

Social Security and Wealth Accumulation in Developing Economies: Evidence from the 1981 Chilean Reform

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Summary. — Wealth holdings are particularly important in developing economies as they allow individuals to insure themselves against income shocks in the absence of developed financial markets. In this paper, we test whether the existence of future social security benefits impacts wealth holdings by using the 1981 Chilean social security reform. Our estimates are based on the EPS 2004, which contains detailed data on wealth holdings (assets and liabilities) and social security account balances. By means of different econometric methods, we find no impact of social security on wealth accumulation, with the exception of poorer individuals. In that case, each additional peso in social security wealth depresses other types of wealth by almost 0.1 pesos, mainly in regard to real estate.

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1. INTRODUCTION

People accumulate assets for two main reasons: to smooth consumption over their life cycle and to buffer unexpected income/expense shocks. In developing economies, wealth accumulation is particularly important as people usually do not have a large set of instruments available to insure themselves against income shocks, contrary to developed economies.

One element that should be considered in the study of wealth accumulation is the social security system. There is some evidence, generally focusing on developed economies, showing potential negative impacts of the PAYG social security systems on wealth accumulation. In that case, social security programs might leave individuals less protected against income/expense shocks.

The impact of social security on wealth accumulation is not clear. On the one hand, views in theories are contradictory. The life cycle model predicts that larger future benefits to be received from the social security system upon retirement will increase current consumption, and thus depress savings and asset accumulation. Furthermore, if future social security ben-

efits are perceived as good substitute to future wealth, the impact on current wealth might be great. Conversely, the dynastic family set-up predicts that greater social security benefits are associated with higher future taxes and, therefore, wealth accumulation does not vary. On the other hand, the empirical evidence, which is mainly obtained from developed economies, is also inconclusive.

The above discussion relates to the “Pay-as-you-go” (PAYG) social security system, which is one of the social security designs most used around the world. However, individual account (IA) social security systems are becoming a subject of increasing interest as countries are switching from PAYG systems to IA systems.

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The relation between the IA system and wealth accumulation is also unclear and this lack of evidence is a problem faced by policy agents when analyzing the effects of reforming the PAYG social security system through a possible privatization. Thus, evidence on the impact of the PAYG and IA system on wealth accumulation is currently an important input for policy makers in developing economies.

In this study, we analyze the impact of the PAYG system and the IA system on individual wealth accumulation by providing evidence from Chile. We focus on Chile because it was one of the first countries switching from a PAYG system to an IA system. Furthermore, the 1981 Chilean social security reform allowed some individuals to remain affiliated to the old PAYG system while other individuals switched to the IA system. Hence, in Chile, individuals affiliated to the old PAYG system coexist with individuals affiliated to the IA system. This characteristic allows us to disentangle the impact of both types of social security on wealth accumulation by using Chilean micro-data. On the other hand, we have a rich dataset available that includes information on an extensive number of different instruments to accumulate wealth. While there are a large number of surveys available in Chile since the social security reform, the particular survey we use is the unique survey containing information both on the social security system and the wealth accumulation.¹

Initially, we run OLS regressions and later we provide IV regressions to correct for the potential self-selection of individuals between social security systems. Next, we provide estimates by sources of wealth and later we study how our results differ by socioeconomic characteristics of individuals.

This paper is developed in the following way: Section 2 makes a brief review of the theory and the empirical evidence on the topic. Section 3 discusses the Chilean historical background while Section 4 discusses the data and the empirical strategy. Section 5 discusses the results and Section 6 concludes.

2. PREVIOUS EVIDENCE

Feldstein (1974) inaugurated the debate on the influence of the PAYG over savings and asset accumulation. He focused on a life cycle model with a PAYG social security system in which greater future benefits increase current

consumption but depress savings and asset accumulation. Barro (1974) provided a different argument and indicated that the social security system should not have an effect on savings and wealth because in his Ricardian analysis, greater current PAYG benefits are associated with higher future taxes.

The evidence reported in the literature focuses on developed economies and is generally obtained from time series and cross-sections of countries or household surveys. Feldstein (1974), using United States aggregate data, found that the marginal propensity to consume social security wealth was 2.1%. Hence, savings were significantly depressed by social security benefits. The international evidence is quite mixed. Feldstein (1977, 1980) found negative impacts of social security on savings. In his 1980 study, he used social security benefits from twelve industrial countries elaborated by the United States Social Security Administration and found a negative impact on the savings rate of the benefit-to-earnings ratio. However, Barro and MacDonald (1979) found mixed evidence using an international cross-section of countries. In their analysis of time series, they found a positive relationship between aggregate consumption and social security wealth. However, using cross-section data, they found a negative association.

On the other hand, Feldstein and Pellechio (1979) used the 1963 Survey of Consumer Finances (SCF) to find a considerable negative impact of social security wealth.² Novos (1989) provided a sensitivity analysis to Feldstein and Pellechio's approach by excluding farm operators and by changing the criteria to assign individuals to percentiles in the income distribution. In that case, the negative impact of social security wealth on wealth accumulation is no longer significant. Gullason, Kolluri, and Panik (1993) provided microeconomic evidence using data from the 1983 SCF, which contains more information concerning assets and liabilities than the 1963 SCF used by Feldstein and Pellechio (1979) and Novos (1989). Their results are similar to the results on Novos (1989). Gustman and Steinmeier (1999) also provided evidence of no impact of pensions on wealth for the United States by using detailed data from the Health and Retirement Study.

The literature has also examined the effects of the IA system on wealth accumulation. Kotlikoff (1995) argued that privatization may have ambiguous effects. On the one hand, the

privatization of the system eliminates the redistribution toward current generations and depresses aggregate consumption. Yet on the other hand, income taxation required to finance the transition from the PAYG to the IA system increases the price of future consumption and lowers savings. Feldstein and Samwick (1997) argued that as the transition is completed, capital intensity and lifetime income rise, which implies "that individuals would want to save more during their working years." Mitchell and Zeldes (1996) emphasized risk as a mechanism affecting asset accumulation. If the rate of return of the privatized system is kept constant, greater uncertainty increases asset accumulation for precautionary reasons.

There are some papers that have empirically studied the impact of the pension reform on the Chilean savings rate ³ (Arrau, 1991; Cifuentes, 2000; Coronado, 2002; Hachette, 1998; Schmidt-Hebbel, 1998). The study by Hachette (1998) does not find conclusive evidence of the impact of the pension reform on private savings. However, other studies, such as Coronado (2002), find an important impact on families' saving rates. Schmidt-Hebbel (1998) surveyed the evidence on the topic and indicated that the pension reform might have increased savings rates between 1.2% and 5.5% of Chilean GDP. Furthermore, Cifuentes (2000), using a general equilibrium model with precautionary savings, showed an increment in the savings rate between 1.5% and 2.8%. Holzmman (1997) analyzed the impact of pension reform on the Chilean economy. He found an important impact on the deepening of financial markets, which had a positive effect on the total factor productivity and capital stock accumulation.

Corbo and Schmidt-Hebbel (2003) presented a detailed analysis of the macroeconomic impacts of the 1981 pension reform on the Chilean economy. Cerda (2008) evaluated the social security reform by using a dynamic computable general equilibrium model. Both studies (Cerda (2008); Corbo & Schmidt-Hebbel, 2003) found significant macroeconomic impacts, especially on the capital market. Corbo and Schmidt-Hebbel showed positive impacts of the pension reform on the Chilean economy by three different channels: (1) savings, (2) job market, and (3) impact on total factor productivity. They found an increase in national savings between 0.7% and 4.5% of GDP while formal employment rose between 3.2% and 7.6% and infor-

mal employment decreased approximately 1%. The impact on total factor productivity is approximately 0.2% on average during 1980–2001. As a result of these positive impacts, the Chilean GDP might have increased between 1.9% and 9.8% in 2001.

In summary, there is still no clear evidence on the hypothesis concerning social security wealth and wealth accumulation. Furthermore, the analysis has mainly focused on developed economies. This paper will study the case of a developing economy (Chile) and it will provide evidence for individuals affiliated to the IA system and the PAYG system.

3. THE CHILEAN SOCIAL SECURITY SYSTEM

Chile implemented a PAYG social security system in 1925. The system became unsustainable and it was replaced in 1981 by an individual account system. The new system was obligatory for individuals entering the work force after 1981 while individuals already working as of May 1981 had the choice of remaining in the old PAYG system or switching to the new IA system. In the IA system, individuals contribute to their individual private accounts and debit benefits from these funds upon retirement. ⁴ The new IA system requires additions equal to 10% of payroll income. These funds are managed by one of approximately six private corporations called "Administradoras de Fondos de Pensiones" (AFPs), which also provide death and disability insurance. Those corporations invest these contributions and individuals pay commissions for the administration of the funds. Individuals may choose the AFP to which they affiliate and they can switch among AFPs as they wish. However, individuals cannot distribute their contributions among different AFPs.

One of the characteristics of the private system has been the large and highly variable rate of return on the AFPs' investments. Since the implementation of the system in mid-1981 through 2006, the average rate of return was 10.3%, with a standard deviation of 8.2%. Figure 1 shows the evolution of the return in the period 1981–2006. ⁵ The standard deviation of the rate of return among different AFPs is quite small, ranging from 0.11% in 2000 to 2.38% in 1982. It should be noted that the balance in an individual's social security account depends on the individual's contributions, rates

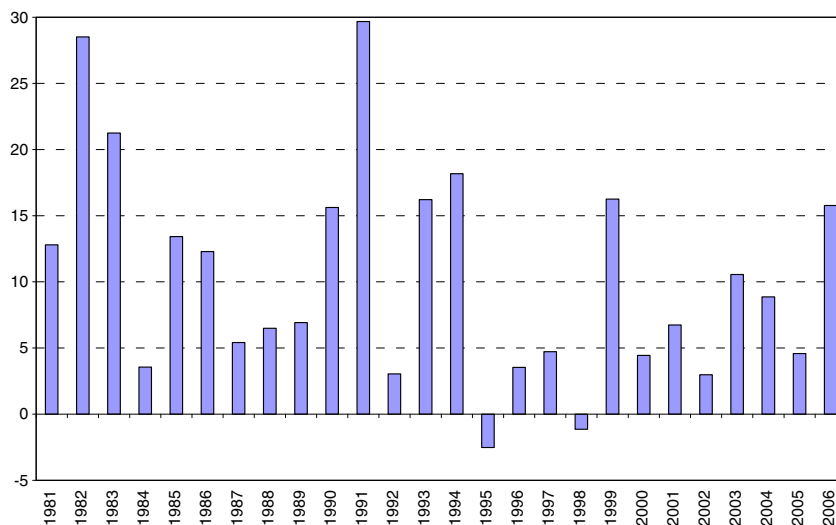


Figure 1. AFP rate of return, %, 1981–2006.

of return, and commissions paid to the AFP. There are two types of commissions: (1) a fixed commission, regardless of the individual contribution or balance; and (2) a proportional commission based on an individual's contribution. Both commissions may vary among AFPs.

The government successfully facilitated the transition to the new system by (1) reducing contributions to the new IA to 10% of payroll taxes (while individuals in the PAYG system paid at a higher rate), (2) issuing government recognition bonds to workers who had accrued benefits under the old system and decided to switch to the new system, and (3) giving workers the option of remaining with the old system or participating in the new system.

Individuals enrolled in the PAYG system might have been affiliated before the 1981 social security reform to any of four main institutions: the Social Security Administration (SSA), the Private Worker Pension Administration (PRWPA), the Public Worker Pension Administration (PUWPA), and the Armed Forces Pension Administration (AAFFPA). Some other institutions existed, but they were smaller in size than those cited above. The SSA managed the pension funds of blue-collar workers in the private sector. Individuals who remained affiliated to the SSA currently pay an 18.84% social security tax. The PRWPA manages the funds of white-collar workers in the private sector and taxes affiliates at a rate of 21.84%. The PUWPA encompasses the majority of public

sector workers and taxes affiliates at a rate of 18.62%. Finally, the contributors to the AAFFPA are all individuals working in the armed forces.

Those taxes were quite high compared to the tax rate faced by an individual affiliated to the new individual account system. In fact, individuals in the IA system pay only 10% of their salary as a social security tax. This tax differential and the subsequent increase in disposable income for those individuals switching to the new system may have been very influential in the overall switching from the old to the new system.

In the PAYG system, pensions are determined as a fraction of salary earned during the last years before retirement, usually the last 5 years. The incentives to remain in the old system are linked to the level of compensation received from the institution to which they were affiliated. If we compare the level of pensions in the four main institutions in the PAYG system, we find that in 1980, the average pensioner of the SSA received 46% of the average Chilean pension while individuals affiliated to the PRWPA received 77% of the average and individuals affiliated to the PUWPA received 148% of the average. In the case of the Armed Forces Pension Administration, the benefit was 350% of the average Chilean pension.⁶ This difference in the level of pension may have also had an impact on the decision to switch to the new pension system.

4. THE DATA AND THE EMPIRICAL STRATEGY

(a) *The empirical strategy*

The literature generally focuses on a life cycle model when analyzing the effects that the social security system has on asset accumulation. The usual specification in the literature is the following:

$$A = \beta_0 SSW + X\alpha + u. \quad (1)$$

In this paper, the variable A denotes net assets (assets minus debts) while SSW denotes the expected present value of benefits from the social security system (PAYG or private account). The matrix X is a set of other variables that may influence wealth accumulation decisions, such as permanent income and life-cycle variables while u is a well-behaved error term with a zero mean. Theory indicates $\beta_0 \leq 0$, as social security may decrease savings in a life-cycle context. The above specification is easily obtained on a life-cycle model under assumptions such as time-additive preferences and quadratic utility functions. Similar specifications can be found in [Feldstein and Pellechio \(1979\)](#) and [Diamond and Hausman \(1984\)](#), among others.

The empirical strategy followed in this paper will be a switching regression model since individuals have two different options: (1) affiliation to the IA social security system and (2) affiliation to the PAYG system. In fact, it could be the case that the saving behavior varies under these two different systems. The switching regression model will allow us to explore this possibility. The general specification of the econometric model will be the following:

$$I_1^* = 1(IA) = 1(Z_1\gamma_1 > \varepsilon_1) \quad (2)$$

$$A^{IA} = \beta_0^{IA} SSW + X\alpha + u, \dots \text{if} \dots I_1^* = 1 \quad (3)$$

$$A^{PG} = \beta_0^{PG} SSW + X\alpha + u, \dots \text{if} \dots I_1^* = 0, \quad (4)$$

where $1(\bullet)$ is an indicator function equal to one if the enclosed statement is true and zero otherwise while Z_1 are variables determining the affiliation to the IA social security system. The error term ε_1 is an unobservable component that affects the decision process. Eqns. (3) and (4) present similar specifications, but Eqn. (4) indicates the behavior under the IA system while Eqn. (3) indicates behavior on the PAYG system. The superscripts IA and PG denote IA system and PAYG, respectively.

The specification indicated by Eqns. (2)–(4) can be combined in the following way:

$$A = A^{IA}(I_1^*) + A^{PG}(1 - I_1^*), \quad (5)$$

or

$$A = X\alpha + \beta_0^{PG}(SSW) + (\beta_0^{IA} - \beta_0^{PG})(I_1^*SSW) + u, \quad (6)$$

where (I_1^*SSW) is a variable that includes the present value of social security benefits if the individual is affiliated to the IA system and zero otherwise while A and SSW represent wealth and the present value of benefits in any social security system.

Note that to obtain consistent estimates, we require that the covariance between the right-hand side variables in (6) and the error term be zero. However, those conditions may possibly not hold, as the individuals may self-select between social security systems based on individual unobservable variables that might affect wealth accumulation and social security affiliation, thus $\text{cov}(I_1^*SSW, u) \neq 0$.

To avoid the inconsistency problem, we will use an exogenous instrument based on the regulations established by the 1981 social security reform law. The 1981 reform law requires individuals entering the labor force for the first time after 1981 (the year of the reform) to affiliate to the IA system. It follows that an individual in that group is likely to be affiliated to the IA system and since those individuals were exogenously allocated to the IA system, we assure no interaction between social security affiliation and unobservable characteristics that could affect wealth accumulation.

(b) *The data*

The dataset used in this paper is the 2004 EPS (“Encuesta de Protección Social” or Social Protection Survey).⁷ The survey was taken during the years 2004 and 2005. It is a representative survey of the Chilean population of individuals aged at least 18 in December 2003. The EPS is the first longitudinal dataset available in Chile. The first wave of the survey was taken in 2002. The 2004 EPS is the second wave of the panel. The survey has detailed sections on social security (information on elderly, health, disability, etc.), demographics, education, employment and job income, plus a section on assets, liabilities, and expenditures. The reason we focus on the 2004 EPS rather than using the complete panel is that the section on

assets and liabilities is available only in the 2004 wave.

The section concerning an individual's assets and liabilities includes information on (1) characteristics of houses and other real estate owned by individuals; (2) durable goods such as cars, TVs, computers, and microwaves; (3) financial assets such as bank deposits, mutual fund investments, stocks, and other similar financial assets as well as information on real assets used in family businesses, such as machinery, land, cattle, or any other similar type of asset; and (4) ownership and partnership in others' businesses. To obtain a complete picture of the individual's net financial position, the survey also contains information on different types of debts, such as commercial bank loans, credit cards from banks or other businesses (stores), educational loans, or other debts that might include informal debts with other family members or illegal moneylenders. Each of the categories includes the current value of the assets or debts.⁸

In the case of assets, and specifically in the case of real estate and household residency, the survey contains information about the current value of the real estate and information on whether the property is fully or partially paid up, and in the latter case the amount of the remaining debt to be paid. As to vehicles (cars, motor cycles, trucks, *etc.*), the survey provides information on the number and the value of those vehicles. Similar information is provided on the real assets in the family business. Like in the case of real estate, the survey indicates if there is debt still owed on these assets. Therefore, we compute the net wealth as

$$\begin{aligned}
 W_i = & \underbrace{\sum_j (V_j^i - D_j^i)}_{\text{Real estates}} + \underbrace{\sum_k (FA_k^i - FD_k^i)}_{\text{Net financial wealth}} \\
 & + \underbrace{\sum_l (C_l^i - CD_l^i)}_{\text{Net vehicles}} + \underbrace{\sum_m BV_m^i}_{\text{Business}} \\
 & + \underbrace{\sum_n (BA_n^i - DBA_n^i)}_{\text{real assets in family business}}
 \end{aligned}$$

where V_j^i is the value of real estate, D_j^i is the associated debt, FA_k^i is the value of financial assets, FD_k^i is the value of financial debts, C_l^i is the value of vehicles, CD_l^i is the value of debts on vehicles, BV_m^i is the value of ownership and partnership in others' businesses while BA_n^i is the value of real assets in the family business,

and DBA_n^i is the value of the remaining debt for these items. The sum totals indicate that there are multiple items in each category. In the definition of wealth, we did not include consumer durables, such as microwaves, and TVs, because these goods are generally more related to consumption flow than to wealth holdings.

The survey also contains information on household expenditures. In particular, we have information on expenditures such as (1) food, (2) clothing, (3) utilities, and (4) domestic services, that is, the overall average cost of a full-time maid/cook, which includes wages plus social security insurance and transportation costs. As consumption is directly related to permanent income and permanent income might be one of the variables determining wealth accumulation, we use these expenditure data as a proxy for permanent income in our regression.

In addition, the survey provides information about the social security system to which each individual is affiliated⁹ plus other characteristics concerning social security, such as payments and benefits obtained from the social security system. We describe next the way we compute social security wealth in both the IA and the PAYG systems.

The variable containing the present value of the social security benefits (*SSW*) is constructed using three pieces of information. Firstly, one of the questions of the survey provides information concerning the type of social security to which each individual is affiliated. Secondly, the survey provides data on retirement income for individuals affiliated to the PAYG system. Thirdly, the survey provides information on the balance in the individual account that an individual has, if affiliated to the IA system.

If the individual is affiliated to the IA system, we use the balance in the IA social security account as a direct measure of social security wealth. In fact, the individual will receive upon retirement the balance of his social security account to purchase an annuity that acts as social security income. Note that the balance on the IA account differs considerably across individuals due to differences in individuals' employment rate, differences in wage rates, AFP administration costs, or AFP rates of return. The heterogeneity of these variables is summarized in the individual's social security account.

To compute the present value of the benefits in the PAYG, we use the characteristic that

benefits in the PAYG system are related to a replacement-ratio rule, which is not necessarily based upon past contributions. In this case, we estimate a reduced form equation of pension benefits of retired individuals affiliated to the PAYG social security system as a function of age, age squared, schooling, and demographic variables. This equation is similar to a Mincer equation in which pension benefits are the left-hand side variable. Using this estimation, we project the life-cycle retirement income profile for individuals affiliated to the PAYG system by varying age, from 60 to 80 in the case of women and 65 to 80 in the case of men.¹⁰

To construct expected PAYG social security wealth, we also consider the survival probability of individuals. To do so, we use information on the survey plus information on national life tables in Chile. We proceed as follows. The survey asks each individual her perceived odds of reaching age 65. Furthermore, for both men and women we have available life tables from the *Instituto Nacional de Estadísticas* (2004)—National Institute of Statistics, INE—for the period 2001–02.¹¹ These life tables provide the probability that a female (male) who has reached age t will reach age $t + k$, $k > 0$. For each individual, we construct the survival probability to age $m > 65$ (60 in the case of women) by multiplying each individual's perceived likelihood of reaching the age of 65 by the survival probability between age 65 and m obtained from the Chilean life tables. Therefore, the survival probability from current age, j , to age $m > 65$, is constructed as follows:

$$S_j^m = S_j^{65} S_{65}^m,$$

where S_j^{65} is obtained from the survey and S_{65}^m is obtained from the national life tables. Finally, we compute the expected present value of PAYG benefits by using a 5% discount rate. Thus, the present value benefits of PAYG system for the i th individual are computed as

$$BPAYG^i = \begin{cases} \sum_{t=60}^{80} \frac{\hat{y}_t^{R,i}}{(1+r)^t} S_j^t & \text{women,} \\ \sum_{t=65}^{80} \frac{\hat{y}_t^{R,i}}{(1+r)^t} S_j^t & \text{men,} \end{cases}$$

where $\hat{y}_t^{R,i}$ is the projected level of benefits received by the i th individual at t and S_j^t is the survival probability of reaching age t conditional to the individual's current age, j .¹² Hence, we construct the social security benefit variable as

$$SSW = \begin{cases} BIA, & \text{individual affiliated to} \\ & \text{the IA system} \\ BPAYG, & \text{individual affiliated to} \\ & \text{the PAYG system} \end{cases}$$

$$I_1^*SSW = \begin{cases} BIA, & \text{individual affiliated to} \\ & \text{the IA system} \\ 0, & \text{individual affiliated to} \\ & \text{the PAYG system,} \end{cases}$$

where BIA is the balance of the individual account in the IA system.

Tables 1 and 2 provide summary statistics of the dataset. The data contain approximately 5850 observations corresponding to individuals answering the set of questions we require, that is, individuals with missing data on the questions in which we are interested were excluded from the empirical analysis. The data are measured in Chilean pesos as of 2004. As can be seen in the table, there is a great heterogeneity among assets and debts, with real estate being the major asset holdings and credit cards and bank loans being the major sources of debt. To get an idea of the magnitude of the data, note that an individual's average job income (from his primary job) is approximately \$186,000 pesos per month.¹³ Therefore, the average value of real estate (houses) corresponds to approximately 56 months of average employment income while credit card debts correspond to 1 month of average job income and bank consumer loans correspond to almost 1.1 months of job income. When added up, the mean of debt corresponds to almost 3.4 months of average job income.

The value of financial assets represents, on average, almost 20% of the mean value of real estate and vehicles. Financial assets include savings to purchase a house (savings in "Administradora de Fondos de Vivienda" (AFV, which stands for Housing Fund Administrator), voluntary pension savings (savings in "Ahorro Previsional Voluntario" or APV, and savings in a second account in the AFP), bank saving accounts and deposits, mutual funds, stocks and bonds and other loans, including loans to third parties. Note that voluntary pension savings are quite small as they represent only 0.5% of the mean value of real estate and vehicles, that is, there is almost no voluntary pension savings. Finally, note that the average social security wealth in IA is quite

Table 1. *Summary statistics, assets and debts*

Variable	Obs.	Mean	Standard deviation	Min.	Max.
<i>Assets</i>					
<i>Real estate and vehicles</i>					
Real estate, \$ (house)	5,778	10,400,000	19,800,000	−33,800,00	600,000,000
Fraction paid	5,850	0.9034884	0.2345501	0	1
Other real estate, \$	5,850	1,552,214	11,300,000	0	50,000,000
Remaining debt on other real estate	5,850	194,780	2,045,181	0	5,000,000
Cars, \$	5,850	1,416,922	32,900,000	0	180,000,000
Motorcycle, \$	5,850	3,760	60,320	0	2,000,000
Other vehicles, \$	5,850	242,025	17,070,000	0	1,300,000,000
<i>Financial assets</i>					
Banking savings to purchase a house	5,850	54,575	479,057	0	23,000,000
Savings in AFV	5,850	19,020	654,254	0	40,000,000
Additional pension savings, \$	5,850	32,719	932,260	0	56,000,000
Savings AFP (2nd account)	5,850	26,580	1,092,743	0	80,000,000
Banking savings account, \$	5,850	2,361,925	147,800,000	0	11,000,000,000
Bank deposits, \$	5,850	19,816	389,246	0	17,000,000
Mutual funds, \$	5,850	29,064	660,129	0	30,000,000
Bonds and stocks, \$	5,850	44,397	1,422,778	0	90,000,000
Loans to third parties	5,850	1,543	67,879	0	5,000,000
Other savings (cash, dollars, etc.)	5,850	7,040	155,341	0	8,000,000
<i>Real assets (net of debt)</i>					
Machinery	5,850	13,396	318,371	0	19,000,000
Land	5,850	387,453	7,589,514	−9,000,000	350,000,000
Cattle	5,850	13,851	374,134	0	25,000,000
Others	5,850	4,119	264,174	0	20,000,000
Value of commercial business, \$	5,850	133,642	4,481,649	−4,000,000	300,000,000
<i>Debts</i>					
Bank credit cards, \$	5,850	−33,755	284,063	−10,000,000	0
Bank credit line, \$	5,850	−49,133	503,566	−20,000,000	0
Other credit cards (stores), \$	5,850	−141,225	424,803	−16,000,000	0
Banking loans (consumption), \$	5,850	−201,734	1,585,054	−60,000,000	0
Other loans (consumption), \$	5,850	−67,871	423,562	−10,000,000	0
Other loans (car financing), \$	5,850	−13,629	231,034	−8,500,000	0
Loans (social organizations), \$	5,850	−9,387	142,106	−7,000,000	0
Educational debts, \$	5,850	−73,160	567,042	−10,000,000	0
Loans from family or friends	5,850	−3,749	60,421	−2,000,000	0
Loans from illegal brokers, \$	5,850	−550	19,050	−1,000,000	0
Other debts	5,850	−22,415	369,030	−18,000,000	0

Source: Own calculations.

high as it represents almost 90% of average net assets (assets minus debts) while average social security wealth in the PAYG system represents just 16% of average net assets.

5. THE RESULTS

Table 3 reports our initial OLS estimates of Eqn. (6). The baseline specification includes control consumption variables as well as other demographic variables, such as schooling, the

size of the household (and other variables including a dummy variable for females, a dummy variable for married individuals, a dummy variable for widowed individuals, and a dummy variable for broken households). It also includes job income from the primary and secondary job plus job characteristics, subsidies and other sources of income and cohort effects. The inclusion of the additional variables like job characteristics is motivated by the fact that individuals in a permanent job may have less incentive to accumulate

Table 2. *Summary statistics*

Variable	Obs.	Mean	Standard deviation	Min.	Max.
Net assets (assets-debts)	5,778	14,600,000	159,000,000	-218,000,000	11,000,000,000
<i>Demographics</i>					
Age	5850	40.19	11.71	16	80
Survival probability of reaching age 65	5603	82.65	23.63	0	100
1 year of education	5850	0.002	0.047	0	1
2 years of education	5850	0.008	0.090	0	1
3 years of education	5850	0.041	0.20	0	1
4 years of education	5850	0.206	0.404	0	1
5 years of education	5850	0.0008	0.292	0	1
6 years of education	5850	0.0309	0.173	0	1
7 years of education	5850	0.297	0.457	0	1
8 years of education	5850	0.015	0.123	0	1
9 years of education	5850	0.152	0.359	0	1
10 years of education	5850	0.038	0.193	0	1
11 years of education	5850	0.068	0.252	0	1
12 (and more) years of education	5850	0.125	0.331	0	1
<i>Labor income</i>					
Annual labor income (primary job)	5850	2,836,612	2,740,145	0	60,000,000
Annual labor income (second job)	5850	111,703	951,941	0	39,600,000
<i>Social security</i>					
Social security wealth	5850	12,700,000	329,000,000	0	25,000,000,000
Social security wealth—PAYG	5850	2,147,027	15,400,000	0	310,000,000
Social security wealth—IA	5850	10,300,000	329,000,000	0	25,000,000,000
In labor force in 1981 or before	5850	0.045	0.206	0	1
PAYG affiliation	5850	0.036	0.192	0	1
<i>Other sources of income and expenditure</i>					
Government subsidies to families	5850	108	1,608	0	80,000
Food expenditure (annual)	5850	112,858	1,179,327	0	90,000,000
Clothing expenditure (annual)	5850	18,276	33,103	0	15,000,000
Expenditure on utilities (annual)	5850	42,031	39,569	0	15,000,000
Expenditure on domestic services (annual)	5850	24,902	37,699	0	12,000,000

Source: Own calculations.

assets than individuals in a temporary job as they face less uncertainty in their job income flows. Similarly, other sources of income (including subsidies) may act as insurance in the case of a negative job income shock.

In Table 3, we report initially regressions using net assets as the dependent variable and later, we use the components of net assets as the dependent variable. In that case, we focus on real estate, cars, financial assets (savings, bonds, stocks, mutual funds, *etc.* See Table 2), family business, and total debts. The estimates of SSW and I^*_SSW are not significant in the estimates with the exception of debt, for example, in general, we cannot reject the hypothesis that social security wealth does not

impact wealth accumulation. This result holds true for both the PAYG social security system and the IA system.

There are other results. Firstly, the consumption variables are generally positive and significant, indicating a positive and significant effect of permanent income on asset accumulation. Secondly, the coefficients for job income are positive and significant, indicating that part of positive shocks on current job income are saved, producing greater wealth accumulation. This result is consistent with the abundant evidence reported in the consumption literature—see Deaton (1991)—in which both wealth and consumption react to current income in the presence of borrowing constraints.

Table 3. *Impact of social security wealth on wealth accumulation, OLS regressions*

Variable			Real estate	Cars	Family business	Capital goods	Debts
Fraction of assets, %			84.0	7.35	0.3	5.02	63.02
Dependent variable	Net assets	Net assets	Real estate	Cars	Family Business	Capital goods	Debts
<i>SSW</i>	-.0084008 (-0.31)	-.010027 (-0.41)	.0019884 (0.11)	-.0060448 (-1.23)	.0011574 (0.64)	-.0164551 (-1.55)	-.003282** (-2.49)
$I_1^* SSW$	.0082881 (0.30)	.0072505 (0.30)	-.0022237 (-0.12)	.0058818 (1.22)	-.0011858 (-0.65)	.0142486 (1.53)	.0034149** (2.60)
Food expenditure	.6320688** (3.66)	.6890699** (4.45)	.8008981** (13.7)	-.0614877 (-1.09)	.0061236 (0.58)	-.0471731 (-0.49)	-.0025753 (-0.55)
Expenditure on clothing	26.84264 (0.69)	35.11208 (0.95)	27.81656 (1.49)	-8.532201 (-0.89)	-5.295026 (-1.19)	19.87816 (0.75)	-1.1557822 (-0.15)
Expenditure on utilities	18.74761 (0.54)	7.673368 (0.22)	62.13645** (3.16)	-7.393882 (-0.86)	-2.399348 (-1.01)	-31.1412 (-1.34)	2.368208** (2.13)
Expenditure on domestic services	25.70771** (2.68)	19.8498** (2.78)	13.42105** (2.89)	.164975 (0.15)	.7750382 (1.28)	1.024039 (0.81)	.398192* (1.74)
Labor income (primary job)	4.217382** (4.15)	3.037848** (3.61)	1.107749** (2.30)	.498295** (3.82)	.0990744 (0.92)	.7414616 (1.49)	.1063393** (2.88)
Labor income (secondary job)	3.754727 (1.15)	2.675995 (0.93)	.3640682 (0.26)	-.1155452 (-0.76)	.3200545 (0.84)	-.4531229 (-1.33)	.0067658 (0.17)
Demographics	YES	YES	YES	YES	YES	YES	YES
Education	YES	YES	YES	YES	YES	YES	YES
Job characteristics	YES	YES	YES	YES	YES	YES	YES
Cohort effect	NO	YES	YES	YES	YES	YES	YES
Subsidies and other income	NO	YES	YES	YES	YES	YES	YES
Impact of PAYG <i>SSW</i>	-.0084008 (-0.31)	-.010027 (-0.41)	.0019884 (0.11)	-.0060448 (-1.23)	.0011574 (0.64)	-.0164551 (-1.55)	-.003282** (-2.49)
Impact of IA <i>SSW</i>	-0.0001127	-0.0027765	-0.0002353	-0.000163	-0.0000284	-0.002206	0.0001329**
Prob. <i>F</i> -Stat.	(0.72)	(0.15)	(0.19)	(0.68)	(0.42)	(0.21)	(0.00)
Observations	5778	5778	5778	5850	5850	5850	5850
R^2	0.02	0.06	0.37	0.20	0.28	0.01	0.11

Source: Own calculations. Note 1 (·) defines an indicator function equal to one when the enclosed text is true. *T*-test in parentheses. The notes ** and * indicate significance at 5% and 10%, respectively. The coefficient on "Impact of IA *SSW*" is constructed by adding up the estimates β_0^{PG} and $(\beta_0^{IA} - \beta_0^{PG})$. The "Prob *F*-Stat" corresponds to the null hypothesis "Impact of IA *SSW*" being zero.

Table 4. *Impact of social security wealth on wealth accumulation, IV regressions*

First step: social security wealth in IA system						
1 (Exogenously allocated IA)	5.12e+07** (14.6)	5.12e+07** (14.6)	5.12e+07** (14.6)	5.12e+07** (14.6)	5.12e+07** (14.6)	5.12e+07* (14.6)
Dependent variable	Net assets	Real estate	Cars	Financial assets	Family business	Debts
<i>Second step</i>						
<i>SSW</i>	−.0853962** (−2.13)	−.0391674 (−1.39)	−.0236744* (−1.82)	−.0202284 (−1.11)	.0027327 (0.89)	−.0009962 (−0.37)
$I_1^* SSW$	.0827799** (2.09)	.0390195 (1.38)	.0235488* (1.82)	.0180299 (1.05)	−.0027645 (−0.90)	.0011238 (0.41)
Food expenditure	.6891914** (4.45)	.8009645** (13.72)	−.0614743 (−1.09)	−.0471703 (−0.49)	.0061224 (0.58)	−.002577 (−0.55)
Expenditure on clothing	34.98969 (0.95)	27.74972 (1.49)	−8.582784 (−0.90)	19.86733 (0.75)	−5.290506 (−1.19)	−.1492224 (−0.15)
Expenditure on utilities	7.490607 (0.22)	62.03665** (3.16)	−7.428439 (−0.87)	−31.1486 (−1.34)	−2.39626 (−1.01)	2.37269** (2.13)
Expenditure on domestic services	19.73862** (2.77)	13.36034** (2.88)	.1409869 (0.13)	1.018905 (0.80)	.7771817 (1.29)	.4013029* (1.76)
Labor income (primary job)	3.035714** (3.60)	1.106584** (2.30)	.4973377** (3.81)	.7412567 (1.49)	.09916 (0.93)	.1064635** (2.88)
Labor income (secondary job)	2.670616 (0.93)	.3611314 (0.25)	−.1164277 (−0.77)	−.4533117 (−1.33)	.3201334 (0.84)	.0068802 (0.17)
Demographics	YES	YES	YES	YES	YES	YES
Education	YES	YES	YES	YES	YES	YES
Job characteristics	YES	YES	YES	YES	YES	YES
Cohort effect	YES	YES	YES	YES	YES	YES
Subsidies and other income	YES	YES	YES	YES	YES	YES
Impact of PAYG <i>SSW</i>	−.0853962** (−2.13)	−.0391674 (−1.39)	−.0236744* (−1.82)	−.0202284 (−1.11)	.0027327 (0.89)	−.0009962 (−0.37)
Impact of IA <i>SSW</i>	−0.0026163	−0.0001479	−0.0001256	−0.0021985	−3.18E−05	0.0001276**
Prob. <i>F</i> -Stat.	0.18	0.57	0.75	0.21	0.42	0.00
Observations	5778	5778	5850	5850	5850	5850
R^2	0.06	0.36	0.19	0.01	0.28	0.11
Prob- <i>F</i>	0.000	0.000	0.000	0.000	0.000	0.000

Source: Own calculations. The note 1 (·) defines an indicator function equal to one when the enclosed text is true. *T*-test in parentheses. The notes ** and * indicate significance at 5% and 10%, respectively. The coefficient on “Impact of IA *SSW*” is constructed by adding up the estimates β_0^{PG} and $(\beta_0^A - \beta_0^{PG})$. The “Prob *F*-Stat” corresponds to the null hypothesis “Impact of IA *SSW*” being zero.

Table 4 provides estimates when we use the IV approach to correct potential self-selection between social security systems. As discussed above, we use the instrument of the set of individuals exogenously allocated to the IA system, for example, individuals who had not yet entered the work force for the first time at the time of the social security reform. As can be seen in the table, the instrument is highly significant and positive, as expected, as individuals entering the work force after 1981 are obligated to affiliate to the IA system.

When we use the IV procedure, the PAYG social security wealth shows a negative impact on wealth accumulation at a 10% confidence rate. As can be seen at the bottom of the table, the coefficient on the impact of the IA system is

insignificant. Furthermore, as we broke down assets into component parts, we found that the PAYG social security impacts wealth negatively in terms of real estate and cars, the coefficient being significant at a 5% confidence rate in the case of cars. Note that similar to the result reported in the case of net assets, the IA social security has no impact on wealth accumulation. The coefficient of the impact of PAYG on net assets is approximately -0.08 . Thus, since social security wealth represents 13 million pesos on average, an individual holding the average social security wealth would depress wealth holdings by almost 1.1 million, which represents a 7% average wealth and half of the average annual job income from a primary job, as reported in Table 2. We must be

Table 5. *Impact of social security wealth on wealth accumulation, by education*

Method	OLS	OLS	OLS	IV	IV	IV
Education	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary
<i>SSW</i>	-.098704** (-2.19)	.0229317 (0.75)	.0120978 (0.28)	-.130698** (-2.39)	-.0293277 (-0.65)	-.0141597 (-0.20)
$I_1^* SSW$	-.1781205 (-1.07)	-.024732 (-0.79)	-.0155146 (-0.37)	.3249314 (0.76)	.0310201 (0.67)	.0107689 (0.15)
Food expenditure	13.24759 (1.44)	37.49501 (1.25)	.4602467 (1.40)	15.31101 (1.57)	37.34298 (1.25)	.4611332 (1.41)
Expenditure on clothing	-26.4307 (-0.30)	100.4461 (1.02)	2.88572 (0.15)	-9.443368 (-0.11)	101.07 (1.02)	2.667263 (0.14)
Expenditure on utilities	123.2062** (2.30)	-55.45117 (-0.82)	39.76168 (0.98)	124.9311** (2.30)	-55.97136 (-0.83)	39.73349 (0.98)
Expenditure on domestic services	-57.65391 (-1.06)	38.52214** (2.97)	18.73544** (2.80)	-73.48157 (-1.34)	38.46817** (2.97)	18.68608** (2.79)
Labor income (primary job)	5.714477** (8.55)	4.434803 (1.37)	1.998662** (3.14)	4.924015** (4.77)	4.428484 (1.37)	2.000056** (3.14)
Labor income (secondary job)	17.62391 (1.50)	2.498964 (1.05)	-.9322938 (-0.48)	16.84447 (1.50)	2.495881 (1.05)	-.939897 (-0.49)
Demographics	YES	YES	YES	YES	YES	YES
Education	YES	YES	YES	YES	YES	YES
Job characteristics	YES	YES	YES	YES	YES	YES
Cohort effect	YES	YES	YES	YES	YES	YES
Subsidies and other income	YES	YES	YES	YES	YES	YES
Impact of PAYG <i>SSW</i>	-.098704** (-2.19)	.0229317 (0.75)	.0120978 (0.28)	-.130698** (-2.39)	-.0293277 (-0.65)	-.0141597 (-0.20)
Impact of IA <i>SSW</i>	-0.2768245	-0.0018003	-0.0034168	0.1942334	0.0016924	-0.0033908
Prob <i>F</i> -Stat	0.40	0.78	0.24	0.63	0.78	0.24
Observations	305	3112	2361	305	3112	2361
R^2	0.55	0.11	0.17	0.53	0.06	0.16
Prob- <i>F</i>	0.000	0.000	0.000	0.000	0.000	0.000

Source: Own calculations. The note 1 (·) defines an indicator function equal to one when the enclosed text is true. *T*-test in parentheses. The note ** indicates significance at 5%. The coefficient on "Impact of IA *SSW*" is constructed by adding up the estimates β_0^{PG} and $(\beta_0^{IA} - \beta_0^{PG})$. The "Prob *F*-Stat" corresponds to the null hypothesis "Impact of IA *SSW*" being zero.

cautious with the result because the significance of the coefficient remains firm only at 10%. However, the coefficient for cars is highly significant. The coefficients for other variables are similar to the ones reported in Table 3.

To check the robustness of our results, we decided to obtain estimates by socioeconomic groups. We used education as a proxy of a socioeconomic group. We separated our sample into three main groups: (i) individuals with primary education, (ii) individuals with secondary education, and (iii) individuals with tertiary education. Table 5 provides the results. Breaking down these groups is quite useful. In fact, note that like above, the impact of the IA system is insignificant in the three cases. However, there are clear differences among groups con-

cerning the impact of PAYG wealth on net assets. This variable impacts only in the group of less educated individuals. Further note that the coefficient is higher (in absolute value) than the one obtained in Table 4 and also, in this case, it is highly significant. The coefficient indicates that in this specific group, for each peso in PAYG wealth, the individuals would depress wealth accumulation by almost 0.1.

Table 6 provides additional information concerning the wealth decisions of the group of less educated individuals. The table breaks down net assets into main components, as we did in Tables 3 and 4. The results are in line with the results in Table 5. Note that PAYG social security wealth depresses mainly real estate and the estimate indicates that for each peso

Table 6. *Impact of social security wealth on wealth accumulation, IV regressions Group of individuals with less than primary education*

<i>Second step: social security wealth</i>					
Dependent variable	Real estate	Cars	Financial assets	Family business	Debts
<i>SSW</i>	-.1118112** (-2.80)	.0097989 (1.00)	.0027088 (0.95)	.0002247 (1.33)	.0048121 (0.72)
$I_1^* SSW$	.3536639 (1.17)	-.1354795 (-1.06)	-.0449267 (-1.19)	-.0004873 (-0.75)	-.073117 (-0.91)
Food expenditure	12.80718* (1.81)	.3111366 (0.23)	-.0624392 (-0.22)	-.0087102 (-0.98)	-.2397646 (-0.41)
Expenditure on clothing	-22.60174 (-0.37)	3.668776 (0.39)	.3444465 (0.11)	.0291966 (0.58)	-2.444699 (-0.37)
Expenditure on utilities	132.8742** (3.14)	.8428882 (0.05)	-1.582753 (-0.94)	-.0026962 (-0.08)	7.634478 (1.39)
Expenditure on domestic services	-100.5595** (-2.38)	6.701948 (0.84)	41.07179** (19.78)	-.4033706 (-1.46)	5.397612 (1.18)
Labor income (primary job)	4.686251** (5.90)	.4925579* (1.81)	.1386365* (1.61)	.0021665 (0.97)	.1842506 (1.36)
Labor income (secondary job)	13.45792 (1.58)	.0207055 (0.01)	.4422422 (1.03)	.0847397 (1.53)	-.20819 (-0.37)
Demographics	YES	YES	YES	YES	YES
Education	YES	YES	YES	YES	YES
Job characteristics	YES	YES	YES	YES	YES
Cohort effect	YES	YES	YES	YES	YES
Subsidies and other income	YES	YES	YES	YES	YES
Impact of PAYG <i>SSW</i>	-.1118112** (-2.80)	.0097989 (1.00)	.0027088 (0.95)	.0002247 (1.33)	.0048121 (0.72)
Impact of IA <i>SSW</i>	0.2418527	-0.1256806	-0.0422179	-0.0002626	-0.0683049
Prob <i>F</i> -Stat	0.39	0.29	0.24	0.62	0.36
Observations	305	305	305	305	305
R^2	0.63	0.12	0.95	0.45	0.22
Prob- <i>F</i>	0.000	0.000	0.00	0.000	0.000

Source: Own calculations. The note 1 (·) defines an indicator function equal to one when the enclosed text is true. *T*-test in parentheses. The notes ** and * indicate significance at 5% and 10%, respectively. The coefficient on "Impact of IA *SSW*" is constructed by adding up the estimates β_0^{PG} and $(\beta_0^{IA} - \beta_0^{PG})$. The "Prob *F*-Stat" corresponds to the null hypothesis "Impact of IA *SSW*" being zero.

of PAYG social security wealth, individuals in this group depress the value of the ownership of real estate by almost 0.11 pesos. Furthermore, the impact of IA is insignificant.

6. DISCUSSION

We can summarize our results as follows. Firstly, there is consistent evidence indicating no impact of IA social security wealth on other types of wealth holdings. This result holds true for different definitions of wealth and for different socioeconomic groups of individuals. A similar conclusion holds for the PAYG social security wealth with the exception of the group of poorer individuals, which, in our case, is approximated by individuals with no more than primary education. This first result, for example, no impact of social security wealth on other types of wealth holdings, might indicate that social security wealth is a poor substitute for other types of wealth.

A second result is that the impact of PAYG social security wealth is economically and statistically significant if we focus on the group of poorer individuals, as it depresses by almost 0.1 pesos other types of wealth holdings per each peso in the PAYG system. To be more precise, the result occurs in that group because PAYG social security depresses their accumulation of real estate wealth. Note that in fact, it is not surprising that social security wealth depresses wealth accumulation by impacting real estate since a larger fraction of people reports real estate wealth holdings (see Table 7), compared to other categories of wealth holdings. Thus, if any effect would exist,

we might expect that the impact occurs in real estate holdings.

Note that the effect arises in the case of the PAYG system while we found no effect in that group in the case of the IA system. This result might be explained, on the one hand, because the PAYG seems to be more generous to poorer individuals compared to the rest of the population. In fact, note that the ratio of average pensions of individuals with less than primary education *vis-à-vis* the average job income of individuals with less than primary education in 2004 was approximately¹⁴ 1.93. The ratio is similar for individuals with secondary education (1.02) and for individuals with tertiary education (1.04). Thus, the PAYG system provided significant redistribution to poorer (less educated) individuals. On the other hand, poorer individuals seem to be more credit-constrained than other individuals. In fact, individuals with less than primary education hold, on average, a fraction of debt to job income approximately equal to 15% while the same ratios for individuals with secondary and tertiary education are around 22% and 25%, respectively. Borrowing constraints are generally associated with precautionary savings. However, future generous benefits in the PAYG system in the case of poorer individuals might require less precautionary savings and decrease wealth accumulation.

Our results have some important policy implications. Firstly, greater social security benefits depress wealth accumulation only in the case of less educated individuals, but not in the rest of the population. This is an important implication in developing economies where precautionary savings allow people to insure

Table 7. *Fraction of individuals holding assets and debts*

Real estate	Cars	Savings to purchase real estate	Voluntary pension funds savings	Mutual funds	Savings account	Bank deposits	Stocks	Others	Physical capital	Own a business
<i>Assets</i>										
10.3	22.2	0.70	2.70	0.78	12.8	1.13	0.81	1.09	2.01	5.46
Bank credit cards	Banking credit line	Store credit cards	Bank loans	Other loans	Educational debt	Debts with family members				
<i>Debts</i>										
5.25	3.93	44.4	8.47	6.2	3.61	1.17				

Source: Own calculations.

themselves against negative income shocks occurring before retirement. If we would have found that social security wealth depresses asset accumulation, we may have encountered a situation in which individuals become unprotected against negative job income shocks before retirement if social security benefits are increased. Our results generally discard this situation with the exception of less educated (poorer) individuals, who may react by means of a significant decrease in their wealth holdings as a PAYG social security system is implemented.

Note that the negative impact of the PAYG system on wealth holdings of less educated individuals seems to be related to the generous ben-

efits they receive, which implies that the design of the PAYG system might be the key to our result. This result has two contradictory sides: on the one hand, poorer individuals receive high benefits upon retirement but on the other hand, these high benefits leave individuals unsecured before retirement against income shocks as it depresses wealth holdings.

Secondly, our results indicate that switching from a PAYG system to an IA system would have only minor impacts on wealth accumulation because in general, neither of these systems impact wealth holdings considerably. This is, of course, a relevant conclusion for developing economies that are considering switching from a PAYG system to an IA system in the future.

NOTES

1. As will be discussed later, in this paper we use the EPS 2004 ("Encuesta de Protección Social"), which contains detailed information concerning wealth holdings. The CASEN survey (Encuesta de Caracterización Socioeconómica") could be another source of information. However, that survey contains only information on durable goods and real estate.
2. Similar results were obtained in [Diamond and Hausman \(1984\)](#).
3. [Butelmann and Gallego \(2001\)](#) studied savings rates in Chile using a microeconomic dataset similar to the one used in this paper. However, they do not focus on the impact of social security wealth on wealth accumulation like in this paper.
4. If an individual retires and his individual account is too small, the system guarantees a minimum benefit funded from general revenues, calculated as the higher of 75% of the poverty line or 25% of a worker's average pay over the 10 years prior to retirement. In such cases, individuals forfeit their funds and receive the minimum benefit.
5. In the period 1981–2003, each AFP managed a unique portfolio of its investments. Since 2003, each AFP is allowed to manage five different portfolios, which differ in terms of composition, some of the portfolios being riskier than others. In our graph and since 2003, we report the rate of return of the portfolio most similar to the portfolio used before 2003.
6. See [Arellano \(1985\)](#).
7. The survey can be found at www.proteccionsocial.cl.
8. Debts are measured net of payments.
9. As social security taxes are paid as a fraction of job income, the information on social security affiliation is directly linked to employment.
10. Life expectancy was around 80 years in 1998.
11. See http://www.ine.cl/canales/chile_estadistico/demografia_y_vitales/estadisticas_vitales/pdf/tablas-mortalidadporsexo2001_02.pdf.
12. In the case of women, PAYG social security benefits are received from the age of 60. Hence, we must construct survival probabilities starting at age 60. To do so, we assume that the odds of reaching 65 years of age (the variable we have available in the survey) are similar to the odds of reaching 60 years of age.
13. [Berstein, Larraín, and Pino \(2005\)](#) reported average job income of \$340,000 pesos per month in December 2004. The data differ from our calculation because our calculations include individuals with zero earnings (outside of the work force) while [Berstein et al. \(2005\)](#) used data of individuals in the formal job market. Therefore, our calculations use unconditional average job income.
14. *Source*: own calculations.

REFERENCES

- Arellano, J. P. (1985). *Políticas Sociales y Desarrollo: Chile 1924–1984*. Santiago, Chile: Corporación de Investigaciones Económicas para Latinoamérica (CIEPLAN).
- Arrau, P. (1991). La reforma Previsional Chilena y su financiamiento durante la transición. *Colección de Estudios Corporación de Investigaciones Económicas para Latinoamérica (CIEPLAN)*, 32, 5–44.
- Barro, R. (1974). Are government Bonds net wealth?. *Journal of Political Economy*, 82(6), 1095–1117.
- Barro, R., & MacDonald, G. M. (1979). Social Security and Consumer Spending in an International Cross Section. *Journal of Public Economics*, 11(3), 275–289.
- Berstein, S., Larraín, G., & Pino, F. (2005). *Cobertura, densidad y pensiones en Chile: Proyecciones a 20 años plazo: Working paper 12, working paper series*. Santiago, Chile: Superintendencia de Administradora de Fondos de Pensiones.
- Butelmann, A., & Gallego, F. (2001). Household Saving in Chile (1988 and 1997): Testing the Life Cycle Hypothesis. *Cuadernos de Economía-Latin American Journal of Economics*, 38(113), 3–48.
- Cerda, R. (2008). The Chilean pension reform: A model to follow? *Journal of Policy Modeling*, 30(3), 541–558.
- Cifuentes, R. (2000). *How does pension reform affect savings and welfare? Working paper 80, working paper series of the Banco Central de Chile*. Santiago, Chile: Banco Central de Chile.
- Corbo, V., & Schmidt-Hebbel, K. (2003). Efectos macroeconómicos de la reforma de pensiones en Chile. In *Resultados y Desafíos de la Reforma al Sistema de Pensiones* (pp. 259–352). Santiago, Chile: Federación Internacional de Administradoras de Fondos de Pensiones (FIAP).
- Coronado, J. (2002). The effects of social security on household savings: evidence from Chile. *Contributions to Economic Analysis and Policy*, 1(1), 152–175.
- Deaton, A. (1991). Saving and liquidity constraints. *Econometrica*, 59(5), 1221–1248.
- Diamond, P., & Hausman, J. (1984). Individual retirement and individual behavior. *Journal of Public Economics*, 23(1–2), 81–114.
- Feldstein, M. (1974). Social security, induced retirement, and aggregate capital accumulation. *Journal of Political Economy*, 82(5), 905–926.
- Feldstein, M. (1977). Social security and private savings: international evidence in an extended life-cycle model. In M. Feldstein, & R. Inman (Eds.), *The Economics of Public Services*. London: MacMillan Publishing Company.
- Feldstein, M. (1980). International differences in social security and savings. *Journal of Public Economics*, 14(2), 225–244.
- Feldstein, M., & Pellechio, A. (1979). Social security and household wealth accumulation: New microeconomic evidence. *Review of Economics and Statistics*, 61(3), 361–368.
- Feldstein, M., & Samwick, A. (1997). The economics of prefunding social security and Medicare benefits, Working paper 6055, *NBER working paper series*. Cambridge, Massachusetts: National Bureau of Economic Research.
- Gullason, E., Kolluri, B., & Panik, M. (1993). Social security and household wealth accumulation: Refined microeconomic evidence. *The Review of Economics and Statistics*, 75(3), 548–551.
- Gustman, A., & Steinmeier, Th. (1999). Effects of pensions on savings: Analysis with data from the health and retirement study. *Carnegie-Rochester Conference Series*, 50, 271–326.
- Hachette, D. (1998). Ahorro privado en Chile. *Cuadernos de Economía-Latin American Journal of Economics*, 35(104), 3–48.
- Holzmann, R. (1997). *Pension reform, financial market development and economic growth: Preliminary evidence from Chile, IMF staff papers*, 44. Washington: IMF.
- Instituto Nacional de Estadísticas (2004). *Tablas Abreviadas de Mortalidad por Sexo, Total País y Regiones, 2001–2002*. Santiago, Chile: Instituto Nacional de Estadísticas.
- Kotlikoff, L. (1995). Privatization of social security: how it works and why it matters. *Working paper 5330, NBER working paper series*. Cambridge, Massachusetts: National Bureau of Economic Research.
- Mitchell, O., & Zeldes, S. (1996). Social security privatization: A structure for analysis. *American Economic Review*, 86(2), 363–367.
- Novos, I. (1989). Social security wealth and wealth accumulation: Further microeconomic evidence. *Review of Economics and Statistics*, 71(1), 167–171.
- Schmidt-Hebbel, K. (1998). Does pension reform really spur productivity, saving and growth? Working paper 33, *working paper series of the Banco Central de Chile*. Santiago, Chile: Banco Central de Chile.

