pensions, which have been introduced only in recent decades.

3. Data overview

In this study, we use data from the Mexican Health and Aging Study (MHAS), a two-wave panel obtained in 2001 (the first wave) and 2003 (the second wave) for men and women born in 1951 or earlier. The data set is nationally representative and has information on demographic and employment characteristics, health status, access to health-care services, receipt of family transfers (cash or other support from family members), and wealth for respondents in 9,862 households. Spouses of age-eligible individuals were also interviewed, even if they themselves were not age-eligible.

In the first wave, individuals were interviewed between May and August of 2001, with a response rate of 89.7 percent. MHAS (2004) shows that the 2001 sample's demographic and socioeconomic characteristics are similar to nationally representative surveys from the 2000 Mexican Census, the 2000 Mexican National Employment Survey (ENE)[8], the 2000 Mexican National Health Survey, and the Mexican National Income and Expenditure Survey 2000, suggesting that the non-response does not introduce sample selection problems. In the second wave, individuals were interviewed from June to September 2003, with a response rate of 94.2 percent (MHAS, 2004; Wong and Espinoza, 2004).

[6]In addition, workers can claim an additional 10 percent benefit for each child less than 16 years old or for each child less than 26 years old who is disabled and financially dependent. Single workers with no children can claim 10 percent of social security benefits for each parent who is financially dependent. See Article 134 and 138 of the Social Security Law (IMSS, 1994).

[7]See Article 130 of the Social Security Law (IMSS, 1994).

[8]ENE, the National Employment Survey in Mexico, was administered in 1988, 1991 and 1993, annually from 1995 to 2000, and quarterly since. ENE 2000 includes the results of 163,838 households and 436,344 individual observations.

To extend our analysis back to 2000 and include other information on employment characteristics, we merged MHAS data with ENE 2000 data for the same individuals.[9] We also reconstructed 2002 information from retrospective questions of the MHAS 2003 questionnaire. Altogether, we identified a sample of 802 males working and contributing to IMSS who were 50 to 69 years old in 2000. We checked for any potential issues in terms of attrition in the panel. We compared the characteristics of individuals in the 2001 MHAS wave from the panel to the 2001 characteristics of those that died, refused or were not contacted in the 2003 wave. We found that the differences between these groups are not statistically significant. The latter may indicate no sample selection problems due to attrition. In our sample, only 45 individuals attrited from MHAS between the two waves.

Our sample yielded 3,208 person-year observations from 2000 to 2003. The number of retirement-age individuals who stopped working during this time is 215, of whom 45 later re-entered the labor market.[10] The remaining 587 individuals continued working through the observed span, so these observations are right censored; i.e., we do not observe their age of retirement. Table 1 shows the main characteristics of our sample of male workers 50 to 69 years of age who contributed to IMSS.

The mean age of the sample is 56.65 and 89 percent of the individuals have a spouse. The number of residents per household is 4.55, indicating that older adults cohabit with other family members. Fifty three percent of the sample has basic schooling and 11 percent has no schooling. Most males live in urban areas. Nearly all are blue-collar, service, or white-collar workers. Their monthly mean earnings is 449.46 dollars and have an average tenure on their principal job of 23.32 years. Most live in urban areas.

To analyze and compute social security benefits, we use MHAS information about years of contribution to IMSS and current earnings. MHAS does not include earnings histories, so we built earning profiles using data from employment surveys we describe below.

3.1. Earnings profiles

We constructed cohort earnings profiles using the National Urban Employment Survey (ENEU) from 1988 to 2003. The cohort cells only include individuals working and contributing to IMSS.[11] We estimated earnings history with the equation (see Blundell, Meghir, and Smith, 2004):

$$Y_{igt}=\theta_i Y_{gt} \quad (1)$$

[9]The restricted-use linked file was created by the INEGI/Mexico in collaboration with the MHAS research team under NIA/NIH grant number AG18016.

[10]In the empirical analysis we only consider individuals working and enrolled to IMSS before their first retirement. We do not consider individuals that re-enter the labor force after retiring. We consider the first retirement as full retirement because it is generally from the principal activity individuals have performed through working life and are entitled to receive full social security benefits. It is beyond the scope of this paper to analyze patterns of re-entry to the labor market because if any individuals contribute to a social security institute while in these jobs for a shorter period of time it is quite likely they will not receive social security benefits. We follow the same strategy as in Coile and Gruber (2007).

[11]We did not include seasonal workers because they correspond to the temporary regime of enrollment in IMSS, which was not included in the social security system before the 1997 reform.

θ_i is an individual fixed effect that is estimated as $\theta_i = Y_{ig2000} / Y_{g2000}$ in order to adjust for differences among individuals in the same cohort and education group (g). We use the labor income information from 2000 reported in ENE from the exact same individuals who were also interviewed in the MHAS to adjust past earnings history for each individual.[12]

Five percent of our sample had missing observations for the 2000 wage variable. We imputed the missing data using Ordinary Least Squares (OLS), controlling for age, gender, education, number of children, total household residents, marital status, household ownership, occupation, number of working hours, self-employed/employed status, and job tenure.[13] We estimated future earnings from 2001 onwards assuming a constant increase in real wages of 1.0 percent.[14]

As noted, social security benefits are computed from the average wage in the five years prior to retirement. The earliest date earnings are required in order to compute social security benefits is 1995. Another issue to consider is the high proportion of individuals working in the informal sector and the number of workers moving between the formal and informal sectors in Mexico during working age (see for example, Maloney, 2002; Maloney, 2004; Cox-Edwards and Rodríguez-Oregia 2006; Perry et al., 2007). In this analysis, we assume that individuals contribute to IMSS in each of the five years prior to retirement so that previous movements between the formal and informal sectors do not affect our estimations. We consider this plausible because individuals have fewer incentives to stop contributing to IMSS in the five years before retirement.

4. Construction of retirement incentive measures

We use the option value, peak value, and one-year accrual retirement incentive measures (see Stock and Wise, 1990; Coile and Gruber, 2007; Gruber and Wise, 2004) to understand the incentives individuals have to retire in every year as soon as they reach eligibility. These retirement incentive measures include accrued individual social security wealth equal to the present discounted value of accrued social security benefits.

The option value method focuses on the opportunity cost of retiring. It compares the value of retiring today (as measured by the estimates of accrued social security benefits) with that of retiring in the future. The individual continues to work when the expected present value of doing so is greater than that of immediate retirement. The model is forward looking at a point in time and allows expectations about future events to be updated as the individual ages. Thus, the retirement decision is evaluated again every period with the new information available. The value function considers a utility from working that depends on after-tax wage (y) from year s until retirement (R). It also includes a utility of retirement that is a function of retirement social security wealth (SSW) received until death. β is the discount

[12]We also considered merging cohort profiles by education and quantiles, but the cells in the upper part of the distribution had a very high variance and the estimations are not accurate.

[13]The results of the analysis of the paper do not change when dropping individuals with missing incomes. Imputations of 5 percent of the sample do not affect our results.

[14]We do not use the 2001, 2002, and 2003 information on wages in the MHAS to estimate earnings history for computing social security benefits because some individuals had already retired by 2001 and hence wage information is missing for them. In reality, our assumption on real growth in wages may not be true; the annual growth in the real minimum wage between 2000 and 2012 was 0.46 percent.

rate and $pr_{s/t}$ is the probability of being alive at time s conditional on surviving at time t. The term $pr_{s/t}$ is multiplicative assuming independence with earnings and retirement social security wealth.

$$V_t(R) = \sum_{s=t}^{R-1} pr_{s|t}{}^{*}\beta^{(s-t)*}U_w(y_s) + \sum_{s=R}^{T} pr_{s|t}{}^{*}\beta^{(s-t)*}U_R(SSW_s(R)) \quad (2)$$

The value function depends on retirement age (R), which determines retirement benefits and the date until earnings are received. The individual compares the expected value function of retiring in the first period possible with the highest expected value function of retiring in the future: $OV_t(R) \leq E_tV_t(R) - E_tV_t(t)$. When $E_tV_t(R) > E_tV_t(t)$ and therefore $OV_t(R) > 0$, the individual continues working, as the value of retiring is higher in the future. On the contrary, if $OV_t(R) \leq 0$, the individual retires because the value of retiring in the future is lower. The value function is evaluated up to T–1 as there is no mandatory retirement age in Mexico.

$U_w(y_s) = y_s^{\gamma}$ and $U_R(SSW_s(R)) = (k * SSW(R))^{\gamma}$ where γ is the risk aversion parameter with an underlying utility function of constant relative risk aversion, and k accounts for the disutility of labor ($k \geq 1$). $SSW_s(R)$ is the present discounted value of retirement social security benefits and y_s is the present discounted value of after-tax labor income.[15]

The peak value compares the expected discounted present value of a worker's social security wealth if the worker retired today and the maximum wealth in all future periods. Comparing the option value with the findings using the peak value can help isolate more clearly the effect of social security on retirement behavior. Labor earnings in the option value could capture differences across individuals in preferences about leisure and the estimated effect of retirement incentives on the probability of retirement may not be identified. The peak value not including labor earnings could provide a more accurate estimate of the effect of retirement incentives on the probability of retirement (Coile and Gruber, 2007). A single-year accrual compares the value of retiring in period t and $t + 1$ ($SSW_{t+1} - SSW_t$). Coile and Gruber (2007) find that retirement decisions are more sensitive to the peak value than to the single-year accrual, showing that forward-looking retirement incentive measures are more accurate to model retirem ent behavior. The peak value and option value take into account the age profile of possible benefits in the future. In the next section, we explain how to calculate social security wealth for the PAYG system in Mexico.

4.1. Social security wealth of the PAYG system

Social security wealth is the present value of an individual worker's social security benefits. Once we know the social security wealth of every worker, we can compute the retirement incentives measures.

We estimate the present value of social security benefits as follows:

[15]The parameters γ, k, and β to estimate the option value used are the same as in Coile and Gruber (2004), so $\gamma = 0.75$, $k = 1.5$, and $\beta = 0.97$.

$$SSW_t(R) = \sum_{s=R}^{T} \frac{\left[pr_{s|t}{}^{*} rb_R\right]}{(1+d)^{s-t}} \quad (3)$$

SSW_t is the present discounted value of the rb_R which are the PAYG retirement social security benefits.[16] T = 101 is the maximum number of years a worker has been alive according to the Mexican National Population Council mortality tables for 2000. d is the discount rate. R is the date of retirement.

We computed the survival probabilities ($pr_{s|t}$) from the Mexican life tables in 2000 for men published by the National Population Council (CONAPO, 2000). $p_{s|t}$ is estimated as $p_{s|t} = \prod_t^{s-1}(1-\lambda_t)$. λ_t is the hazard function. The hazard function is estimated as $\lambda_t = \frac{d_t}{S_t}$ where d_t are the number of persons dying in period t and S_t are the survivors at time t.[17]

Retirement benefits are computed as follows according to IMSS PAYG rules:

$$rb_R = (1-\mu_R)^{*}\left[\Psi\left(\bar{Y}\right)^{*} + \phi^{*}(\omega-10)^{*}\lambda\left(\bar{Y}\right)^{*}\bar{Y}\right] \quad (4)$$

ϕ indicates if the individual has contributed more than 10 years to the social security institute. $\bar{Y}$ is the average wage of the previous five years to retirement. $\psi\left(\bar{Y}\right)$ is the replacement rate which is a decreasing function of $\bar{Y}$. $\lambda\left(\bar{Y}\right)$ is the replacement rate for every year of contribution beyond ten and is an increasing function of $\bar{Y}$. ω are years of contribution to IMSS. μ_R is the penalty for early retirement.

We calculate the average wage in the five years prior to retirement as

$$\bar{Y} = \frac{1}{5}\sum_{s=R-5}^{R-1} Y_s{}^{*}(1+Y_{lb}) \quad (5)$$

Y_s is the nominal wage before taxes. Y_{lb} are labor benefits provided by the employer such as meals, uniforms, and commissions. Y_s is top-coded to a maximum of 25 times the minimum wage, the maximum a worker can contribute to the system. For higher-income workers that receive a salary greater than the maximum, the social security retirement benefit is computed as 25 times the minimum wage. After-tax labor income for workers enrolled in IMSS is:

[16] In 2002, Mexico modified its indexing of PAYG benefits. Previously, it had indexed social security benefits to the minimum wage; subsequently, it indexed them to inflation. This different indexation is applied to all benefits paid out after 2002. We estimated social security benefits before 2002 including an annual inflationary loss because benefits are indexed to the minimum wage. Historically, the minimum wage in Mexico has increased more slowly than the rate of inflation. We consider no inflationary loss after 2002 because benefits are indexed to inflation.

[17] This is an additional issue to consider in the correlation between wealth and mortality rates (see, for example, Attanasio and Hilary W. Hoynes, 2000). The wealthy typically receive their retirement benefits for a longer period than the poor. To our knowledge, there are no estimates of mortality or life expectancy for lower and higher wealth individuals in Mexico. Hence, we cannot include this in the analysis.

$$y_s = Y_{mw}{}^* Y_s{}^* \left[1 - \tau_\pi\left(Y_s\right)\right] + \left[1 - Y_{mw}\right]{}^* Y_s{}^* \left\{1 - \tau_\pi\left(Y_s\right) - \tau_{ss}(Y_s)^* \left(1 + Y_{lb}\right)\right\} \quad (6)$$

τ_{IT} is the income tax, which is an increasing function of Y_s. σ_{ss} is the social security contribution. Y_{mw} has a value of one when the worker earns no more than the minimum wage and a value of zero if making more than the minimum wage. Workers earning the minimum wage are exempt from paying the income tax and receive a redistributive subsidy by the government called a salary loan. Additionally, employers cover social security contributions for workers making the minimum wage. In these cases, before-tax labor income is lower than after-tax wage due to the government subsidy [18].

The MHAS provides information on after-tax income (y_s) . In order to compute social security benefits, before-tax labor income (Y_s) is required. The income tax (τ_{IT}) and social security tax (τ_{SS}) are deducted from the gross labor income to obtain the after-tax wage. The income tax is a function of before-tax labor income but the social security tax is a function of before-tax labor income plus labor benefits (Y_{lb}). After rearranging terms in equation (6), we obtain before-tax labor income. We approximated the before-tax wage with an iterative procedure. According to labor regulations in Mexico, the minimum labor benefits (Y_{lb}) provided by the employer must represent 4.52 percent of a worker's before-tax wage. We obtained income tax brackets (τ_{IT}) from 1995 to 2003. Labor benefits vary by firm but we assume that all workers receive the minimum Y_{lb} according to the regulatory framework, as there are no studies that indicate a difference in benefits by firm size or industry. Moreover, the Y_{lb} proportion has not changed in the regulatory framework since the 1970s. τ_{SS} was estimated taking into account the employee social security contributions to all IMSS services described in Aguila (2011). For workers earning the minimum wage, the employer pays τ_{SS}.[19] We used the Mexican National Consumer Price Index to deflate retirement benefits and after-tax labor income since 2002.

4.2. Social security wealth and retirement incentives estimates

Table 2 shows workers' social security wealth computations. It also presents our estimated retirement incentive measures. The single-year accrual and peak value measures for social security wealth (SSW) are in U.S. dollars. The estimates of the option value are measured in utility units so they are not comparable in magnitude to the peak value or single-year accrual.

Table 2 also presents the percentiles of the distribution of social security wealth and each incentive measure. It shows the percentile values for each age of those individuals that were working in the year 2000 and had not exited the formal sector. Each age is affected by sample selection. Given that the MHAS does not have past earnings histories, we cannot check whether the typical individual in these percentiles have patterns of social security wealth accumulation or decumulation that are similar to those of the percentile values in Table 2.

[19] In 2001 the monthly minimum wage in Mexico City was equivalent to $110.70 U.S. dollars using an exchange rate of 1 dollar for $11.1 Mexican pesos.

A median worker's social security wealth is $34,798 dollars at age 60. This increases but at a decreasing rate to age 65 when it is $45,044 dollars. The accrual rate declines from age 60 to 65 but is positive. After age 65, social security wealth increases slightly and then decreases by 0.8 to 1.7 percent each year.

For workers at the 10th percentile, social security wealth is highest at age 60 and decreases most years after that, indicating that lower-income workers would be better off retiring as soon as they fulfill the requirements to obtain social security benefits. This is largely because workers in the 10th percentile would claim the MPG and social security wealth declines the longer they stay in the labor market because they receive the same monthly benefits for a shorter period of time.

In contrast, workers in the 90th percentile have a positive accrual rate up to age 65. After age 65, the accrual rate is negative. Social security wealth at age 60 is $24,713 dollars for those in the 10th percentile at age 60, and $107,979 for those in the 90th percentile. Workers in the 10th percentile receive, on average, 23 percent of the social security wealth that workers in the 90th percentile obtain at age 60. The standard deviation shows high variation in social security wealth.

The results of single-year accrual and peak value follow the same tendency. The incentive measures are computed from age 60, the earliest possible age to retire. The single-year accruals in Table 2 show that individuals in the 10th percentile have incentives to choose the early retirement option. In contrast, individuals in the 90th percentile and the median would have incentives to work until age 65.

Table 2 shows the results for the peak value. The peak value predicts that individuals in the 10th percentile would choose to retire as soon as they reach the minimum requirements. Individuals in the 90th percentile face different retirement incentives; the peak value shows that they have more to incentives to delay retirement until age 65. It is worth highlighting that the single-year accrual and peak value are very similar for the 10th percentile. This is consistent with the social security wealth for the 10th percentile in Table 2, which indicates that the highest amount is always in the current period when compared to all possible future periods.

The option value shows positive values for the 10th and 50th percentiles up to age 64 in Table 3. After 64 years of age, the option value is negative. In the 10th percentile the positive option values up to age 64 are very small. Workers in the 90th percentile have positive option values at all possible retirement ages but the estimate shows a decreasing trend. The single-year accrual, peak value, and option value provide similar results for the 50th percentile. The correlation between the peak and option values is 0.82, the correlation between the peak value and the single-year accrual is 0.93, and the correlation between the single-year accrual and the option value is 0.74.

In sum, social security wealth for lower-income employees is higher the earlier they retire. In contrast, higher-income workers are better off delaying retirement. The incentive measures, particularly the single-year accrual and the peak value, indicate workers in the 10th percentile should retire at age 60 while those in the 50th and 90th percentiles should

retire at age 65. The option value predicts normal retirement for workers in the 10th and 50th percentiles but later retirement for those in the 90th percentile.

5. Retirement behavior

5.1. Empirical model

This section presents the estimates of the regression models for retirement decisions. The benchmark model is:

$$P(R_{it}=1) = G(\alpha_0 + \alpha_1 RI_{it} + \alpha_2 SSW_{it} + a_3 X_{it}) \quad (7)$$

R_{it} equals one in the year the individual transitions from working to not working and zero otherwise. Thus, in period t the individual was not working and in period $t - 1$ the individual was working. This is a conditional probability model where G is the cumulative distribution function. G is assumed to have a standard normal distribution, so we estimate the model with a probit equation. We pool information for each individual from 2000 to 2003, yielding four periods of data for each individual around retirement age.

RI_{it} is the retirement incentive measures estimated in the previous section, single-year accrual, peak value, and option value. SSW_{it} is social security wealth. X_{it} is a matrix of demographic characteristics that include age, marital status, number of household residents, education, residence in an urban or rural area, and household ownership. We also include year dummies to capture macro shocks. The variable total number of residents reflects cohabitation arrangements of different generations in a household.

Employment characteristics and earnings variables we included in the regression were occupation (white collar, blue-collar, services, and farmers), type of job (employed or self-employed), tenure at firm in years and years squared, labor market experience in years and years squared, and labor income in dollars and dollars squared.[20] We define labor-market experience as age minus six years and minus the number of years in school (see Coile and Gruber, 2004).

Other sources of income during retirement are private pensions and U.S. social security benefits. We do not include private pensions in our model because only one percent of the individuals interviewed in the MHAS 2001 had one. To control for U.S. social security retirement benefits, we include a dummy variable indicating U.S. permanent residency or citizenship.

To capture differences in wealth, we included a variable on household ownership. This variable indicates whether individuals own, rent, or borrow the house where they currently live. The MHAS provides other measures of wealth but unfortunately we could not reconstruct these variables for 2000 and 2002.

[20]The correlation between labor income and mean average labor income of the previous 5 years to retirement is 0.99 so we included in the regression analysis labor income and excluded labor income of the previous 5 years to retirement. The latter is the variable used to compute PAYG social security wealth.

Health can also affect retirement decisions. MHAS has rich information about health status and health conditions but the retrospective questions are not suitable to reconstruct these health variables for 2000 and 2002. We therefore did not include health variables in our analysis.

5.2. Results

This section describes the results of the retirement-probability models for each incentive measure. Table 3 summarizes the estimated specifications. The coefficients are the marginal effects of the probit regressions.[21] We report the average of the marginal effects computed for each individual and then average all computed effects.

The first set of results includes no control variables (Specification I). The second set includes demographic characteristics (Specification II). The third set includes demographic and employment characteristics and earnings. Employment and earnings variables are as noted earlier (Specification III). The social security wealth, incentive measures and earnings variables are in hundred thousands of U.S. dollars.

We use employment and earnings variables to compute social security wealth and incentive measures. Including them in the retirement probability model may cause identification problems in the coefficients. Coile and Gruber (2007) argue against excluding earning and tenure variables from the specification of the model because it could introduce omitted variable bias. Earnings and tenure variables may capture omitted determinants of labor supply; therefore, it would be inaccurate to exclude them from the model. We are interested in separating the effects of omitted determinants of the labor supply from the effects of the social security wealth and retirement incentive measures as discussed in Coile and Gruber (2007).

Table 3 shows the main results including the incentive measures: single-year accrual, peak value, and option value. Social security wealth and the retirement incentive measures are statistically significant at the 5-percent level in all the specifications. As expected, the coefficients of social security wealth are positive and the coefficients of the retirement incentive measures are negative. We can observe in Table 2 a rather large standard deviation of SSW and the retirement incentive measures indicating that using the probit model assuming a normal distribution might not be accurate. For robustness, we conducted the same analysis using a transformation for SSW, labor income variables, and the retirement incentive measures but the results were very similar.[22]

An increase in 10,000 dollars of the single year accrual implies a decline in the probability to retire by 12.6 percent for the effect estimated in Specification I with no control variables. An increase in 10,000 dollars of the peak value implies a decline in the probability to retire by 4.8 percent. For the option value, a rise in 10,000 units decreases the probability to retire by 2.4 percent. The Appendix shows the results of the entire specifications.

[21]We estimated the same specifications including a term of linear age or age dummies or cohort dummies providing similar results.
[22]We used a transformation that is less skewed and sensitive to outliers, the inverse hyperbolic sine similar to a logarithmic transformation but can handle negative values. We also obtained the original specification using a logit model that assumes a logistic function instead of a normal distribution and the results were almost identical in magnitude and sign of the estimator.

In order to compare and interpret these effects, we compute the changes in the predicted probability by an increase in one standard deviation of the retirement incentive measures. In Specification I, an increase by one standard deviation of the single-year accrual decreases the predicted likelihood of retirement by 3.6 percent. An increase by one standard deviation of the peak value decreases the predicted likelihood of retirement by 3.5 percent, while a one standard deviation increase in the option value declines by 2.8 percent. In Specification II, an increase by one standard deviation of the single-year accrual decreases the predicted likelihood of retirement by 2.1 percent, for the peak value we find a decline by 2.0 percent, and for the option value by 1.8 percent. In Specification III, an increase by one standard deviation of the single-year accrual, peak value, and option value decreases the predicted likelihood of retirement by 1.4 percent.

In sum, the social security wealth and incentive measures coefficients are as expected. Social security wealth always has a positive influence, implying a higher probability to retire as social security benefits increase. This shows an income effect in the retirement decision. The incentive measures coefficients are negative, indicating that higher social security retirement benefits in the future decrease the probability of retiring in the current period. A substitution effect is present in the retirement decision. The coefficients of the single-year accrual, peak value, and option value are smaller when employment characteristics and earnings are included.

6. Simulating the effect of a reform from a PAYG system to PRAs

In this section, we present the simulation results of the effect on retirement behavior of a reform from a PAYG to a PRA system. To estimate the effect of the reform from a PAYG to a PRA system on retirement behavior, we assume that transition-generation individuals in this analysis contribute all their working life to the PRA system. We assume the cohorts that retire at the beginning the 2000s in our data contributed during all their working life to the PRA system. Ideally, we would observe responses to retirement incentives that will be in place from the 2020s onwards, when the new-generation will start retiring under the PRA system. In this analysis, we provide an indication of the changes in retirement behavior in Mexico as a result of the replacement of the PAYG with a PRA system. Our data are for individuals who faced a different labor market and economic environment when working between the 1950s and the 2000s. Unfortunately, we cannot estimate directly the effects of the PRA system on retirement decisions: there are 20 individuals from the new-generation in our sample, not a sufficient number to analyze retirement decisions as we do above.

We compute social security wealth and retirement incentives according to the PRA system and obtain hazard rates of the probability of retirement under the PRA system. We compare the retirement hazard rates under the PRA system with the hazard rates under the PAYG system. In the next section we show how we estimated social security wealth under the reform scenario and then present the results of the simulation analysis.

6.1 Social security wealth of the PRA system

Private retirement funds administrators (Administradoras de Fondos para el Retiro, or AFORES) manage the PRA system. The longer workers contribute, the higher their benefits,

so early retirement is penalized. This system does allow early retirement from age 60 as long as the worker can obtain benefits of at least 130 percent of the MPG with PRA funds. As in the PAYG system, in the PRA there is an MPG equivalent to the minimum wage of Mexico City, indexed to inflation. The IMSS computes the PAYG benefits and the AFORE presents the PRA options of annuitization or scheduled withdrawals provided by insurance companies. Insurance companies sell different types of annuities and workers can choose among those available (Aguila, 2011).

The PRA benefits are computed from the balance in the individual account, which depend on the employee contribution rate (τ_e), the employer contribution rate (τ_{em}), and the government contribution rate (τ_g), which are a percentage of the worker's monthly wage *w*. The employee and employer contributions did not change after the pension reform, remaining at 6.275 percent of a worker's wage.

The government contribution also includes a redistributive component called the social quota that is a fixed amount (c_{sq}) equivalent to 5.5 percent of the minimum wage in Mexico City. These contributions are calculated monthly but deducted from the worker's wage and deposited in the AFORES bimonthly. The balance of the PRA account also depends on the fees charged by the AFORES. Since its beginning, the PRA system has had up to three types of management fees: load factor (f_{lf}), accrued interest (f_r) and balance fee (f_b). Accrued-interest fees were discontinued in 2003 and load-factor fees in 2008. The load-factor fee was a percentage of the total wage on which the worker paid a contribution to the PRA system. It was also charged bimonthly, but the balance and the interest fees were charged monthly. PRA performance also depends on the monthly rate of return *r* and the bimonthly periods of contribution to the system *M*. Because the contributions are deposited bimonthly, but the balance and the interest fees are charged monthly, the PRA retirement benefits with management fees is computed as follows:

$$rb^{DC} = \sum_{k=3}^{2M} \left[rb_k^{DC} + rb_{k+1}^{DC} \right]$$

$$rb_k^{DC} = \langle \{ [(Y_{k-1} + Y_{k-2})^* (\tau_e + \tau_{em} + \tau_g)] - f_{lf} + c_{sq}{}^* 2 \}^* [1 + r(1 - f_r)] \rangle^* (1 - f_b)$$

where

$$rb_{k+1}^{DC} = \left\{ rb_k^{DC*} [1 + r(1 - f_r)] \right\}^* (1 - f_b) \quad (8)$$

$$k = (2^* i) + 1 \quad i = 1, \ldots, M - 1$$

The present value of social security benefits of the PRA system is computed using equation (3) in section 4.1.[23]24 We include the fees of the representative AFORE from 1997 to 2008 as in Aguila et al. (2012). The fees structure as we mention above changed in 2008 to include only balance fees, but according to the analysis in Aguila et al. (2012), the loss in social security wealth improves only 2 percent with respect to the previous scheme with balance, accrued interest, and load factor.[25] We use the historic time series of the annual

[23]In the case of the PRA system, there is no inflationary loss because benefits are indexed to inflation.

rate of return of commercial banks; for years after 2001, we assume an annual rate of return of retirement funds of 5.0 percent, which is a standard rate used to compute social security benefits (Aguila et al., 2012). We simulate earnings history of these individuals over their working life because MHAS does not contain earning histories. We simulate earnings profiles with a simple version of the Mincer (1974) model of earnings.[26] We employ the National Urban Employment Survey (ENEU) from 1988 to 2003; our sample is individuals working and contributing to IMSS by education group. With the simulation results, for each individual, we estimated his average annual rate of growth of labor income (Δ_{it}) from 1950 to 2000. We estimated earnings history for every period from t to $t - 51$ in order to include first possible entry into the labor market for the individuals in our sample as follows: $Y_{it-1} = \Delta_{it} Y_{it}$. We estimated future earnings from 2001 onwards assuming a constant increase in real wages of 1.0 percent.

6.2. Effects of the PRA reform on retirement behavior

We estimated the social security wealth of the PRA system and retirement incentives. We find that social security wealth is much lower in the PRA than in the PAYG system (results not shown).[27] The low levels of social security wealth accumulation are due in part to the volatility of the Mexican economy between 1970 and 2000. Economic cycles affect severely social security wealth accumulation.

The retirement incentive measures show that individuals in the PRA system have incentives to retire as soon as they can with the minimum pension guarantee because working more years does not provide them with a higher retirement wealth. The minimum pension guarantee distorts the incentives to work for longer in the PRA system and offsets the wealth effect of the system.[28] In Figure 2 we show the hazard rates of retirement for the PAYG system and the PRA reform scenario. We observe that individuals are more likely to choose the early retirement option as soon as they reach eligibility. While the worker's entire wage history and real rate of return of the AFORE determine retirement benefits of the PRA, retirement benefits of the PAYG system only depend on the wage history of the five years prior to retirement. In our simulations, retirement benefits under the PRA system are more sensitive to the performance of the Mexican economy during the period of analysis than retirement benefits of the PAYG system. During the period of analysis, Mexico experienced several economic crises resulting in periods with negative real interest rates and negative real rate of growth of wages. In the reform scenario shown in Figure 2, we assume individuals make consecutive contributions for the years they reported working in their

[25]We performed a sensitivity analysis including the representative balance fee since 2008 but the results are very similar.

[26]Mincer's model provides a basic framework to describe labor market rewards from individuals' human capital. Human capital is described as individuals' schooling and experience years. The model allows for estimation of the rate of returns to education in the labor market describing individuals' log-earnings as a linear function of schooling, and as quadratic function of experience (Mincer, 1974).

[27]Forteza (2011) computes social security wealth for several Latin American countries including Mexico. The author finds that the PRA system in Mexico has almost no impact on income redistribution after retirement. By contrast, countries with a PAYG system are more redistributive of income after retirement.

[28]For example, the median social security wealth for an individual 60 years old under the PRA system is USD $24,713 while that for the PAYG system is USD $34,798. We found 97.7 percent of individuals 65 years old obtain retirement wealth below the minimum pension guarantee. If they choose to retire, they receive a higher social security wealth equivalent to the minimum pension guarantee, which is the minimum wage. Therefore, these individuals have incentives to retire as soon as they are able to claim the minimum pension guarantee.

principal job. The average retirement age in the reform scenario is 60 for the PRA while the average retirement age for the PAYG system is 62.

6.3. Sensitivity Analysis

We conducted several sensitivity analyses in order to test the robustness of the results. First, we performed the same analysis as in section 6.2 but assuming all individuals at age 60 have 25 years of contribution. The results did not change: individuals prefer to retire as early as possible. Second, we conducted a sensitivity analysis to changes in the real rate of return but results are very similar. The impact of the economic crises on wages, during the period of analysis, makes increases in the interest rate up to 10 percent in real terms, have a very small effect on retirement wealth accumulation. Even with an increase in 10 percent in the real interest rate, more than 95 percent of individuals at age 60 have accumulated retirement wealth below the MPG. These individuals have incentives to claim the MPG and retire as soon as they are eligible.

Finally, we conducted a sensitivity analysis by constructing earnings profiles with different scenarios of transitions into and out of the formal sector. We designed six different scenarios of plausible earnings trajectories that each individual might have followed in the past.[29] We find that individuals who move out of the formal sector in the middle and at the end of their working life accumulate lower social security wealth. This may indicate that individuals who move between the formal and informal sectors in the middle and end of their working life obtain lower levels of social security wealth. Individuals who can only claim the MPG prefer to retire as soon as they comply with the eligibility criteria. Given low levels of accumulation of social security wealth, individuals prefer to retire as soon as they reach the eligibility criteria.

7. Concluding remarks

Mexico and other Latin American nations have seen a decrease in labor-force participation in early retirement ages similar to that seen in the United States before the 1990s. We find that the incentives for retirement built into the social security system have likely contributed to such retirement decisions.

According to the incentive measures we estimated, lower-income workers would always choose the early retirement option. Higher-income individuals delay retirement in order to claim normal retirement age social security benefits. The accrual rate is in most cases negative, implying that the social security system is not actuarially fair. We find a higher probability to retire when workers have higher social security wealth. The incentive measures indicate there is a lower probability to retire today when social security benefits are higher in future periods. These results are as expected and similar to the findings in Gruber and Wise (2004).

[29]Each scenario specifies different periods of time during working life at which individuals move from the IMSS system. Scenario 1 represents the benchmark case in which individuals do not interrupt their enrollment to IMSS during their working life. Scenario 2 presents a situation in which the individual delays entry to the labor market. Scenarios 3, 4, and 5 describe cases in which the individual interrupts IMSS participation in mid-career. Scenario 6 shows a case in which individuals do not contribute during the last years of their working life to IMSS. When individuals move from the formal sector contributing to IMSS and return we assume they have the same level of earnings as when they previously moved from the IMSS.

Mexico reformed its old PAYG system to a system with personal retirement accounts. The results of simulating the impact of the PRA system on retirement behavior show that individuals' social security wealth is lower in the PRA than in the PAYG system. We also find that the PRA provides incentives to retire early. This may indicate further analysis is required to understand the consequences for the financial sustainability of the social security system and income security at older ages in Mexico.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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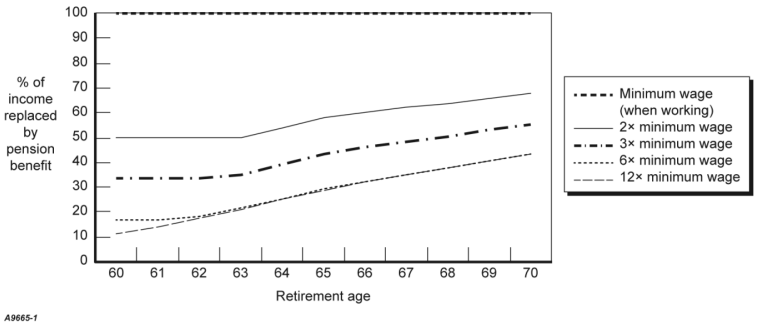
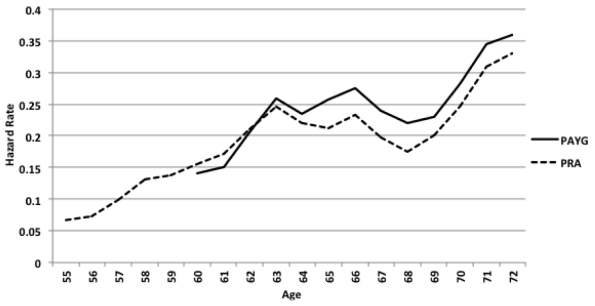
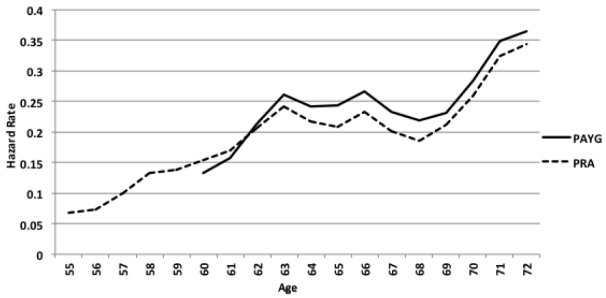


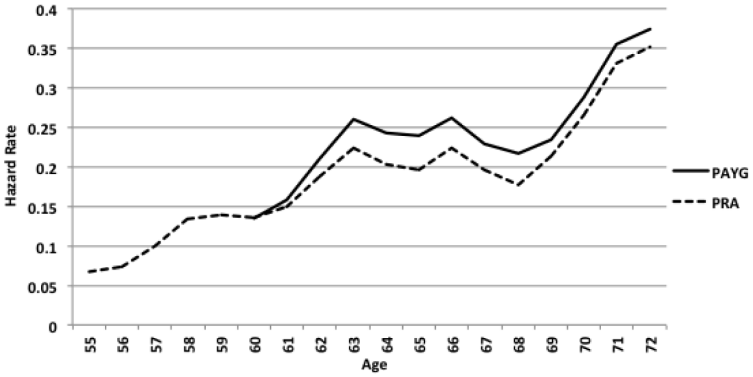
Figure 1. PAYG replacement rate by selected levels of labor income
Source: The authors



(a) Single-year accrual



(b) Peak value



(c) Option value

Figure 2. Hazard rates by age in the PAYG and PRA systems

Notes: Individuals in the PAYG system can only start claiming benefits at age 60. *Source:* The authors

Table 1

Summary statistics of the sample: 50-69 years old male workers at IMSS

Variable	Mean	Standard Deviation
Mean age	56.65	4.87
Couples	0.89	0.30
Mean number of children	5.07	2.98
Mean number of residents	4.55	2.10
Education: No schooling	0.11	0.31
Education: Basic schooling	0.53	0.49
Education: High school	0.21	0.40
Education: Undergraduate or more	0.14	0.34
Occupation: White-collar	0.24	0.43
Occupation: Blue-collar	0.38	0.48
Occupation: Services	0.30	0.46
Occupation: Farmers	0.05	0.23
Employees (vs self-employed)	0.85	0.35
Mean principal job tenure (years)	23.32	11.50
Mean labor market experience (years)	44.05	7.81
Monthly mean labor income (US dollars)	449.46	571.98
Household ownership	0.89	0.31
U.S. citizen or resident	0.01	0.09
Living in rural areas	0.06	0.24
Number of observations	802	

Notes: The categories of the education variable are: no schooling (0 years of education), basic schooling (up to 6 years of education), high school (between 7 and 12 years of education), and undergraduate or more (more than 12 years of education).

Source: Author's calculations using the 2000 Mexican National Employment Survey (ENE).

Table 2

Social security wealth, single-year accrual, peak value, and option value percentiles by age (U.S. dollars)

		Social Security Wealth				Single-year Accrual			
Age	N	10th	50th	90th	SD	10th	50th	90th	SD
60	436	24,713	34,798	107,979	60,186	−866	2,347	8,564	5,008
61	439	24,202	38,178	116,368	65,769	−590	2,645	9,311	5,344
62	441	23,991	41,186	126,201	71,824	−1,068	1,370	5,378	3,343
63	447	23,267	42,727	131,180	75,803	−774	404	2,675	2,135
64	451	22,760	43,454	133,897	78,272	−230	432	3,200	2,888
65	451	23,588	45,044	140,099	81,543	−3,769	−1,350	−539	2,308
66	451	23,057	45,159	140,205	81,441	−3,318	−1,142	−434	2,036
67	451	22,789	45,117	141,000	81,751	−4,858	−1,572	−842	2,828
68	451	22,481	44,607	140,876	81,201	−5,128	−1,653	−931	2,992
69	451	21,987	43,966	139,762	80,579	−5,757	−1,859	−1,013	3,331
70	451	21,802	42,883	142,491	79,720	−6,443	−2,067	−1,222	3,585

		Peak Value				Option Value			
Age	**N**	10th	50th	90th	SD	10th	50th	90th	SD
60	436	−866	7,042	27,872	16,633	2,078	13,311	40,275	24,077
61	439	−590	5,044	20,481	12,057	2,271	10,103	31,132	20,646
62	441	−370	2,393	12,366	7,600	1,470	6,214	22,833	19,210
63	447	−407	908	6,257	5,216	615	3,655	17,845	17,996
64	451	−225	436	3,600	4,232	384	2,020	14,118	18,021
65	451	−3,769	−1,350	−539	3,247	−1,860	−534	6,916	15,882
66	451	−3,318	−1,142	−434	2,558	−1,436	−311	5,264	14,195
67	451	−4,858	−1,572	−842	3,005	−2,384	−875	2,958	12,680
68	451	−5,128	−1,653	−931	3,054	−2,700	−932	1,546	11,339
69	451	−5,757	−1,859	−1,013	3,346	−3,277	−1,118	975	10,135
70	451	−6,443	−2,067	−1,222	3,587	−3,788	−1,358	389	9,034

Notes: N is the number of observations by age. SD is the standard deviation.

Source: Author's calculation using the 2001 and 2003 Mexican Health and Aging Study (MHAS) and the 2000 Mexican National Employment Survey (ENE).

Table 3

Marginal effect of the probability of retirement: single-year accrual, peak value, and option value

	Single-year accrual	Peak value	Option value
Specification I: cohort dummies and no other control variables			
Social security wealth	0.06832	0.06414	0.05015
	[0.01342**]	[0.01323**]	[0.01198**]
Retirement incentive	−1.26967	−0.48582	−0.24915
Measures	[0.25436**]	[0.10639**]	[0.07332**]
Specification II: cohort dummies and demographic characteristics			
Social security wealth	0.03685	0.03443	0.02639
	[0.01244**]	[0.01236**]	[0.01100**]
Retirement incentive	−0.73519	−0.29096	−0.16008
	[0.23490**]	[0.09914**]	[0.06714**]
Specification III: cohort dummies and demographics, employment characteristics and earnings			
Social security wealth	0.04143	0.03922	0.03380
	[0.01606**]	[0.01582**]	[0.01442**]
Retirement incentive	−0.50721	−0.20205	−0.012641
Measures	[0.24375**]	[0.10132**]	[0.06278**]
Number of observations	3,028	3,028	3,028

Notes: Demographic variables included in the regression are: cohort dummies, marital status, U.S. citizenship or permanent residency, total number of household residents, years of schooling, residence in a urban or rural area, and household ownership. Employment characteristics and earnings variables included in the regression are: occupation (white-collar, blue-collar, services, and farmer), type of job (employed or self-employed), tenure at firm, tenure at firm squared, labor market experience, labor market experience squared, labor income, labor income squared. Cohorts are defined as born between 1931-1935, 1936-1940, 1941-1945, and 1946-1950. The benchmark categories for the dummy variables are: cohort born between 1946-1950, year 2000, and white-collar occupation. Social security wealth, labor income variables, and the retirement incentive measures amounts are in $100,000 U.S. dollars.

** estimates are significant at 5-percent level of confidence.

* estimates are significant at 10-percent level of confidence. Standard errors were corrected with the Huber-White robust method for heteroskedasticity.

Source: Author's calculation using the 2001 and 2003 Mexican Health and Aging Study (MHAS) and the 2000 Mexican National Employment Survey (ENE).