



HHS Public Access

Author manuscript

Am Econ J Econ Policy. Author manuscript; available in PMC 2017 March 10.

Published in final edited form as:

Am Econ J Econ Policy. 2011 November ; 3(4): 1–24. doi:10.1257/pol.3.4.1.

Personal Retirement Accounts and Saving†

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Abstract

Aging populations are leading countries worldwide to social security reforms. Many countries are moving from pay-as-you-go to personal retirement account (PRA) systems because of their financial sustainability and positive impact on private savings. PRA systems boost private savings at a macro level by converting a government liability into financial wealth managed by private fund managers. However, at a micro level, changes in retirement wealth affect individuals' saving and consumption patterns through their working lives. Retirement wealth increased for lower-income workers after Mexico introduced PRAs, crowding out saving, increasing consumption, and offsetting some of the PRA effect on private savings. (JEL D14, E21, H55, J26, O16)

This is a crucial moment in world history for retirement security. In the United States, the baby boomers are just three years away from receiving Social Security checks and an aging-population tsunami is sweeping the rest of the world as well.

— Olivia Mitchell 2005¹

Traditional pay-as-you-go (PAYG) social security systems, based on younger workers paying into the system to fund retirees' social security benefits, are under worldwide threat as a result of an aging population. Many Latin American, Eastern European, and Asian countries have chosen to meet this challenge by considering a social security reform that shifts the traditional PAYG system to a system of personal retirement accounts (PRAs). Defined simply, PRA systems are hybrids between traditional PAYG schemes and individual retirement accounts, as the PRA plan includes a government-guaranteed minimum benefit.

In this study, we analyze the impact that reforming a PAYG system to a PRA system has on individuals' consumption and saving behavior. Previous studies have found that the reform from PAYG to a PRA program is successful, from a macro-economic perspective, in increasing private savings.² These analyses account only for the transfer of those retirement funds previously under government management to the financial market and for the fiscal costs of this reform.³

†To comment on this article in the online discussion forum, or to view additional materials, visit the article page at <http://www.aeaweb.org/articles.php?doi=10.1257/pol.3.4.1>.

¹In “Retirement Programs Face an ‘Aging-Population Tsunami,’” (Knowledge@Wharton 2005).

²A survey about the impact of the pension reform on savings for Latin American countries is presented in Carmelo Mesa-Lago (2004). For the Mexican case, see Carlos Sales-Sarrapy, Fernando Solís-Soberón, and Alejandro Villagómez-Amezcuca (1998).

³The reform's fiscal cost is generally defined as the total government liability of the PAYG system, which includes both the social security benefits of retired individuals and the transition cost of the reform itself.

A microeconomic perspective is equally important to consider, as this type of reform could change expected retirement wealth, modifying individuals' decisions about saving and consumption. Such modifications could lead to crowding-out effects of workers' personal savings, which may, in turn, offset the expansion of overall private savings and generate long-run effects on saving patterns. The Mexican case lends itself especially to understanding the microeconomic impact caused by this shift in social security systems.

In 1997, the Mexican Social Security Institute (Instituto Mexicano del Seguro Social, or IMSS) for private-sector workers changed its PAYG system to a PRA model, which affected 38 percent of the labor force and 51 percent of those working in the formal sector.⁴ The reform generated differential effects on social security wealth by labor-income level, which allows us to analyze the impact of this reform across individuals. Moreover, because employees in other social security systems in Mexico did not undergo the reform, the Mexican case provides its own comparison group to evaluate the reform as an experiment using a difference-in-differences approach.

In this study, we compare workers in the formal private sector with those in the public sector. Later, we discuss and test extensively the comparability of these groups. Other studies evaluating labor-market reforms compare informal- and formal-sector workers (see, for example, Adriana D. Kugler 1999). However, estimation problems may arise in such studies because workers in the informal sector are a selected population.⁵ In this case, it would not be valid to include workers in the informal sector as a comparison group because they do not face the same incentives for working that those in the formal sector have because, by definition, they are not part of the social security system.

Our study of the Mexican case finds that the social security reform increased retirement wealth for lower-income workers, raising their consumption and reducing their saving rates. Lower-income individuals represent more than 50 percent of the workforce in Mexico, so these findings suggest that such a reform can have a long-term effect on saving patterns.

Following Martin S. Feldstein's seminal 1974 paper, a growing body of literature has found evidence that social security wealth strongly decreases private saving (see, for example, Alicia H. Munnell 1974; Martin Feldstein and Anthony Pellechio 1979; Rob J. M. Alessie, Arie Kapteyn, and Frank Klijn 1997; Orazio P. Attanasio and Agar Brugiavini 2003; Attanasio and Susann Rohwedder 2003; Renata Bottazzi, Tullio Jappelli, and Mario Padula 2006; Gary V. Engelhardt and Anil Kumar 2011). However, other studies have found low or no displacement of private savings by social security wealth (see, e.g., P. A. Diamond and J. A. Hausman 1984; Alan L. Gustman and Thomas Steinmeier 1999; and Rob Euwals 2000). There is no conclusive evidence on the crowding-out effects of social security wealth on private saving. Some of the previous studies analyze parametric changes to a social security scheme (e.g., changes to the rules of the plan maintaining the public provision), which may be vulnerable to endogenous policy problems and lack of policy variation. Our results are novel in that they analyze a large social security reform changing the unfunded defined-

⁴In this paper, the formal sector consists of individuals who pay taxes and make social security contributions.

⁵Guillermo Perry et al. (2007) describe the informal sector across Latin America and conclude that it is made up of a diverse group of individuals, including voluntary and involuntary salaried workers and the self-employed.

benefit (DB) system to a funded defined-contribution (DC) plan and provide evidence that supports the predictions of the life cycle model.⁶

This paper is organized as follows. Section I describes the general features of the PAYG and PRA systems while providing some of the more specific institutional background for the Mexican reform. Section II presents our theoretical framework—a simple version of the life cycle model—and the model's predictions for consumption and saving patterns. Section III describes the data and discusses the comparability of the treatment and control groups. Section IV discusses the evaluation methodology and presents the results using parametric difference-in-differences methods. In Section V, we explore the evaluation results further by using nonparametric difference-in-differences methods. Propensity-score matching is used to obtain a more flexible estimator that balances the differences between IMSS and comparison-group samples. In Section VI, we present robustness checks, including tests for announcement effects and differential trends between treatment and control groups. Section VII offers a brief conclusion and some policy implications derived from this study.

I. Context

Chile was the first country to reform social security from a PAYG system to a PRA system. Since the Chilean reform in 1981, at least 18 countries have followed in Latin America, Europe, and Asia. The design of the PRA system is based on three pillars. The first pillar is a minimum pension guarantee managed by the government. The second is a mandatory personal retirement account, and the third is a voluntary-saving account. Both of these latter two pillars are privately managed.⁷ The PRA has a hybrid design, including characteristics from DB and DC schemes.

In the Mexican case, PRAs are managed by private retirement-fund managers (Administradoras de Fondos de Ahorro para el Retiro, or AFOREs). Individuals can choose to retire either by receiving an annuity or by receiving a prespecified programmed withdrawal amount. Voluntary contributions are managed separately from the mandatory-saving retirement account. At retirement, if the amount accumulated in a worker's individual account yields an annuity lower than the minimum wage, the government provides a lifetime minimum pension that makes up the difference by providing an annuity equivalent to the minimum wage.

One of the primary differences between the Mexican reform and similar largescale shifts in other countries is that all Mexican workers affiliated with a PAYG system switched to the PRA system at the moment of the reform. Because of this, we can distinguish two cases: The *transition-generation* group, those employees who made contributions to the PAYG system before the reform, and the *new generation*, those individuals who entered the social security system after the reform.⁸ The transition generation has the option of choosing, at retirement, the highest social security benefits under the PAYG or PRA rules. At the moment

⁶In DB schemes, at retirement, the individual receives a specific amount of pension based on years of service and salary history. In contrast, in a DC plan, at retirement, the individual receives a pension based on the amount contributed throughout his or her working life and the investment income earned. There is no guarantee of receiving a specific amount in pension payments.

⁷For a more detailed description of the design of fully funded systems with individual accounts, see World Bank (1994).

of retirement, the government shows the retiree the annuities under both schemes, and the individual chooses the preferred option.⁹ After the reform, workers had to choose an AFORE, and this process was done gradually. The reform was implemented in July 1997. By December 1997 more than 65 percent of workers enrolled in the social security system had chosen an AFORE (Aguila, Attanasio, and Ximena Quintanilla 2010). New-generation individuals can retire only under the PRA plan.

Fiscal cost is, and continues to be, a common concern when implementing this type of social security reform. In Mexico, the fiscal cost includes the social security benefits for individuals who retired before the reform, the provision of the minimum pension guaranteed under the PRA plan, and the social security benefits of those transition-generation employees who choose to retire under the PAYG scheme after the reform has been implemented. The government has been financing this liability through income tax and debt. Later, we discuss the possible effects that government financing of fiscal costs may have on our analysis.

Mexico's Reform of Its Payg System to a PRA Plan

The 1997 reform significantly changed the social security system in Mexico. The minimum number of years of contribution changed from 10 to 25 under the PRA system, and social security benefits changed from a DB scheme to a DC scheme. Moreover, the PAYG system included an actuarially fair discount for early retirement at age 60, while the PRA plan allows early retirement from age 60 as long as the individual has enough funding to cover an annuity equivalent to the minimum wage. Finally, an indexation of social security benefits in the PAYG system was made according to changes in the minimum wage, while a PRA is indexed to inflation (see Table 1).

Table 2 shows contributions to the social security system before and after the reform. Services provided by IMSS are financed with a monthly payroll tax levied on employer and employee. Mandated contribution amounts did not change for the employee and employer.

Additionally, the government makes monthly contributions to the social security system. This is the second redistributive element of the PRA system in Mexico. The reform increased government contributions to the social security scheme by about US\$5 per month as a result of the introduction of a flat rate called a social quota. The social quota is equivalent to 5.5 percent of the minimum wage for Mexico City, adjusted for inflation using the National Consumer Price Index (NCPI).¹⁰

⁸Other studies with a more macro approach define as the transition generation all individuals who finance, through income tax or other type of taxes, the fiscal cost of the reform. In this paper, the transition generation is defined as those transitioning from the PAYG system to the PRA system who keep their acquired labor rights to claim the PAYG social security benefits.

⁹This is a unique feature of the Mexican pension reform. For example, in Chile, individuals contributing to the PAYG system were given the option to stay in that system or switch to the PRA system when the reform was implemented. Those individuals who chose to switch to the PRA system were given recognition bonds equivalent to the amount previously contributed in the PAYG system.

¹⁰IMSS also offers health-care services. The reform completely changed the formula of contributions to healthcare services. Before 1997, the employer and worker jointly contributed 11.875 percent of the worker's wage. After 1997, the employer contributes 13.9 percent of the minimum wage for workers' labor income equivalent to up to three times the minimum wage. For workers earning more than three times the minimum wage, the employer and employee contribute an additional 8 percent of the difference between the worker's wage and three times the minimum wage.

II. Simple Theoretical Framework

According to the life cycle hypothesis (LCH), an individual smoothes the marginal utility of consumption across periods to maximize utility during his or her life span. We use a four-period version of the life cycle model: During the first three periods, the representative individual of a generation is in the labor market, while, in the fourth period, he or she retires. In this model, the new generation is the young cohort that had not reached the age to enter the labor market in 1997. In contrast, the transition generation was already in the formal labor market at the end of the first or second period of its members' working lives—i.e., these are middle-aged (*ma*) or older (*old*) workers.

The LCH predicts a degree of substitutability between social security wealth and household assets. Social security wealth may not be a perfect substitute for other types of savings because social security benefits are not liquid assets. In the model, disposable income is allocated between consumption and savings. Assume that the utility function is isoelastic and intertemporally separable:

$$U(C_1, C_2, C_3, C_4) = \sum_{t=1}^4 \rho^{t-1} \frac{C_t^{1-\theta}}{1-\theta}. \quad (1)$$

The utility function depends on consumption in every period C_t . The intertemporal elasticity of substitution is $1/\theta$, and ρ is the discount factor. The budget constraint specifies that the present value of lifetime consumption is less than or equal to the present value of net labor income W_t and social security benefits (SS^j):

$$\sum_{t=1}^4 \frac{C_t}{(1+r)^{t-1}} \leq \sum_{t=1}^3 \frac{w_t}{(1+r)^{t-1}} + \frac{SS^j}{(1+r)^3}, \quad (2)$$

where r is the interest rate and $j = PAYG, PRA$. $W_t = w_t(1 - \tau - \phi)$, where w_t is before-tax labor income, τ is the contribution rate to the social security institution, and ϕ is the income tax rate. We assume no bequests. Thus, the individual does not have assets in period 1, and all wealth is consumed by the last period. Borrowing or lending is possible, but, at the end of the life span, there must be no debt. Savings evolve according to $S_t = (1+r)S_{t-1} + W_t - C_t$. Consumption in the fourth period is $C_4 = (1+r)S_3 + SS^j$. Maximization of the utility function subject to the budget constraint gives the following optimal conditions:

$$C_t = \frac{\left(\rho^{\frac{1}{\theta}}(1+r)^{\frac{1}{\theta}}\right)^{t-1}}{m} \left\{ \sum_{t=1}^3 \frac{W_t}{(1+r)^{t-1}} + \frac{SS^j}{(1+r)^3} \right\}, \quad (3)$$

where $t = 1, 2, 3$ and $m = \sum_{t=1}^4 \left(\rho^{\frac{1}{\theta}} (1+r)^{(1-\theta)/\theta} \right)^{t-1}$. The saving rate (s_t) for periods 1 to 3 ($t = 1, 2, 3$) is as follows:

$$s_t = \frac{W_t - C_t}{W_t} = 1 - \frac{\left(\rho^{\frac{1}{\theta}} (1+r)^{\frac{1-\theta}{\theta}} \right)^{t-1}}{m} \left\{ \frac{1}{W_t (1+r)^{4-t}} \left(\sum_{t=1}^3 W_t (1+r)^{4-t} + SS^j \right) \right\}. \quad (4)$$

The model implies that an increase in social security wealth decreases the saving rate through working life and increases consumption.¹¹ The transition generation reoptimizes choices because, at the beginning of the fourth period, its members will choose max [SS^{PAYG} , SS^{PRA}]. It is easy to verify that $C_{3,old} SS < C_{3,ma} SS < C_{3,young} SS$ and $s_{3,old} SS > s_{3,ma} SS > s_{3,young} SS$. The latter implies that, for those individuals of the transition generation who experienced the social security reform in the third (last) period of their working lives (*old*), the increase in consumption and decline in the saving rate are higher than for middle-aged persons (*ma*) from the transition generation who reoptimize their consumption and saving rates at the beginning of the second period. Younger cohorts (*young*) from the new generation, reoptimize their choices in the first period, and the increase in consumption and decline in saving rate are spread throughout the three periods in the labor market. In the next section, we simulate the differential effects of the Mexican reform on social security benefits across the distribution of lower- middle-, and higher-income individuals and interpret these findings within the framework of the life cycle model.

Model Predictions for the Mexican Reform from a PAYG System to a PRA Plan

We estimate the changes in the present value of social security benefits and take into account the indexation rules of the PAYG and PRA plans:

$$PVSS^j = \sum_{i=R}^I \frac{SS^j \times (1-\delta)^{i-R+1}}{(1+\eta)^{i-R}}. \quad (5)$$

$PVSS^j$ is the present value of the PAYG or PRA social security benefits; I is the total life span, η is the discount rate, and R is the date of retirement. δ is the annual inflationary loss, $\delta > 0$ for the PAYG because it is indexed to the minimum wage, and $\delta = 0$ for the PRA because of its indexation to inflation. Historically, the minimum-wage increase has been lower than the price increase in Mexico, so we introduce an inflationary loss for social security benefits indexed to the minimum wage.

Social security benefits of the PAYG system are estimated according to the pre-reform Mexican system rules. The PRA social security benefits (SS^{PRA}) depend on the rate of return and the amount deposited in the individual account. We assume for simplicity that annuities have a money's-worth ratio of 100 percent, so that there is no cost to obtain an

¹¹These predictions hold for all homothetic utility functions.

annuity¹² A detailed description of the social security wealth estimations is presented in the online Appendix.

After estimating the present value of social security benefits under the PAYG and PRA plans, i.e., under the nonreform and reform scenarios, we find that low- and low-middle-income workers (those earning up to five times the minimum wage) from the new generation obtain greater social security wealth in the reform scenario ($PVSS^{PRA} > PVSS^{PAYG}$). New-generation higher-income cohorts (those earning more than five times the minimum wage) prefer the PAYG system. Higher-income workers would have to obtain an annual average real rate of return of at least 7 percent in the PRA system to match their PAYG social security wealth.¹³

For the transition generation, the main finding is that low- and low-middle-income individuals in older and middle-aged cohorts always choose the PRA ($PVSS^{PRA} > PVSS^{PAYG}$). In fact, the lower the labor income, the higher the social security wealth effect. It is worth highlighting that the majority of workers enrolled with IMSS earn between two and four times the minimum wage, so they are better off in the reform scenario. Higher-income older cohorts always opt for the PAYG scheme. Higher-income middle-aged cohorts also choose the PAYG system ($PVSS^{PRA} < PVSS^{PAYG}$). They would choose the PRA when the annual real rate of return is above 7 percent.

In sum, we find an increase in social security wealth for lower-income workers of the young, middle-aged, and older cohorts, for which we expect an increase in consumption and a decline in the saving rate according to the predictions of the life cycle model derived in the previous section. Social security wealth increased for lower-income cohorts because the PRA indexation to inflation makes social security benefits at and just above the minimum pension guarantee more generous than the PAYG system does.¹⁴ We find basically no change in social security wealth for higher-income workers. For higher-income workers to choose the PRA system, the real rate of return would have to be consistently high.

The next section presents an empirical analysis of the 1997 Mexican social security reform only for the transition generation. The available data are repeated cross-sections; we cannot identify individuals before the reform from the new generation, given that they were outside the formal labor market.

¹²In the Mexican case, annuities are computed with a unique pricing system (SUC). The money's-worth ratio of the annuity is the same for every insurance company (World Bank and International Monetary Fund 2006). For simplicity, we assume a 100-percent money's-worth ratio and use IMSS's mortality tables, since annuities offered by insurance companies using SUC are very close in value to IMSS's annuities.

¹³An issue to take into account is that wealth and mortality rates are correlated (see, for example, Attanasio and Hilary Williamson Hoynes 2000). The wealthy typically receive their pensions for a longer period than the poor. In our framework, it is relevant only to establish which social security system individuals prefer at retirement. The differential mortality effect widens the gap between high- and low-income workers' social security wealth, but the order of preference for a social security system does not change.

¹⁴The social security reform changed labor income because of modifications to the health-care service contribution scheme for employees and employers. We found that the change in employees' contributions caused a very small increase—close to zero—in after-tax labor income. Grecia Maygualida Marrufo (2001) finds that only part of the decline in employers' contribution was shifted to the employee, and the other part was used to generate more employment. Therefore, we expect a negligible impact on after-tax labor income as a result of the reform.

III. Empirical Evaluation of the Social Security Reform

We evaluate the effects of the social security reform using a difference-in-differences approach. We use the 1992–1998 Mexican National Income and Expenditure Survey (Encuesta Nacional de Ingresos y Gastos de los Hogares, or ENIGH), a cross-sectional biennial survey that is the most comprehensive one of household expenditure in Mexico.¹⁵

These data allow us to identify the treatment and control groups for the empirical evaluation. Specifically, the treatment group is private-sector workers enrolled with IMSS before the reform—the transition generation—as we are able to identify them in the survey data before and after the reform. The control group is public-sector workers enrolled with Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado (ISSSTE) who continued in the traditional PAYG system during the same period of observation. In the next two sections, we describe the data and discuss the comparability of the treatment and control groups in terms of individuals' characteristics and regulatory framework.

A. data

The outcome variables are consumption and saving rates. Consumption includes expenditures on both nondurables and durables.¹⁶ The earnings variable is defined as labor income.¹⁷ Saving is obtained as the difference between after-tax labor income and consumption.¹⁸ The saving rate is defined as savings divided by after-tax labor income. Contributions to the social security system are not deductible from income tax. After-tax labor income is gross income minus social security contributions and income-tax payments.

In the analysis, we include age, gender, education, occupation, number of jobs of the head of household, number of children, total household residents, total number of men in the household, family type, geographical region, and community size. Other variables, such as income and number of total working hours, were not included because they could have been affected by the reform. We include heads of household contributing to the private-sector (IMSS) or public-sector (ISSSTE) social security systems. The data for the treatment group after the reform was restricted to workers with more than one year of tenure, to include only the transition generation. The variable tenure is obtained in the 1998 survey using the question about the number of years on the job.¹⁹

¹⁵Chiara Binelli and Attanasio (2010) find that ENIGH consumption measures have a trend similar to that of national accounts of per capita consumption. For most years, ENIGH overestimates consumption by around 20 percent. Those authors conclude that ENIGH may be a more precise source with fewer problems of measurement error to estimate consumption than national accounts. ENIGH has a methodology and design similar to the US Consumer Expenditure Survey (CEX).

¹⁶Each survey contains interviews of approximately 10,000 random households. The survey reports household income and expenditure from the three months prior to the interview. Each household is interviewed with a questionnaire, including household demographic characteristics, labor status, and less frequently purchased goods. After the interview, households fill in an expenditure diary for a week to register nondurable products. The survey has more than 400 expenditure categories.

¹⁷Expenditure and income variables are deflated by the NCPI with the base year 1994. To avoid some sources of measurement error, households that reported zero nondurable consumption or income were excluded from the sample.

¹⁸ENIGH has limited information to estimate the flow of financial savings, and it is not possible to measure the stock of wealth.

¹⁹Before the 1997 reform, IMSS had two types of enrollment: temporary and mandatory. This analysis includes only mandatory workers, because temporary workers did not contribute to the social security system before the reform. Temporary affiliates were entitled only to health-care services, and they were mainly seasonal workers. Because the 1997 reform incorporated all workers who contribute to the pension plan, temporary workers were eliminated from the 1998 sample. Temporary workers are also a small proportion, representing 2.8 percent in 1996, of total IMSS affiliates. In our sample, we dropped 15 observations that corresponded to temporary workers.

Table 3 shows the characteristics over time of the treatment and control groups. In this table, we can observe changes in characteristics before the reform from 1992 to 1996 and after the reform in 1998.²⁰ The distributions of characteristics changed in similar ways from 1992 to 1998 for IMSS and ISSSTE. There is a decrease in the number of individuals with basic schooling and an increasing proportion with a high-school education. The distribution of occupations is very similar in 1992, 1994, 1996, and 1998 within both the treatment and control groups.

Although ISSSTE covers public-sector rather than private-sector employees, its characteristics are similar to the private sector, as the public sector includes both white- and blue-collar workers; additionally, by that time there was no career civil servants in the Mexican government, so the government position was not guaranteed by tenure; the labor regulatory framework provides the same conditions for public- and private-sector workers in terms of job stability.²¹ The control group has a smaller sample. This is consistent with the public-sector system, which covers fewer workers—around 30 percent of those covered by the private-sector scheme. In the next section, we present the comparability of the characteristics of the regulatory framework of the treatment and control groups.

B. Regulatory Framework for Treatment and control groups

In Mexico, ISSSTE manages the mandatory social security scheme with the highest coverage for public-sector workers. ISSSTE covers 5.7 percent of the labor force and 7.6 percent of the formal sector. The private-sector (IMSS) and public-sector (ISSSTE) systems provide similar kinds of services. Table 4 shows a comparison of the regulatory framework of their PAYG plans. The retirement age and minimum years of contribution are the same for both groups. Contributions are lower for the public-sector system. However, the employee pays a higher contribution: 3.5 percent for the public-sector plan, compared with 2.125 percent for the private-sector system. The method of computing the public-sector social security benefits can be more generous than that of the private-sector system. The private-sector plan takes into account in the estimation of social security benefits the average wage of the five years prior to retirement; the public-sector plan takes into account only the wage of the year preceding retirement.

In 1992, a social security reform that primarily affected the private-sector (IMSS) and public-sector (ISSSTE) schemes introduced complementary PRAs managed by the Central Bank (Sistema de Ahorro para el Retiro 1992, or SAR 92). The balance of the SAR 92 personal account was given to the worker at retirement as a one-off payment in addition to the PAYG pension. SAR 92 had many management inefficiencies, and the PAYG schemes had an unsustainable deficit that led to Mexico's Congress approving a major social security reform in December 1995 that required that PRAs substitute for the private-sector (IMSS) PAYG scheme starting July 1, 1997. Both social security schemes followed the same course until the private-sector (IMSS) system was reformed in 1997. The public-sector system (ISSSTE) remained unaltered until 2007.

²⁰On December 19, 1994, Mexico suffered an unexpected depreciation of the peso exchange rate, igniting a major economic crisis throughout the country. The 1994 ENIGH interviews finished before this event.

²¹Career civil service was instituted in Mexico since April 2003.

This major social security reform was a response to a growing concern about the low levels of private savings and an unsustainable financial imbalance of social security schemes. As the private-sector (IMSS) system represented the largest cash-flow deficit problem for the government, this social security system was the first one to be reformed. The next section presents the empirical results of the impact on consumption and saving rate of the 1997 reform.

IV. Difference-in-Differences Approach

We evaluate the impact of the social security reform using the 1994 and 1998 ENIGH surveys—one year before the reform was approved and one year after the reform was enacted. The difference-in-differences framework is the following: Let C_{it} denote the outcome in treatment status i and period t . A person in state $i = 1$ is a treated unit who was affected by the social security reform switching from PAYG to PRA. A person in state $i = 0$ is a nontreated (control) unit who was not affected by the social security reform and continued contributing to PAYG. $IM = 1$ refers to the reception of treatment and $IM = 0$ to nontreatment. The difference-in-differences estimator is

$$E(C_{11} - C_{10}|IM=1, X) - E(C_{01} - C_{00}|IM=1, X). \quad (6)$$

The main identifying assumption is that the change in the outcome variable for workers affiliated with the private-sector system would have been the same as for the control group in the absence of the social security reform. The estimated difference-in-differences model is

$$\ln C_{it} = \gamma_t \beta_1 + \zeta_{IM} \beta_2 + (\gamma_t \times \zeta_{IM}) \beta_3 + X'_{it} \beta_4 + \varepsilon_{it}, \quad (7)$$

where γ_t is a dummy variable for time period, ζ_{IM} is a dummy for contribution to IMSS, $\gamma_t \times \zeta_{IM}$ is the interaction term, and X_{it} includes household and head-of-family characteristics, including a constant term.

Table 5 shows the impact of the social security reform on consumption and saving rates. The first row of Table 5 shows the average effect on consumption and the saving rate of the treatment on the treated for low- and lower-middle-income workers (earning up to five times the minimum wage) and, in the second row, for middle- and higher-income employees (earning more than five times the minimum wage). For the sake of completeness, the third row shows the average effects for the total sample, including all levels of labor income. We also present in the first column the estimates for all age groups, including both younger and older cohorts, as well as separately for younger and older cohorts in the second and third columns, respectively.

We find a significant positive effect on consumption of 6.6 percent for lower-income workers consistent with life cycle model predictions. The second column of Table 5 also shows a significant increase in consumption for younger lower-income cohorts by 8.0

percent. We find a very small decline in the saving rate, less than 1 percent for all groups of age and for younger cohorts, but the estimate is not statistically significant. The estimates for lower-income older cohorts are small and not precise enough to be statistically significant. We find no effects for higher-income workers, which is consistent with the life cycle model predictions.

One of the key identifying assumptions of the difference-in-differences model is no contemporaneous shock to the treatment group when the treatment is implemented. It is relevant to check whether treatment and control groups follow different trends before the reform. Figure 1 shows the trend of consumption and labor income for the treatment and control groups from 1992 to 1998.

We observe that there is a systematic difference and a similar trend between the mean consumption and labor income of the control and treatment groups.²² The sharp decline in consumption is a result of the 1995 economic crisis. We also conducted regressions to test for differential macro shocks in the outcome variables, and we find evidence that the treatment and control groups follow the same income trends.²³

Table 6 shows a comparison of the variables relevant in the analysis for the treatment and control groups before the Mexican reform. The third column shows the difference between treatment and control groups and whether these differences are statistically significant. The distribution of the treatment is more concentrated on those receiving basic schooling, while the control group contains more individuals with a college background. The treatment sample has more blue-collar employees; the control group has more white-collar and service workers. Clearly, the sample of treatment and control individuals is not balanced.

In this case, it is appropriate to use a method that balances the characteristics between treatment and control groups, allowing a comparison between comparable individuals. Propensity-score matching has a more adaptable weighting system and balances the characteristics between the treatment and control groups. Multivariate linear regression produces estimates that are a weighted average of the covariates. The value of the coefficients depends on the distribution of the independent variables and the heterogeneity of the average effect of the treatment on the treated (Joshua D. Angrist and Alan B. Krueger 1999). Additionally, it imposes a linear functional form. In the next section, we present the results of the difference-in-differences estimator using nonparametric methods.

V. Nonparametric Difference-in-Differences

We use nonparametric propensity-score matching (Orley C. Ashenfelter 1978; James J. Heckman and Richard Robb Jr. 1985; Heckman, Hidehiko Ichimura, and Petra E. Todd 1997). Matching mimics experimental methods using nonexperimental data. Matching methods provide a control group comparable to the treatment group, as in the case of experimental data, conditioning on observable characteristic X .

²²We also observe, for the mean saving rate, a systematic difference and similar trend between treatment and control groups.

²³Results can be provided upon request to the author.

We estimate the propensity scores using a probit model, impose common support across the four cells, and conduct kernel matching to obtain the average effect of the treatment on the treated. Because there are two sources of nonrandomness—contribution to IMSS or other social security system and time period—two propensity scores are estimated.²⁴ The standard errors are estimated using the bootstrap method.

Table 7 shows the results of the impact that a PAYG-to-PRA social security reform has on consumption and saving rates using nonparametric methods. The first row of Table 7 shows the average effect on consumption and saving rates of the treatment on the treated for low- and lower-middle-income workers, and we find an increase in consumption by 10.4 percent and a decline in the saving rate by 8.4 percent for low- and lower-middle-income individuals.²⁵ In the second row, for middle- and higher-income employees, and the third row, which shows the average effects for the total sample, including all levels of labor income, we do not find any statistically significant results. These results are expected according to the predictions of the life cycle model because the social security reform did not affect all individuals similarly.²⁶

According to the simple version of the life cycle model, we expect a stronger effect for individuals closer to retirement age than for younger cohorts. The second column of Table 7 shows the estimates for younger cohorts (less than 50 years old). The third column shows the results for individuals closer to retirement age (50 years old or above). The total sample (6,056) reduced to 1,011 when obtaining the estimates for persons close to retirement age and to 5,045 for younger cohorts. These estimates are less precise because of the reduced sample size. We obtain a higher increase in consumption and a decline in the saving rate for those closer to retirement age than younger cohorts in the lower-middle-income group. The saving rate drops by 20.4 percent, and consumption rises by 14.6 percent. The sign and relative magnitude of the results for the younger and older cohorts coincide with the predictions of a simple version of the life cycle model. There is no impact for middle- and higher-income workers or for the total sample. The standard errors are large, and the sign and relative magnitude of the estimates between younger and older cohorts show contradictory effects.

Table 8 shows the characteristics of the sample after matching. Kernel matching procedure reweights the comparison units correcting for the differences between the treatment and control samples. We can observe more balanced characteristics between treatment and control groups in comparison to Table 6.

²⁴Because, in this case, the data are repeated cross-sections, we estimate two propensity scores to balance the characteristics of individuals across the four groups. See Richard Blundell et al. (2004).

²⁵The estimations of the confidence intervals using a normal approximation, percentile, and bias-corrected methods give similar results, indicating that the bootstrap distribution is approximately normal. The percentile and bias-corrected confidence intervals provide similar results, so the coefficients estimated are close to the median of the bootstrap distribution.

²⁶For example, for a median low-income worker, who has a monthly labor income of 2.74 times the minimum wage, the average monthly consumption was \$264 before the reform and \$285 after the reform, implying an increase of 8 percent, which is close to the 10 percent found in Table 7. The average increase in monthly income was 2 percent, and the change in the average person's social security wealth is 56 percent. Both effects would increase consumption. These findings also coincide with previous evidence for the Mexican case, in which low-income people change their saving patterns as a result of an intervention. Fernando Aportela (2000) finds that low-income individuals increase their saving rate by 7 percent because of the introduction of *tandabonos* and *cuentahorro* saving instruments, which are liquid saving accounts with a low minimum-balance requirement of around \$5.

In order to check the robustness of the estimates in Table 7, we conduct the analysis using different bandwidths. We also compare the kernel-matching estimates with an alternative method, nearest-neighbor matching. We show the results of different nonparametric specifications in the Appendix, and the estimates are consistent across the different methods. In this case, parametric difference-in-differences methods could be misleading given that the treatment and control-group samples are not balanced. Matching methods corrects for the differences, and we could more accurately compare treatment and control groups.

In order to understand our results within the context of the previous literature, we contrast the change in consumption for low- and lower-middle-income workers found using the difference-in-differences estimator with the findings of previous studies. This exercise is useful to obtain an approximation of the degree of substitutability between social security wealth and financial wealth for the Mexican case and compare them with the findings for other countries. The degree of substitutability between pension wealth and financial wealth was estimated with the simple model presented in Section II for individuals of the transition generation, taking into account the present value of social security wealth before and after the reform.

In the Mexican case, the degree of substitutability would range from 55 percent to 60 percent.²⁷ Attanasio and Rohwedder (2003) found a degree of substitutability between 60 and 90 percent for the United Kingdom. However, for the Italian case, Attanasio and Brugiavini (2003) obtain a lower degree of substitutability that is between 30 and 70 percent, while Bottazzi, Jappelli, and Padula (2006) found the degree of substitutability to be between 30 and 45 percent. For the Netherlands, it is very high, with the degree of substitutability shown to be 100 percent in Alessie, Kapteyn, and Klijn (1997).

Moreover, the impact on number of working hours was estimated, but none of the results is significant. This suggests that labor-supply effects are minimal or absent. We looked into changes in income tax and value-added tax that could have affected labor earnings and consumption during the evaluation period.²⁸ The government strategy to finance the fiscal cost of the pension reform through increasing taxes would not affect our results, as these changes affect both the treatment and control groups in the same way and the effects cancel out. The next section presents other robustness checks and explores potential sources of bias that could violate the identifying assumptions of the difference-in-differences method.

VI. Potential Sources of Bias and Identifying Assumptions

In this section, we analyze further the robustness of our estimates. We test for potential announcement effects of the reform and for preexisting trends between treatment and control groups introducing a placebo reform. We also explore other potential biases that could affect our empirical estimates.

²⁷The assumptions made for the discount factor and intertemporal elasticity of substitution (IES) are based on estimates for other countries and parameters used in previous studies. We assumed a discount factor of 0.90 and an IES between 1.96 and 1.02.

²⁸In 1996, the value-added tax increased by roughly 5 percent. The income tax decreased by around 1 percent from 1994 to 1998 for all levels of labor income.

A. Announcement Effects

It is also worth considering a possible change in saving and consumption patterns immediately after the reform was announced in 1995. This effect would also invalidate our estimator because the growth rate of consumption between treatment and control groups would be different in the absence of treatment. The law that specifies the regulatory framework of the PRA plan was not issued until May 23, 1996 (Ley de los Sistemas de Ahorro para el Retiro). Even when workers became aware in 1995 of the coming reform, there was no certainty about how it was going to be implemented, especially considering that the previous 1992 social security reform failed.

Nevertheless, we test announcement effects using the same methodology to obtain the average effect of the treatment on the treated using the time periods 1992 (three years before the reform) or 1994 (one year before the reform) and 1996 (one year after the reform was announced). Table 9 shows that the results are not statistically significantly different from zero for either consumption or saving rate. There are no significant effects because of the announcement of the social security reform in 1995.

B. Preexisting Trends Between Treatment and control groups

Another approach to test the existence of trends before the reform is introducing a placebo intervention. We could assume that the social security reform was implemented in 1993 and evaluate the impact using data from 1992 and 1994. Table 10 shows the results of a placebo reform.

The results are not statistically significantly different from zero, and we find no evidence of preexisting trends. Lower-, lower-middle-, middle-, and higher-income individuals do not exhibit any treatment effect on their consumption or saving behavior. This falsification test provides further support to our identification strategy.

C. compositional Bias

In this particular case, migration from the informal to the formal sector as a result of the social security reform could change the composition of the treatment group after the social security reform. The informal sector is very diverse and provides an immediate buffer for any shock in the formal sector (Perry et al. 2007). Marrufo (2001) finds evidence of migration from the informal to the formal sector after the 1997 Mexican social security reform. However, this does not cause a bias in the estimates, because the treatment group is the transition generation.²⁹

Another source of compositional bias is migration from the control to the treatment group after the reform. This may change the composition of the control group after the reform. It would not affect the treatment group, because it corresponds only to the transition generation. We find no evidence of migration from ISSSTE to IMSS after the social security

²⁹As mentioned above, the transition generation is made up of individuals who entered the social security system before the reform and kept contributing to the system. Therefore, none of the transition-generation workers, as defined in this study, were in the informal sector after the reform and reentered the system.

reform; the number of contributors shows a steady increase per year of 1.3 percent (see Figure 2).

We further analyzed the pattern of control-group individuals switching to IMSS before and after the reform using the panel component of the Encuesta Nacional de Empleo Urbano (ENEU, or National Urban Employment Survey) from 1994 to 1998 to test this assumption. We find a stable switching of workers from ISSSTE to IMSS between 1994 and 1998 by 4.0 percent of those enrolled with ISSSTE every year.

D. general Equilibrium Effects

Changes in the interest rate could reflect potential general equilibrium effects as a result of the social security reform. On the one hand, the investment portfolios of the PRA pension funds are invested mainly in government bonds. In 1998 and 1999, government bonds represented 97 percent of the investment portfolio. The sudden increase in the demand for government bonds from the pension funds could have affected their rate of return. On the other hand, a sudden increase in the supply of government bonds to finance the fiscal cost of the reform could have changed the rate of return. These changes in the rate of return affect individuals' consumption and saving decisions. We address this issue by looking at the time series of Mexican treasury bills (Certificados de la Tesorería, or CETES) from 1990 to 2000 because other government instruments follow the same trends; this is mentioned in a study of the historical behavior of real interest rates in Mexico by Aportela, José Antonio Ardavín, and Yyannú Cruz Aguayo (2001).

The results do not indicate that the treasury-bill series is a unit root process. Rather, it appears that CETES is stationary in levels, and there is no evidence of a time trend. Moreover, in 1998, pension funds owned 13.1 percent of the total government securities; by 1999, this represented 15.7 percent. The previous findings do not show any evidence of a change in the rate of return of treasury bills because of the increase in the demand from pension funds during the evaluation period of this study. These results also suggest no impact on the rate of return of treasury bills as a result of government financing the fiscal cost of the reform through debt. All these results, taken together, imply that general equilibrium effects are either absent or small.³⁰

E. changes in the Risk of the System and Labor-Market Risk

Labor-market risk could have increased because the requirement of the minimum years of contribution to be eligible for a pension changed from 10 to 25 years, and some workers may not be able to satisfy the new requirement. We can also assume that labor-market risk decreased for individuals with unemployment spells or periods of working life in the informal sector because, under PRA, an individual never loses his or her rights to the amount accumulated in the individual account. Labor-market risk could increase or decrease precautionary savings. In this case, labor-market risk may be causing effects in opposite directions, lowering the possibility of contaminating our results.

³⁰This study does not analyze the reasons that the rate of return of treasury bills did not change. One of the potential reasons is that Mexico is an open economy and its rates are affected more by international capital flows.

Changes in individuals' perception of the risk of the system would also affect precautionary saving. The change in credibility of the social security system is likely to have a generalized impact across all type of workers, and the estimations in Table 7 indicate only an effect for low-income employees. There is no empirical literature to support an assumption that low-income workers have greater expectations of the PRA scheme while higher-income individuals do not perceive any substantial change.

However, the second pillar passes on to the new generation the risk of system performance that the government was bearing in the PAYG plan. There is no additional risk to the transition generation because, in the Mexican case, they can choose to retire under PAYG as discussed in Section I.

VII. Conclusions

This paper demonstrates how the shift from a traditional PAYG social security system to a system fully funded with personal accounts crowds out household saving. The crowding-out effects on low-income household saving imply a decline of 0.53 percent of gross domestic product (GDP) in 1998. Sales-Sarrapy, Solís-Soberón, and Villagómez-Amezcuca (1998) estimate an increase in private saving of 2.18 percent of GDP in the first year of the PRA system, taking into account only the fiscal cost of the reform. Therefore, the increase in private savings found in previous studies is 25 percent lower than originally estimated when the crowding-out effects are considered.

In terms of the design of social security systems, the PRA system is more financially sustainable and redistributive toward low-income individuals by combining a government subsidy with the minimum pension guarantee in the first pillar and with the social quota in the second pillar. A limitation of the social security system is not providing a retirement annuity for those individuals who do not satisfy the minimum contribution requirements of the PRA system. In the Mexican case, the minimum number of years of contribution rose by 15 years. This increase affects individuals with unemployment spells or periods of working life in the informal sector—generally, low-income workers at the bottom of the distribution who cannot contribute voluntarily to the social security system and thus are unable to reach the minimum number of contribution years.

Our results suggest several important public policy implications. The PRA plan's hybrid design eliminates many of the limitations of the PAYG system. However, its implementation requires a thorough evaluation of its impact on vulnerable groups. The third pillar should be carefully designed to promote voluntary saving, given that it is an instrument that could help offset the crowding-out effects on household saving. Additional policies should be put in place to promote saving for retirement. Finally, labor-market policies may be focused on extending working lives to provide an incentive for a higher accumulation of retirement savings in the PRA system.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

I would like to thank CONACYT for the financial support. I am grateful for the advice and support of Costas Meghir. I also wish to thank Orazio Attanasio, James Banks, Erich Battistin, Richard Blundell, Axel Börsch-Supan, Ulises Carrillo, Rodrigo Garcia-Verdu, Tullio Jappelli, Estelle James, Arie Kapteyn, Paula Lopes, Olivia Mitchell, John Van Reenen, Marcos Vera-Hernandez, and participants at the Mexican Central Bank Seminar and the RTN Conferences on Financing Retirement at LSE and on Economics of Ageing at Venice International University for their valuable comments.

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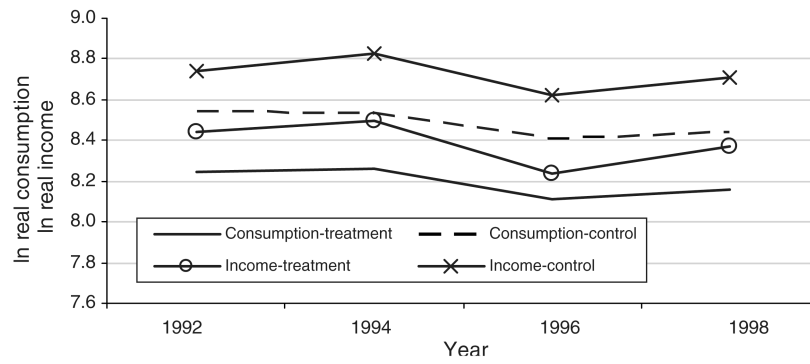


Figure 1. Consumption and Income Trends: Treatment and Control Groups, 1992–1998
Source: Author's calculations using ENIGH 1992–1998

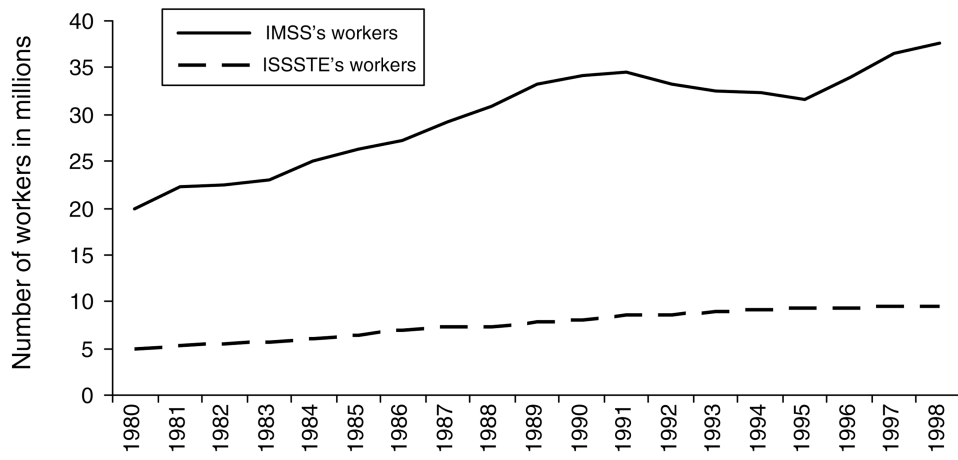


Figure 2. Number of Affiliates in the Private-Sector (IMSS) and Public-Sector (ISSSTE) Social Security Systems, 1980–1998

Sources: Memoria Estadística 2001, Mexico, IMSS; ISSSTE (2001)

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Table 1
Main Characteristics of the Private-Sector (IMSS) Social Security System PAYG and PRA Plans

	Before 1997: PAYG	After 1997: PRA
Normal retirement age	65	65
Early retirement age	60	60
Minimum years of contribution	10	25
Normal-retirement social security benefit	Percentage of average wage of the last five years before retirement	Annuity based on balance of PRA
Early-retirement benefits	A reduction of 5 percent for each year below the normal retirement age	No reduction
Guaranteed minimum pension	Minimum wage	Minimum wage
Indexation of benefits	Minimum wage	Inflation

Notes: *PAYG* refers to the pay-as-you-go system and *PRA* to the personal retirement account plan. The PRA system allows early retirement even before age 60, but the annuity must be higher than 30 percent of the minimum pension guarantee. The minimum wage varies by region. There are three determined regions. The guaranteed minimum pension and the indexation of benefits are computed with the minimum wage for the Mexico City region.

Sources: IMSS (1994, 1998)

Table 2
Contributions to the Private-Sector (IMSS) Social Security System (*Percentage of worker's wage*)

Scheme	Before 1997: PAYG			After 1997: PRA		
	Employer	Employee	Government	Employer	Employee	Government
PAY G	7.950	2.125	0.425	2.800	1.000	0.200
PRA	—	—	—	5.150	1.125	0.225 + social quota
Total	7.950	2.125	0.425	7.950	2.125	0.425 + social quota

Notes: *PAYg* refers to the pay-as-you-go system and *PRA* to the personal retirement account plan. The social quota is a flat-rate government contribution equivalent to US\$5 per month. After 1997, *PAYG* contributions managed by IMSS correspond to health services for pensioners (1.05 percent employer, 0.625 percent employee, 0.125 percent government) and disability and life insurance (1.75 percent employer, 0.375 percent employee, 0.075 percent government).

Sources: IMSS (1994, 1998)

Table 3
Main Characteristics of Treatment and Control Groups, 1992, 1994, 1996, and 1998

	Treatment				Control			
	1992	1994	1996	1998	1992	1994	1996	1998
Average age (years)	36.44	37.26	37.08	38.54	39.75	40.31	40.82	41.61
Standard deviation	(10.63)	(11.17)	(10.63)	(10.78)	(10.22)	(10.44)	(10.12)	(9.84)
Education (percentage)								
Basic	75.43	75.09	71.08	70.11	48.42	44.41	39.79	38.75
High school	11.70	10.72	14.44	15.72	17.98	18.74	19.05	20.85
Undergraduate or more	12.85	14.18	14.47	14.15	33.59	36.84	41.14	40.38
Occupation (percentage)								
White collar	18.08	18.05	19.07	21.42	29.81	29.13	34.38	34.31
Blue collar	60.78	59.23	56.53	55.64	24.60	25.93	20.51	21.15
Services/sales	21.13	22.71	24.39	22.93	45.58	44.92	45.09	44.52
Average ln consumption	8.24	8.25	8.10	8.15	8.54	8.53	8.41	8.44
Standard deviation	(0.70)	(0.73)	(0.65)	(0.65)	(0.66)	(0.69)	(0.64)	(0.68)
Observations	2,333	2,686	2,763	1,914	634	779	887	676

Notes: ln = natural logarithm. We dropped 376 observations from the treatment sample in 1998 that corresponded to individuals of the new generation who enrolled with IMSS in the first year after the social security reform.

Table 4
Requirements and Benefits of the Private-Sector (IMSS) and Public-Sector (ISSSTE)
Social Security Systems

	Private PAYG system	Public PAYG system
Early retirement age	60	60
Minimum years of contribution	10	10
Contributions (percentage of worker's wage)	10.5	9.0
Method to compute social security benefits	Average wage of 5 years preceding retirement	Wage of year preceding retirement
Indexation of social security benefits	Minimum wage	Minimum wage

Notes: *PAyg* refers to the pay-as-you-go system. Contributions in the private-sector social security system are made by the employee, the employer, and the government. For the public-sector social security system, contributions are made by the employee and the employer. The employee contributes 2.125 percent in the private-sector system and 3.5 percent in the public-sector scheme. The minimum wage varies by region. There are three determined regions. The indexation of benefits is computed with the minimum wage for the Mexico City region.

Sources: IMSS (1994), ISSSTE (1994)

Table 5
Consumption and Saving Rates: Average Effect of the Treatment on the Treated Using Parametric Methods

Labor income	All groups of age		Younger cohorts		Older cohorts	
	In consumption	Saving rate	In consumption	Saving rate	In consumption	Saving rate
Lower income	0.0662	-0.0059	0.0800	-0.0087	0.0166	0.0027
Standard error	[0.0396 [*]]	[0.0326]	[0.0428 [*]]	[0.0361]	[0.1046]	[0.0787]
Observations	3,887	3,887	3,341	3,341	546	546
Higher income	-0.0541	0.0160	-0.0499	0.0439	-0.0773	-0.0817
Standard error	[0.0457]	[0.0300]	[0.0509]	[0.0343]	[0.1059]	[0.0603]
Observations	2,168	2,168	1,704	1,704	464	464
All in sample	0.0091	0.0033	0.0199	0.0132	-0.0075	-0.0284
Standard error	[0.0340]	[0.0227]	[0.0371]	[0.0258]	[0.0829]	[0.0529]
Observations	6,055	6,055	5,045	5,045	1,010	1,010
Baseline means (treatment)	8.25	0.13	8.24	0.12	8.35	0.18
Baseline means (control)	8.53	0.17	8.53	0.16	8.55	0.21

Notes: Standard errors are robust to heteroskedasticity. Younger cohorts are those younger than 50 years old; older cohorts are those 50 years and older. We refer to those earning less than five times the minimum wage as lower-income workers and those earning more than five times the minimum wage as higher-income workers. The regression controls for age, gender, education, occupation, number of jobs, total household residents, number of children, total number of men in the household, family type, community size, and regional dummies. ln = natural logarithm.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

Table 6
Comparison of the Treatment and Control Groups Before the Reform

	Treatment 1994	Control 1994	Treatment – control
Age bands (percentage)			
<50 years old (younger cohorts)	84.92	81.38	3.53***
Average age (years)	37.26	40.31	-3.04***
Standard deviation	(11.17)	(10.44)	
Male (percentage)	93.44	87.41	6.02***
Average number of children	2.32	2.21	0.10
Education (percentage)			
Basic	75.09	44.41	30.67***
High school	10.72	18.74	-8.01***
Undergraduate or more	14.18	36.84	-22.65***
Occupation (percentage)			
White collar	18.05	29.13	-11.08***
Blue collar	59.23	25.93	33.30***
Services/sales	22.71	44.92	-22.21***
Number of jobs	1.10	1.18	-0.07***
Total household residents	4.58	4.41	0.16***
Family type (percentage)			
Unipersonal	3.05	5.13	-2.08***
Nuclear	77.84	76.37	1.46
Extended	19.09	18.48	0.61
Living in urban areas of more than 2,500 inhabitants (percentage)	81.23	86.26	-5.02***
Geographic region (percentage)			
Northeast	30.00	18.87	11.13***
Northwest	22.89	17.71	5.18***
Center	30.90	39.53	-8.63***
South	3.83	6.03	-2.19***
Southeast	12.36	17.84	-5.48***
ln consumption	8.25	8.53	-0.28***
Standard deviation	(0.73)	(0.69)	
Average wage (number of times the minimum wage)	4.94	6.35	-1.41***
Standard deviation	(5.82)	(6.44)	
Observations	2,686	779	

Note: ln = natural logarithm.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

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Table 7
Consumption and Saving Rates: Average Effect of the Treatment on the Treated Using Nonparametric Methods

Labor income	All groups of age		Younger cohorts		Older cohorts	
	In consumption	Saving rate	In consumption	Saving rate	In consumption	Saving rate
Lower income	0.1040	-0.0844	0.0680	-0.0183	0.1462	-0.2048
Standard error	[0.0550] [*]	[0.0494] [*]	[0.0654]	[0.0589]	[0.1529]	[0.1220] [*]
Observations	3,887	3,887	3,341	3,341	546	546
Higher income	-0.0431	-0.0191	-0.0098	-0.0046	-0.2712	0.0005
Standard error	[0.0709]	[0.0442]	[0.0780]	[0.0562]	[0.1757]	[0.0872]
Observations	2,168	2,168	1,704	1,704	464	464
All in sample	-0.0325	-0.0318	-0.0308	-0.0034	-0.1866	-0.0835
Standard error	[0.0498]	[0.0350]	[0.0593]	[0.0425]	[0.1280]	[0.0814]
Observations	6,055	6,055	5,045	5,045	1,010	1,010
Baseline means (treatment)	8.25	0.13	8.24	0.12	8.35	0.18
Baseline means (control)	8.53	0.17	8.53	0.16	8.55	0.21

Notes: The kernel function used is the Epanechnikov, and the bandwidth is a rule of thumb suggested by Bernard W. Silverman (1986): $1.06\sigma n^{-1/5}$, σ is the standard error of the propensity score, and n is the sample size. Standard errors are obtained with the bootstrap method in 1,000 replications with replacement. We find that they stabilize in 800 replications. The propensity score includes age, gender, education, occupation, number of jobs, total number of household residents, number of children, total number of men in the household, family type, community size, and regional dummies. After imposing the common support, only 0.6 percent of the observations are selected out. We refer to those earning less than five times the minimum wage as lower-income workers and those earning more than five times the minimum wage as higher-income workers. Younger cohorts are those younger than 50 years old; older cohorts are those 50 years and older. ln = natural logarithm.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

Table 8
Main Characteristics of Treatment and Control Groups After Matching

	1994		1998		1994		1998	
	Treatment	Control	Treatment	Control	Treatment - control	Treatment	Control	Treatment - control
Average age (years)	39.38	38.48	39.01	39.44	0.90	39.01	39.44	-0.42
Male (percentage)	91.50	92.44	91.55	92.85	-0.94	91.55	92.85	-1.30
Average number of children	2.18	2.15	2.13	2.08	0.03	2.13	2.08	0.05
Education (percentage)								
Basic	68.68	67.60	68.00	67.15	1.07*	68.00	67.15	0.84
High school	14.76	15.94	17.00	16.25	-1.18*	17.00	16.25	0.74
Undergraduate or more	16.54	16.44	14.99	16.58	0.10	14.99	16.58	-1.58
Occupation (percentage)								
White collar	24.70	28.72	24.49	27.35	-4.02**	24.49	27.35	-2.85*
Blue collar	53.02	49.98	52.00	51.67	3.03*	52.00	51.67	0.32
Services/sales	22.27	21.28	23.49	20.96	0.98	23.49	20.96	2.53
Number of jobs	1.09	1.10	1.10	1.12	0.00	1.10	1.12	-0.02
Total household residents	4.29	4.23	4.25	4.26	-0.05	4.25	4.26	-0.01
Family type (percentage)								
Unipersonal	3.30	3.26	4.48	3.64	0.00	4.48	3.64	0.83
Nuclear	83.39	86.66	83.11	81.01	-3.27	83.11	81.01	2.10
Extended	13.30	10.06	12.39	15.34	3.23	12.39	15.34	-2.94
Living in urban areas of more than 2,500 inhabitants (percentage)	87.38	91.28	89.25	89.09	-3.90	89.25	89.09	0.16
Geographic region (percentage)								
Northeast	12.65	14.12	13.63	13.96	-1.47	13.63	13.96	-0.32
Northwest	24.17	14.92	22.13	24.03	9.24**	22.13	24.03	-1.89
Center	46.76	56.87	49.94	45.73	-10.10**	49.94	45.73	4.20
South	7.02	3.47	4.78	5.19	3.55**	4.78	5.19	-0.40
Southeast	9.38	10.59	9.50	11.07	-1.21	9.50	11.07	-1.56
Observations	2,263	779	1,907	675		1,907	675	

Note: ln = natural logarithm.

*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

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Table 9
Consumption and Saving Rates: Test for Announcement Effects

Labor income	1992 and 1996		1994 and 1996	
	ln consumption	Saving rate	ln consumption	Saving rate
Lower income	0.0237	0.0037	-0.0093	-0.0187
Standard error	[0.0526]	[0.0607]	[0.0507]	[0.0593]
Observations	4,635	4,635	4,829	4,829
Higher income	-0.0095	0.0125	-0.0314	0.0121
Standard error	[0.0705]	[0.0504]	[0.0644]	[0.0443]
Observations	1,982	1,982	2,286	2,286
All in sample	-0.0433	-0.0069	-0.0562	0.0067
Standard error	[0.0499]	[0.0440]	[0.0466]	[0.0440]
Observations	6,617	6,617	7,115	7,115

Notes: Standard errors are obtained with the bootstrap method. We refer to those earning less than five times the minimum wage as lower-income workers and those earning more than five times the minimum wage as higher-income workers. The propensity score includes age, gender, education, occupation, number of jobs, total household residents, number of children, total number of men in the household, family type, community size, and regional dummies. ln = natural logarithm.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

Table 10
Consumption and Saving Rates: Test for Preexisting Trends

Labor income	1992 and 1994	
	In consumption	Saving rate
Lower income	-0.0035	0.0353
Standard error	[0.0669]	[0.0605]
Observations	4,450	4,450
Higher income	0.0482	-0.0303
Standard error	[0.0765]	[0.0540]
Observations	1,982	1,982
All in sample	0.0486	-0.0608
Standard error	[0.0535]	[0.0386]
Observations	6,432	6,432

Notes: Standard errors are obtained with the bootstrap method. We refer to those earning less than five times the minimum wage as lower-income workers and those earning more than five times the minimum wage as higher-income workers. The propensity score includes age, gender, education, occupation, number of jobs, total household residents, number of children, total number of men in the household, family type, community size, and regional dummies. ln = natural logarithm.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.