

POLICY RESEARCH WORKING PAPER

WPS 2719
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Is There a Positive Incentive Effect from Privatizing Social Security?

Evidence from Latin America

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Introducing individual retirement accounts has a positive incentive effect that increases the share of the economically active population contributing to the reformed pension system. But this effect occurs only gradually as employers and workers become familiar with the new set of social insurance institutions put in place by reform.

The World Bank
Latin America and the Caribbean Region
Human Development Sector Unit
November 2001



Summary findings

There is increasing concern among policymakers that social security reforms that involve a transition to individual retirement savings accounts may exclude certain groups of workers from coverage against the risk of poverty in old age. While most public pay-as-you-go systems pool the risk of interrupted careers and periods of low earnings over the covered population, the reformed systems shift the burden of these risks to the individual. Adequate coverage under a system of individual retirement accounts depends critically on accumulating sufficient savings through regular contributions.

In developing countries where opportunities for unregulated employment abound and workers can easily escape mandated social insurance, theory suggests that reforms will increase the number of contributors to social security by reducing distortions and improving incentives in the labor market. Motivated primarily by fiscal pressures stemming from the deficits of overly generous, poorly administered public pension systems, many governments are going ahead with reforms as if this theory is correct.

Does a shift to individual retirement accounts improve the incentives to contribute to social security? Almost a decade after reforms to national social security systems in Latin America (two decades, in the case of Chile),

existing evidence is mixed. Several studies have found that the share of the Chilean workforce covered by the national pension system has increased since individual retirement accounts were installed in 1981; others have shown that there has been no change in this share. But these studies rely on simulations or on casual observation of data on the sectoral allocation of the labor force and relate only to Chile. Sufficient time has now passed since reforms in several Latin American countries to allow more rigorous testing of the theory.

Packard estimates the impact of social security reform—specifically, the transition from a purely public pay-as-you-go system to one with private individual retirement accounts—on the share of the workforce that contributes to formal retirement security systems. To test the predictions of a simple model of a segmented labor market, he exploits variation in data from a panel of 18 Latin American countries, observed from 1980 to 1999.

Results show that introducing individual retirement accounts has a positive incentive effect that, other things equal, increases the share of the economically active population contributing to the reformed system. But this effect occurs only gradually as employers and workers become familiar with the new set of social security institutions put in place by reform.

This paper—a product of the Human Development Sector Unit, Latin America and the Caribbean Region—is part of a regional study on social security reform. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Truman Packard, room I7-151, telephone 202-458-9078, fax 202-614-0832, email address tpackard@worldbank.org. Policy Research Working Papers are also posted on the Web at <http://econ.worldbank.org>. November 2001. (27 pages)

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Is There A Positive Incentive Effect from Privatizing Social Security? Evidence from Latin America*

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I would like to thank Abigail Barr for her supervision and suggestions, as well as Jan Dehn and Shanaka J. Peiris for their guidance on panel estimation methods. Comments from Robert Holzmann, Anita Schwarz and Aniruddha Bonnerjee, the participants at the Latin America Economic Research Network Workshop on June 4, 2001, the Gorman Student Research Workshop on June 8, 2001, and the workshop on Coverage and Contribution in Pension Systems hosted by the Initiative for Policy Dialogue on September 4, 2001, are also greatly appreciated. Enrique Mezzanotte and Elizabeth Dahan provided valuable assistance gathering data.

I. Introduction

There is increasing concern among policy makers that social security reforms that involve a transition to individual retirement savings accounts, may exclude certain groups of workers from coverage against the risk of poverty in old age. While most public pay-as-you-go (PAYGO) systems pool the risk of interrupted careers and periods of low earnings over the covered population, the reformed systems shift the burden of these risks onto the individual. Adequate coverage under a system of individual retirement accounts depends critically on accumulating sufficient savings through regular contribution. In developing countries where opportunities for unregulated employment abound and workers can easily escape mandated social insurance, theory suggests that reforms will increase the number of contributors to social security by reducing distortions and improving incentives in the labor market. Motivated primarily by fiscal pressures brought by the deficits of overly generous, poorly administered public pension systems, many governments are going ahead with reforms as if this theory is correct.

Does a shift to individual retirement accounts improve the incentives to contribute to social security? Can governments that partially privatize retirement security systems expect an increase in the number of workers who contribute? Almost a decade - in the case of Chile, two decades - after reforms to national social security systems in Latin America, existing evidence in the literature is mixed. Corsetti and Schmidt-Hebbel, (1994), and Schmidt-Hebbel (1998) find evidence that there has been an increase in the share of the workforce covered by the national pension system since individual retirement accounts were installed in Chile in 1981. However, Edwards and Edwards (2000) find that in 1997, only 62% of the labor force in Chile was contributing to the reformed national system – about the same share of workers who contributed to the PAYGO system prior to reform. Cortazar (1997) and Arenas de Mesa (2000) similarly find no change in the portion of contributing workers. However, the findings of these studies rely either on simulations or casual observation of the available data on sector allocation of the labor force and relate only to Chile. Sufficient time has now passed since reforms in several Latin American countries to allow for more rigorous testing of the theory.

This paper tests the implications of a simple model developed by Edwards and Edwards (2000) of a labor market undergoing a transition away from a purely PAYGO social security system to one with individual retirement accounts. The objective of the paper is to estimate the impact of these reforms that were intended to lower labor market distortions and correct incentives at the aggregate level. To do this, I exploit variation in the data from a panel of eighteen Latin American countries over the 1980's and 1990's, of which seven have undergone the transition to a national system of individual retirement accounts.¹ The next section provides a brief background on social security reform in Latin America. Section III reviews the relevant literature on the impact of reforms on the labor market, and presents the model. Section IV discusses the methodology, the data used in the estimation, and the hypotheses that are tested. Section V presents the results of regressions using pooled OLS, fixed and random effects estimators, and discusses the robustness of these findings. Section VI concludes.

II. Social Security Reform in Latin America

Among developing regions, Latin America has a relatively long tradition of institutionalized social security. Governments at various levels, unions and trade associations have been administering retirement, disability and survivor insurance - and in some cases unemployment insurance - since the early 1900s. Despite this long tradition, a substantial portion of the working population remains outside of formal systems, relying on other market and non-market forms of protection from shocks to their income. However, demographic and economic forces are putting both formal and informal institutions under strain, making it increasingly difficult for families to care for their elderly on their own, and for governments to deliver on the promises made to those who accumulated rights toward formal income protection in old age.

As in other regions, Latin America's population is aging. Although the pace of the demographic transition varies widely, from relatively "young" countries such as El Salvador, to relatively "old" countries such as Uruguay, falling fertility rates combined with lengthening life expectancy are increasing the portion of the population in old age and shrinking the number of new entrants into the labor force (ECLAC, 1998). This transition has been accompanied by liberalization of product and financial markets and greater integration with the world economy. Structural adjustment after the debt crisis in the 1980s and the need for greater efficiency as countries opened their economies to competition from abroad in the 1990s, has led to a steady reallocation of the labor force. Changes in the relative size of different branches of the economy show a clear increase in the number of workers employed in small firms, temporarily employed and self employed, and a fall in the number working in large firms and in the public sector (ILO, 1998). Growth in the share of elderly, and the push for greater efficiency, have forced governments to restructure labor market institutions to accommodate these trends.

[See Figures 1 and 2. Demographic Trends from 1975 – 2050 & Sector Allocation of Labor from 1980 – 1997, in Latin America]

The most radical labor market adjustments in the region in the last twenty years have been the series of reforms of social security initiated by Chile in 1981, and followed in the 1990s by Peru, Colombia, Argentina, Uruguay, Mexico, Bolivia, El Salvador and Nicaragua (see Table 1). These reforms usually involve a transition away from purely public systems - similar to those administered in Europe and the United States and financed on a pay-as-you-go (PAYGO) basis - to systems with "multiple pillars". In multi-pillar systems the bulk of retirement income is financed from mandated savings in individual retirement accounts. These funds are invested in bonds and equities by private pension fund managers, and the role of the state is reduced to guaranteeing a minimum threshold income to keep individuals from falling into poverty in old age.

Reforms in the region have been controversial. The proponents of the multi-pillar reform model argue that the new institutions increase the efficiency of the labor market. The principal advantage of individual retirement accounts is that - at least in theory - eligibility is extended to all labor force participants regardless of where they work,

¹ While data are also available for Colombia, they are suspect and have thus been removed from the panel. See discussion of the data, in section IV.b.

erasing the “formal/informal” distinction at least as it pertains to retirement income security. By tightening the link between contributions and retirement benefits, reforms that introduce individual retirement accounts cut the pure-tax component of payroll deductions, reduce the cost of hiring incurred by employers, discourage early retirement of experienced workers, and increase the flexibility and cross-sector movement of labor (World Bank, 1994, James 1996, James, 1997). Detractors argue that since they involve little if any redistribution between generations or between high and low-earning workers of the same generation, systems based primarily on individual retirement accounts lead to greater social inequity. PAYGO systems that usually pay benefits according to a defined formula, pool the risk of interrupted careers and periods of low earnings over the covered population, while the new systems shift the burden of these risks onto the individual (Diamond, 1998, Queisser, 1998). The new systems are further criticized for imposing high administrative costs (Diamond, 1993), and exposing workers’ retirement security to the relative volatility of financial markets. Finally, contrary to the efficiency benefits touted by reform advocates, critics argue that it is unclear whether individual retirement accounts have made the labor market more or less efficient (Diamond, 1998).

Theory suggests that a transition away from a purely public, PAYGO regime and toward individual retirement accounts will effect the labor market through two channels. First, reforms can often entail a reduction in the payroll tax rate which reduces the cost of labor and/or increases net wages, encouraging greater participation in the labor market and the creation of regulated employment (Cowell, 1985). Second, systems based on individual retirement accounts tie benefits directly to contributions, reducing the portion of mandated contributions that are perceived as a pure tax (World Bank, 1994). These claims point to a shift in the incentives faced by firms and workers in their resource allocation decisions following a reform, as mandated contributions are more directly linked to future benefits. This shift in incentives is important to the extent that workers who may have evaded coverage in the past, choose to participate in national social security systems after reforms.

III. The Transition to Individual Retirement Accounts: A Two Sector Model

In most developing countries only a small share of workers sell their labor in a regulated, “formal” sector, subject to a mandated minimum wage and *covered* by a social security system. The remainder work in an unregulated, *uncovered*, “informal” sector where wages are determined by the market and workers and employers escape the mandate to contribute to social security. A country’s social security institutions can affect the allocation of labor between the sectors. Social security contributions are one of the main components of non-wage labor costs, thus “informalizing” production allows firms to reduce their costs. In Latin America, the costs imposed by social security are estimated to be as high as 20% of the operating expenses of small firms (Tokman 1992, Tokman and Martinez, 1999).

Theory suggests that, at the margin, a higher contribution rate for social security distorts labor allocation if workers do not consider their contributions “appropriable” in the future at the market rate of interest (Corsetti, 1994, Schmidt-Hebbel, 1998). When the link between mandated contributions and perceived benefits is ambiguous, social security

imposes a tax on labor (Atkinson and Stiglitz, 1980, Summers, 1989). In the case of public pensions where the pay-off to workers' "investment" in the system lies far in the future, this perceived tax can be even more onerous if discount rates are high and access to credit is constrained (Samwick, 1997, James, 1999). Additionally, in many developing countries, public institutions like social security lack credibility – workers may heavily discount that they will receive a pension at all - further increasing the perceived tax burden of current contributions (James, 1996).

Several authors have shown that the extent of distortion to the labor market is independent of whether a country opts for a purely public PAYGO system or one of private individual retirement accounts (Diamond, 1998, Barr, 1998, Thompson, 1999, Barr, 2000). Corsetti (1994) finds that to the extent that workers link current contributions to future pension benefits at the margin, labor market distortions determining the size of the informal sector are not necessarily lower in a system of individual retirement accounts. Once contributions and benefits are actuarially linked, income incentives to work in the formal sector can be higher under a PAYGO regime than in a fully-funded system. Orzag and Stiglitz (1999) and Barr (2000) present similar arguments. This said, Corsetti acknowledges that while the link between contributions and future benefits is unambiguous in a system of individual retirement accounts, such actuarial balance must be carefully built in to the design of the benefit formula of a PAYGO system. James (1997) stresses this point, showing that rarely do PAYGO formulas clearly link benefits to contributions, and if they do the balance is frequently upset by demographic and political pressures, especially in developing countries. Rather than enter into this debate, I focus on measuring the impact of reforms in Latin America, that were expected to lower labor market distortions and improve workers' incentives to contribute.

Below, I use a simple model of a segmented labor market developed by Edwards and Edwards (2000) for Chile, along the lines of the traditional Harris and Todaro (1970) class of migration models, as a theoretical framework for the empirical analysis in later sections. The Harris and Todaro class of models characterize informal employment not as a choice, but as a residual sector where workers who have either lost their jobs or recently migrated from rural areas bide their time queuing for waged employment in modern firms. This view has been widely challenged in the theoretical and empirical literature (Tokman, 1992, Yamada, 1996, Packard, 1997, Maloney, 1999). However the assumption that sorting into formal and informal jobs is determined exogenously by the wedge between wages in the two sectors imposed by payroll taxes, is convenient to testing for aggregate incentive effects in response to institutional changes to social security that lower the wedge. The assumption is relaxed in later chapters of this thesis.

To keep the model simple, Edwards and Edwards (2000) further assume that, other things equal, workers would rather be employed in the covered sector where wages are on-average higher, and income is subject to less variation.² However, jobs in this sector are rationed. In equilibrium the wage rate obtained in the uncovered sector is equal to the expected *net* wage in the covered sector. As in Harris and Todaro (1970), employment in

² The authors assume workers are risk neutral, but point out that assuming constant relative risk aversion does not change the model's predictions.

the covered sector turns over fully in every period, so that the probability of getting a job there is equal to the ratio of job openings to job seekers. However, Edwards and Edwards (2000) depart from the seminal model by assuming there is no migration – an appropriate simplification when analyzing the already highly urbanized economies in Latin America.

Prior to reform of the social security system, workers in the covered sector are subject to a pay-roll tax T that finances the benefits paid to current pensioners. These benefits are determined by a formula that has little relation to mandated contributions. Workers in the covered sector receive a legislated minimum wage W_{min} , making the cost of labor to firms in the covered sector $W_{min} + T$. The social security reform will reduce this tax by: (i) reducing the actual mandated contribution rate; and (ii) tying pension benefits strictly to workers' contributions in a system of individual retirement savings accounts. While differences in rates of time preference keep the transition to individual retirement accounts from completely eliminating the perceived tax component of mandated contributions (Torche and Wagner, 1997, James 1999, Holzmann, Packard and Cuesta, 2000) a share of these contributions will be considered fully-owned savings.

In equilibrium the wage rate in the uncovered sector W_n is equal to the expected wage rate in the covered sector W_c . However, since jobs in the covered sector are rationed, the expected wage rate is weighted by the probability of getting a job, p . Assuming that the unemployed obtain earnings equal to S , and that the probability of finding a job in the covered sector is equal to the ratio of openings (employment in the covered sector, L_c) to applicants (the sum of employment plus the total number of unemployed ($L_c + U$), in equilibrium

$$W_n = W_c \quad (1)$$

$$W_c = p W_{min} + (1-p) S \quad (2)$$

$$p = [L_c / (L_c + U)] \quad (3)$$

where U is the number of unemployed and the ratio $[L_c / (L_c + U)]$ is the probability of finding employment in the covered sector. Substituting (3) into (2), and assuming that the unemployed have zero earnings ($S = 0$), the initial equilibrium wage in the uncovered sector is

$$W_n = [L_c / (L_c + U)] W_{min} \quad (4)$$

The total labor force, F , is equal to the sum of employment in the covered and uncovered sectors, and the stock of unemployed.

$$L_c + L_n + U = F \quad (5)$$

Firms maximize profits, and their demand for labor in each sector (covered and uncovered) depends on wages, W_c and W_n and product prices, P_c and P_n , respectively.

$$L_c = f(W_c, P_c) \quad (6)$$

$$L_n = g(W_n, P_n)$$

The impact of the reduction of the pay-roll tax on wages in the uncovered sector will be

$$d \log W_n = (1/\Delta) [U/(L_c + U) \eta_c (U/F) + (L_n/F) \eta_n (U/(L_c + U))] (T/1 + T) d \log T \quad (7)$$

where η_c is the demand elasticity of labor in the covered sector, η_n is the demand elasticity for labor in the uncovered sector and

$$\Delta = [(U/F) - (L_n/F) \eta_n (U/(L_c + U))] > 0 \quad (8)$$

The right hand side of equation (7) is negative, indicating that reductions in the tax on labor in the covered sector ($d \log T < 0$) will always result in an increase in the clearing wage rate for those workers not covered by the social security system. Edwards and Edwards (2000) are careful to point out that the effects of reform on the level of unemployment are not clear. This will depend on the extent of the reduction in the tax component of social security contributions, as well as on the elasticities of demand for labor in the covered and uncovered sectors.

The comparative statics of the transition to individual accounts are demonstrated in Figure 3. Prior to reform the curve yy satisfies the wage-rate equilibrium. $O^c L^c_0$ people are employed in the covered sector, $O^n L^n_0$ are employed in the uncovered sector, and $L^n_0 L^c_0$ are unemployed. W_{\min} is the net-minimum wage. The pre-reform pay-roll tax for social security is T_0 , and W_0 is the equilibrium wage rate in the uncovered sector, where yy intersects with the labor demand schedule in the uncovered sector $L(N)$. The expected wage of those employed in the uncovered sector and for the unemployed that make up the rest of the queue of applicants for covered jobs, is equal to W_0 . We retain the authors' assumption that non-labor factors of production are sector-specific, and that labor supply is inelastic.

[See Figure 3. Lowering Tax Component of Payroll Contributions & Sector Allocation of Labor Force – Comparative Statics]

The new pay-roll tax rate after the reform is T_1 . The reduction in the payroll tax lowers the cost of covered employment and the number of jobs in the covered sector increases to L^c_1 . Wages in the uncovered sector rise to W_1 , where the new wage rate equilibrium schedule $y'y'$ intersects with $L(N)$. Thus, the number of jobs in the uncovered sector falls to L^n_1 . The Edwards and Edwards (2000) framework predicts that as the tax wedge shrinks, covered employment will increase.

IV.a. Methodology and Estimated Model

The specific questions of interest drawn from the theoretical framework are: does the size of the wedge created by the pay-roll tax for social security, lower the number of contributors in the work force? and does the share of pay-roll taxes accumulating in an individual retirement account increase the number of contributors? To answer these questions, I exploit cross-country and time series variability in the pay-roll tax for social security - and more importantly, the institutional differences between countries that have introduced private individual retirement accounts and those that still run a “single-pillar”

PAYGO system - to estimate the impact of reforms intended to lower labor market distortions and improve incentives. Drawing from the framework, I estimate a reduced form model for changes in the size of the covered sector, proxied here by the portion of the labor force contributing to the national pension system. The two-way error component model is written

$$C_{it} = \alpha + \beta_1 X_{it} + \beta_2 \Delta L_{it} + \beta_3 \Theta_{it} + \beta_4 IRA + \varepsilon_i + u_t \quad (9)$$

where C is the number of contributors to the national social security system as a share of the labor force, in country i in year t ; X is a vector of variables controlling for countries' levels of economic development, and includes per capita income and life expectancy at birth; ΔL is a vector of variables capturing cyclical and non-cyclical features of the labor market, including the change in the rate of unemployment,³ and the number of women in labor force; Θ is the total rate of tax on pay-roll for all social insurance⁴; and IRA is the share of Θ accumulating in an individual retirement account in countries that have reformed. The hypotheses corresponding to the questions above are thus

Ceteris paribus...	Null	Alternative
1. Does the size of the pay-roll tax for social security lower the number of contributors in the work force?	$H_0 : \beta_3 = 0$	$H_1 : \beta_3 < 0$
2. Does the share of pay-roll taxes accumulating in an individual retirement account increase the number of contributors?	$H_0 : \beta_4 = 0$	$H_1 : \beta_4 > 0$

However, the model presented by Edwards and Edwards (2000) is a static model that makes no specific predictions about the transition after reform. Does the labor market jump from pre to post-reform equilibrium, or are there post-reform transition dynamics in the share of workers who contribute? Does the transition follow a particular pattern? To estimate dynamic effects, I add the variable YR to the reduced form, so that

$$C_{it} = \alpha + \beta_1 X_{it} + \beta_2 \Delta L_{it} + \beta_3 \Theta_{it} + \beta_4 IRA + \tau(YR) + \varepsilon_i + u_t \quad (10)$$

where τ is a vector of estimated coefficients, and YR is the number of years that have passed after the introduction of individual retirement accounts. We thus add to the previous set of hypotheses with

Ceteris paribus...	Null	Alternative
3. Are there post-reform transition dynamics in the share of contributors?	$H_0 : \tau = 0$	$H_1 : \tau \neq 0$

³ Readers should note that I use the difference in the rate of unemployment, and not the level of unemployment in the reduced form model. While the Edwards and Edwards (2000) framework is ambiguous with respect to the impact of reforms on the level of unemployment, this may be determined simultaneously with the shift of workers into the covered sector.

⁴ This normally includes retirement security and public health insurance. In most countries this tax will also cover the contributor against the risk to income from disability and death (this last, the risk to dependent household members from the loss of an income provider).

IV.b. The Data

The panel data set includes both middle-income and poorer countries in Latin America, those that have introduced individual retirement accounts, and those that maintain a single-pillar, PAYGO system. The “reformers” in our sample are Chile, Peru, Argentina, Uruguay, Bolivia, Mexico, and El Salvador.⁵ The “non-reformers” include Brazil, Venezuela, Ecuador, Paraguay, Nicaragua, Honduras, Costa Rica, Panama, Guatemala, Jamaica, the Dominican Republic.⁶ There are eighteen countries in the cross section. The time period covered is from 1980 to 1999. The average number of observations per country is 18, varying from 8 to 20. The variables used in the estimated model are defined in Table 2.

Our variable of interest – the share of the economically active population contributing to a national social security system – is non-stationary (see plots in Figure 4.a.), as are some of the independent variables, such as income per capita, the rate of unemployment and the shares of women in the labor force. However, the relatively short time series (a maximum of 20 years) does not permit the use of unit-root tests to determine whether the non-stationarity is stochastic or deterministic. Further, since all of the countries in the sample are far from equilibrium, I found that controlling for non-stationarity by differencing or de-trending the variables, eliminated critical variation in the data. For this reason I control for year-specific effects in the model by including dummy variables for every year in the time-series and fixed effects.

Readers will note that among the reformers only in Chile and Uruguay was there an actual reduction in the absolute rate of payroll taxation for social insurance (see Figure 4.b.). Brazil’s pay-roll tax was also lowered, although not in the context of a structural reform of social security. In all other reforming countries the total rate of pay-roll tax - often very low in relation to the benefits paid by the single pillar systems - was raised as part of the reform packages. However, in every reforming country, the *perceived* tax was lowered by redirecting a portion of the total social insurance contribution to an individual retirement account. Taking this portion as a measure of the degree of privatization, Chile’s reform was the deepest (51%), followed by Bolivia (42%), then Peru and El Salvador (both 33%), Colombia and Mexico (30%), Uruguay (18.5%), and the least privatized, Argentina (16%) (see Figure 4.c . and Figure 5).

The data have other features that could affect the results. In several of the reforming countries, an active PAYGO system has been retained in one form or another (readers are referred back to Table 1).⁷ For example, in Argentina workers have a one-off choice whether to stay in a downsized PAYGO or to save in an individual account. In Colombia

⁵ Colombia was removed from the panel since the number of contributors may be overstated, for reasons explained in later paragraphs.

⁶ Of the “non-reformers” proposals, and in some cases even draft legislation, exist to introduce mandated individual retirement accounts in all but Brazil and Jamaica. Recent changes to the retirement benefit formula of the *Regime Geral da Previdência Social* for Brazil’s private sector workers, that effectively tied benefits to contributions (although without a transition to individual accounts), are not covered by the data, since these came into effect in early 2000. Nicaragua and Costa Rica have passed legislation but the reform takes effect after our time series.

⁷ By “active” we mean that the PAYGO system still receives contributions, and is not phasing itself out by paying benefits to the current stock of elderly.

workers have the same choice, however, they are allowed to switch back and forth between the PAYGO and the individual accounts every three years. In Uruguay, rather than separate pillars, the system of retirement accounts is stacked onto the PAYGO in a system of “tiers” where participation is determined by income level – that is poorer workers are only allowed to contribute to the public system, while workers earning above a threshold contribute to both systems. The active, parallel systems in many countries make it difficult to keep track of where workers are contributing, posing the danger of double counting contributors and overstating the dependent variable in a given year.⁸ Further, in Chile and Peru there are only poor records on contribution to the PAYGO systems prior to reform, challenging attempts to assess the impact of the new regimes in each country. This said, the data in the panel are supported by Holzmann (1997) and Arenas de Mesa (2000). We return to these points and how they may effect our estimates in the next section.

The variation in the sample comes from differences across countries and over time. I control for common, country-specific, unobservable effects that remain constant over time and that may affect both the dependent and the independent variables, by employing fixed effects in the regressions reported below. Regressions employing random effects are also reported, however, these estimates may be biased since the control variables (such as per capita income or share of women in the labor force) are likely to be correlated with country error terms. For this reason I estimate the basic model using OLS, random effects and fixed effects, and test the suitability of the different estimators.

V. Results

Regression results are presented in Table 3. The point estimates on the independent variables vary between the pooled OLS, random effects and fixed effects regressions. The estimated coefficients on all of the control variables except the share of women in the labor force, are significant in all three estimates.⁹ The unexpected positive sign on the coefficient of the social security tax variable indicates that all but the most general specification - fixed effects - may be generating biased estimates.¹⁰ An F test rejects the OLS estimation at the 1% significance level in favor of country fixed effects. However, a Hausman specification (χ^2) test failed to reject the restrictions on the model imposed by the random effects estimation.

Turning attention to the random and fixed effects estimators (in the last two columns of to Table 3) we see that the coefficients on the control variables for level of development (log of per-capita income, lgnppc, life expectancy at birth, lifeexpf) and changes in the

⁸ I am grateful to Hermann Von Gersdorff at World Bank for pointing out this danger, particularly in the data from Colombia.

⁹ Women’s participation in the labor force is positive and significant in the OLS estimation.

¹⁰ From theory we would expect the social security tax, sstax, variable to be negative, however, in the OLS estimation the coefficient is positive and significant at 1%. Since they do not control for country effects, the OLS coefficients on sstax are most likely capturing the relatively higher number of contributing workers in countries where the population is relatively “older”, and where social security systems have been in place longer or matured, requiring higher rates of contribution (Argentina, Uruguay, Colombia, Brazil) (James, 1997).

labor market structure (changes in the rate of unemployment, δ unemp, female participation, femlab) where significant, bear the expected signs.

As income per-capita rises so does the share of contributors to the social security system. Higher rates of life-expectancy also increase the share of workers who contribute. Changes in the rate of unemployment capture cyclical effects, and show a fall in the share of contributors as the number of people who find themselves without work rises. The share of women in the labor force has no significant effect to the share of contributors in either the random or fixed effects estimation. The dummies for the $t - 1$ years in the time series, included to control for time-specific effects but omitted from Table 3, are all significant at the 1% level in both estimations.

As expected from the theoretical discussion in Section II, the estimated coefficient on the social security tax variable is negative and significant (at 10% using random effects, and 1% in fixed effects). In both the random and the fixed effects regressions the social security tax variable bears the largest coefficient in the equation. The fixed effects coefficient on the variable measuring the extent of structural reform to social security, IRA – the portion of the total payroll tax for social insurance accumulating in a privately managed individual retirement account, rather than pooling in a public PAYGO system – is positive and highly significant (at 5%). While the random effects coefficient on IRA is not statistically significantly different from zero, it bears the expected sign.

To capture a possible lag in the reaction of the labor market to reforms – either because of uncertainty due to the dramatic changes they entail, or a learning effect as agents became familiar with the set of new social security institutions - I experimented with several different polynomials on the years-since-reform variable, YR. A third-order polynomial was preferred by the data. The signs and size of the coefficients suggest a “J curve” effect in the share of workers contributing after a reform (in the random and the fixed effects estimations, the coefficients on YR, YR² and YR³ were all significant at 1%).¹¹ A glance at the plotted dependent variable in Figure 4.a. also suggests such an effect, as the share of contributors initially dips after the introduction of individual retirement accounts, begins to rise in the second or third year, and then gradually levels. Readers will note that this effect is most pronounced in the Chile data. Therefore, to test whether the pattern of contribution was different after the reform in Chile than in other reforming countries, I interacted a Chile dummy variable with each of the polynomial terms and included these in both the random and fixed effects regressions. Testing for the joint significance of the coefficients on the Chile interacted variables, I was unable to reject the null hypothesis that these are significantly different from zero in either

¹¹ I experimented with several alternatives to estimate transition dynamics after reforms, including using lags of the dependent variable and the policy (sstax and ira) variables. The lagged variables were not significant in either random or fixed effects, both when the year since reform polynomials were left in the regression and when they were removed. With respect to sstax and ira, the insignificance of the lagged terms may reflect the fact that for each country the variables change only once, at the time of reform. Thus, in each case applying a lagg operator generates a variable that varies from the original variable for only seven out of 287 observations. Further, the relatively small size of the panel's cross-section – 18 countries – dissuaded me from using a GMM (generalized method of moments) estimator, since this would have introduced more biases to the model.

regression.¹² That is to say, the J curve in the share of contributors in Chile is not different to that in any other reforming country in the years following the introduction of individual retirement accounts. The J curve is shown in Figure 6, as a plot of the fixed effects coefficients on the years-since-reform polynomials.

The signs and significance of the coefficients in both random and fixed effects regressions are robust to changes in the model. For example, since the IRA variable is equal to zero in countries without a system of individual accounts, I was concerned that it might act as a dummy variable for countries that have reformed, rather than measure the degree of the shift to individual accounts between one reformer and another. I included a reform dummy as a control, but this only increased the significance of the coefficients on the IRA and social security tax variables. Since the reform dummy captures little additional information, and in order to preserve degrees of freedom, I dropped the variable from the regressions. Additionally, concerned that these results might be driven by double counting of contributors in reforming countries with parallel PAYGO systems, I dropped observations from Colombia – where because workers can switch between regimes every three years, the danger of double counting is highest - and re-ran the regressions, removing the other reforming countries from the panel one by one. The sign and significance of the estimated coefficients remained robust to these changes. Keeping in mind the weakness of the Hausman specification test, the fixed effects regression is preferred.¹³

Turning back to the hypotheses in Section III, these results are summarized as answers to the questions raised. Does the size of the total pay-roll tax for social security lower the number of contributors in the workforce? The negative and significant coefficient on the social security tax variable suggests so. Fiorito and Padrini (2001) arrive at similar results in an analysis of labor taxes in developed economies. Does the portion of pay-roll tax for social security accumulating in an individual retirement account increase the number of contributors? The greater the portion of payroll deductions that accumulates in an individual retirement account, the larger the share of contributors in the work force. Finally, is there evidence of transition dynamics in the number of contributors to social security in the years after a reform? Our results suggest that the drop in contributors in the first years after a new system is introduced - that may reflect uncertainty arising from sudden, dramatic change in the “rules of the game” - is followed by a gradual rise, as agents become familiar with the new retirement security instrument. Evidence of a similar “uncertainty” effect inhibiting workers from saving in the new individual retirement accounts, is found by Barr and Packard (2000). The size of the estimated coefficients suggest that the positive effect on the number of contributors in the work force from the share of the payroll tax accumulating in an individual retirement account, is greater than the dynamic effects in the years after reform.

¹² Random effects, $\chi^2(3) = 0.77$, Prob. > $\chi^2 = 0.8559$; fixed effects, $F(3, 238) = 0.44$, Prob > F = 0.728

¹³ I would like to thank Steve Bond at Nuffield College for pointing out the flaws in the Hausman specification test.

V. Conclusions

There is increasing concern in countries where single-pillar PAYGO social security systems have been replaced by private individual retirement accounts, that a large number of workers will be excluded from coverage. Whereas PAYGO systems pay benefits according to a defined formula and pool the risk of interrupted careers and periods of low earnings over the covered population, the new systems shift the burden of these risks onto the individual. Therefore, adequate coverage under a system of individual retirement accounts depends critically on accumulating sufficient savings through regular contribution. Reforms are expected to increase regular contribution by eliminating distortions and improving incentives in the labor market.

In this paper I have estimated the impact of a transition from a single-pillar PAYGO system to one with individual retirement accounts, on the share of the workforce that contributes to social security. Using a theoretical framework developed by Edwards and Edwards (2000), I exploit variation in data from a panel of eighteen Latin American countries to test the implication of the simple model. The results show evidence of a positive incentive effect after the introduction of individual retirement accounts that increases the share of the economically active population who contribute to the reformed system. However, this takes place only gradually. Employers and workers may need time to overcome uncertainty, and become familiar with the set of new social security institutions that reforms put in place. While these results cannot be used to deny the expected improvement in incentives that may arise from aligning contributions and benefits within a PAYGO system – as with the establishment of “notional” defined-contribution retirement accounts (NDCs) in several countries – they do indicate that workers respond to improvements in individual incentives to contribute to formal retirement security system.

Do these results indicate that policy makers in countries that introduce individual retirement accounts have nothing to worry about? The relatively low numbers of workers who contribute to formal retirement security systems in the Latin America - even in countries that have undertaken reforms - provide the best argument against complacency. Further, the low share of regular contributors in reformed systems – in Chile averaging 50%, and in Argentina as low as 39% in 1999 - indicate that the wedge created by the payroll tax is just one of many possible barriers separating certain groups of workers from formal protection. This said, since the data on contribution to social security ignore other forms of insurance and savings that individuals and households make engage in on their own, they may over-state the degree of vulnerability to the risk of poverty in old age, and should not be a cause of undue panic.

The results reported in this paper, indicate that agents respond to changes in labor market incentives. However, while elimination of the pure-tax component of payroll deductions may be a necessary condition to increase the level of regular contribution, it may not be sufficient. Coverage under a formal social security system is often nested deeply within the broader regulatory and taxation framework of the economy. Even in the less centralized systems based on individual retirement accounts, participation may require compliance with regulations and labor standards unrelated to income security in old-age.

Where formal retirement security is bundled together with unrelated government programs and regulations, the costs of compliance to the individual (or small firm) may be prohibitive.

How contributions are collected under the reformed systems may also affect incentives. While in Chile, the private fund managers are themselves responsible for collecting contributions from their affiliates, in Argentina contributions are collected by the same government authority that collects all other taxes (see Table 1). While “bundling” collection of pension contributions together with other taxes may be efficient in one respect, it may counteract the positive incentive gains of the reform. In a related point, the public cost of a transition from a PAYGO regime to a system of individual retirement accounts may affect the choices of current workers. As governments struggle to meet the obligations of the old PAYGO systems without the revenue from contributions of current workers, the incentives to tax evasion will be very high (Corsetti, 1994). Therefore despite new incentives after reforms, employment in the informal sector can still imply substantial savings. The results presented here indicate that employers and workers respond to changes in labor market incentives. Policy makers must keep this in mind when designing reforms.

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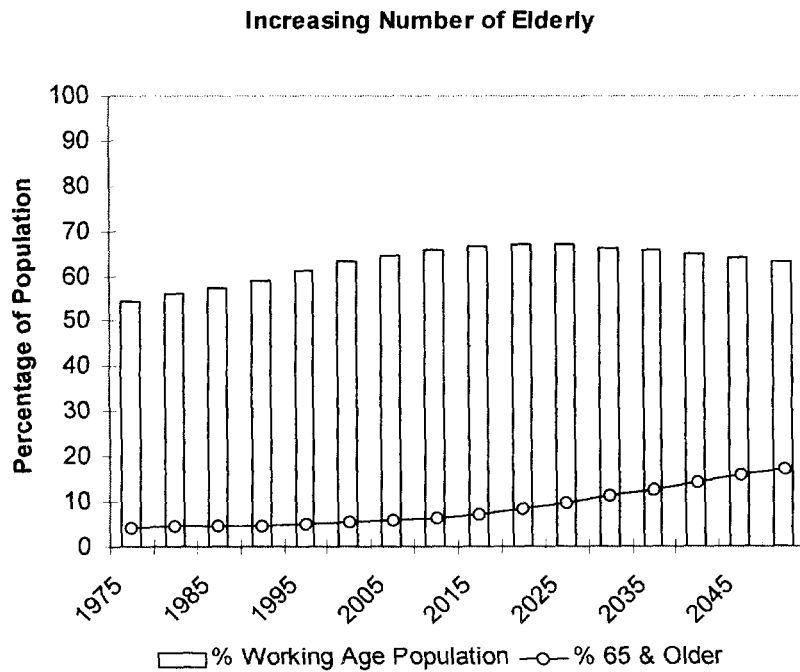
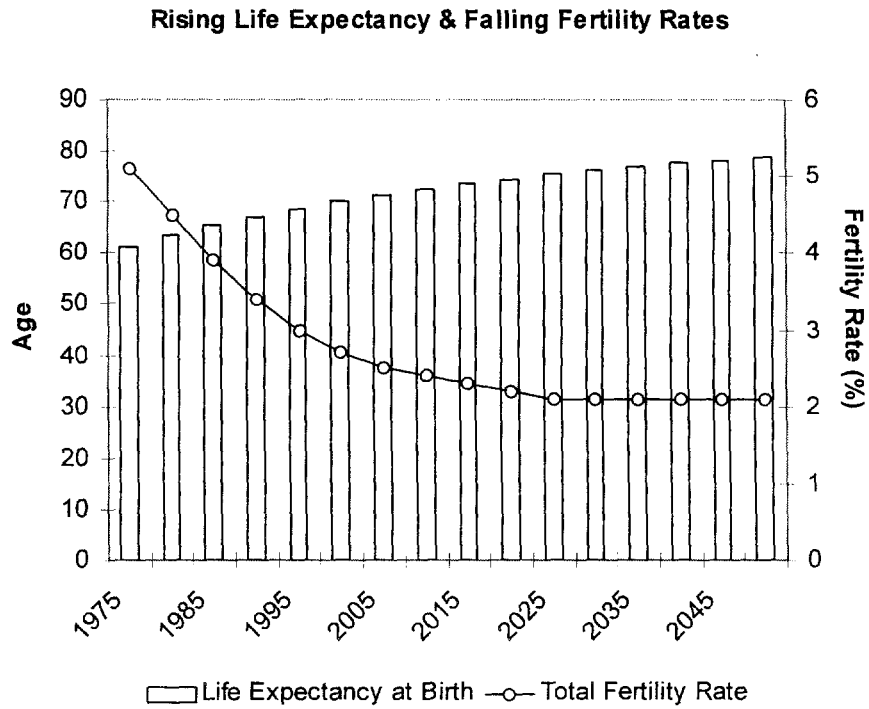
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Figure 1. Demographic Trends in Latin America, 1975 – 2050 (ECLAC, 1998)



**Figure 2. Sector Allocation of Labor Force in Latin America, 1980 – 1997
(ILO, 1998)**

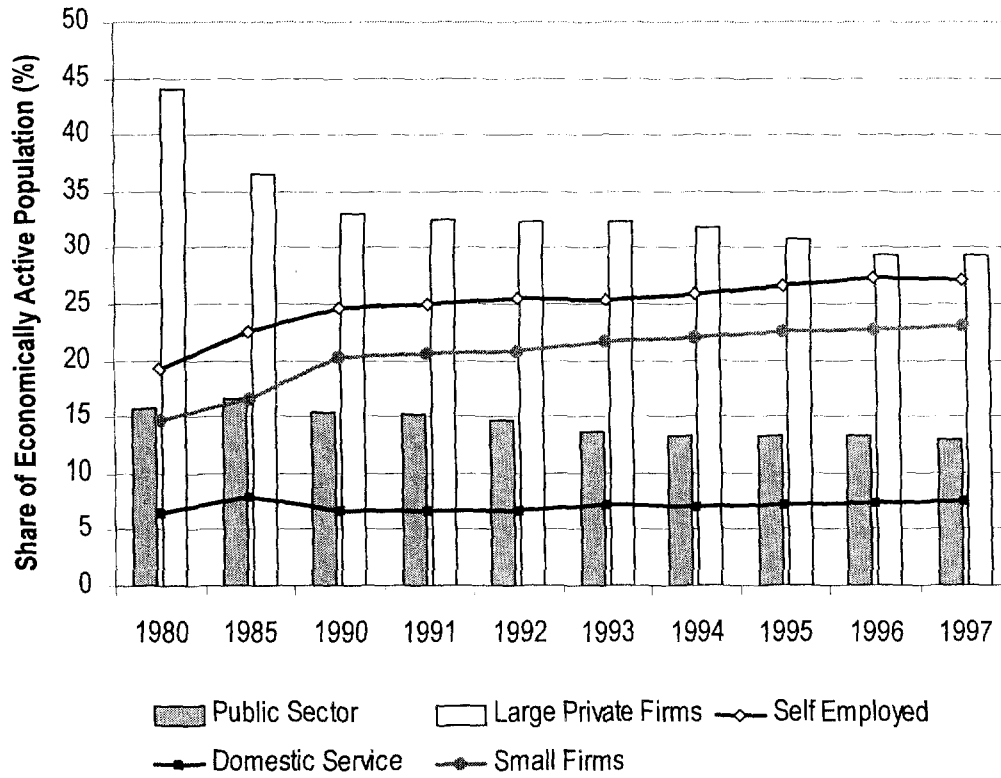
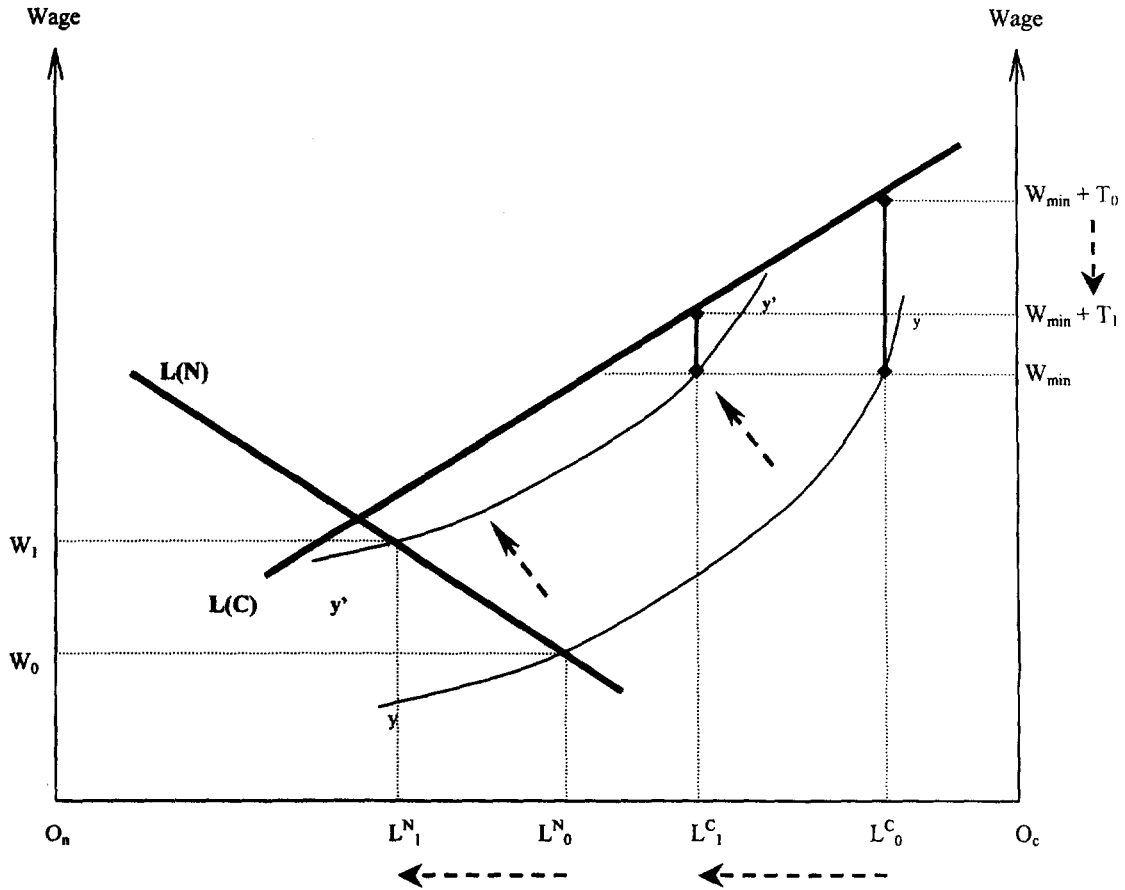


Figure 3. Lowering Tax Component of Payroll Contributions and Impact on Sector Allocation of Labor – Comparative Statics



Dashed arrows chart shifts from pre to post reform equilibria

Source: Edwards and Edwards (2000)

Figure 4a. Contributors to Social Security, Percentage of Economically Active Population
 (Data from Colombia may overstate number of contributors)

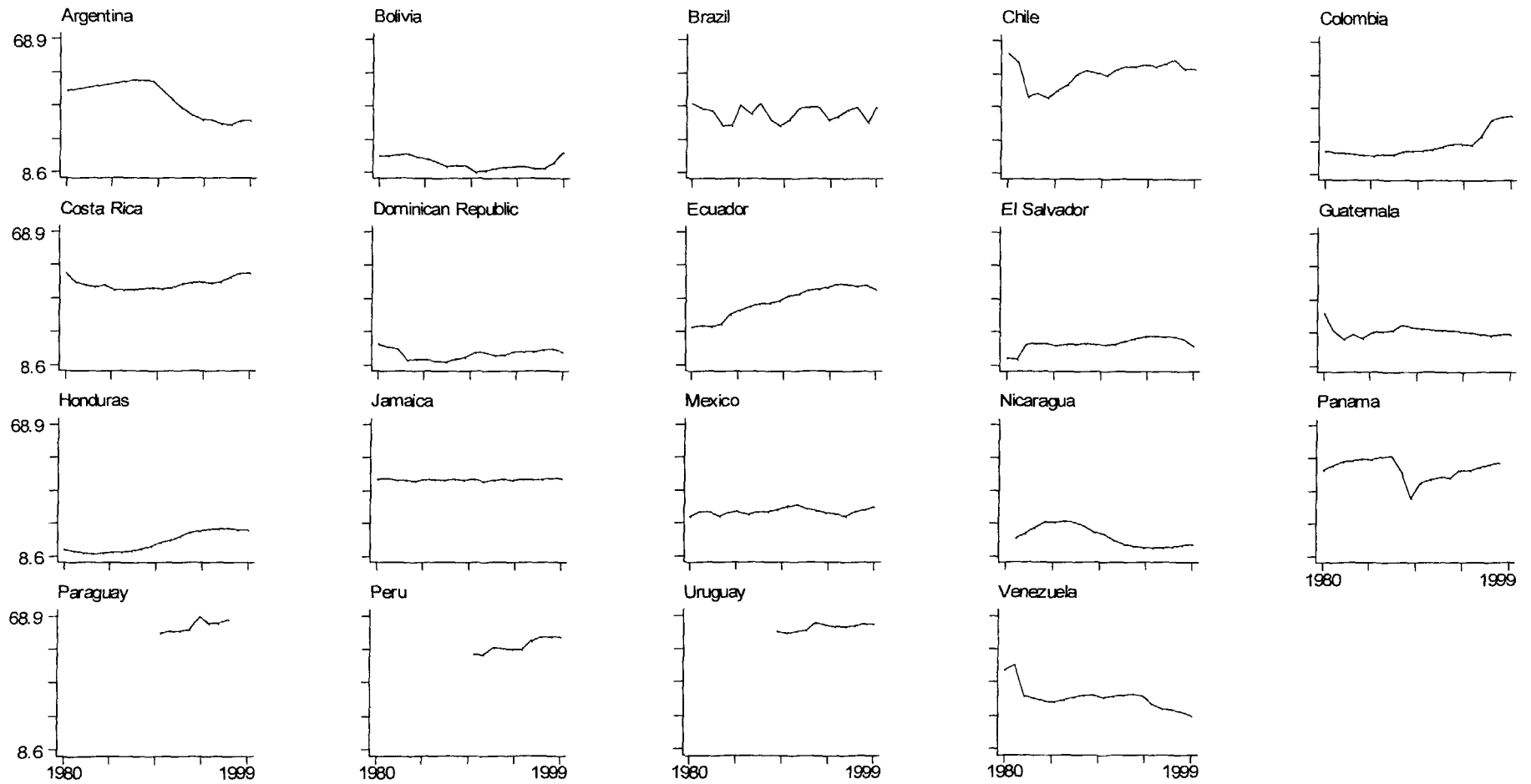


Figure 4b. Social Insurance Tax (%)

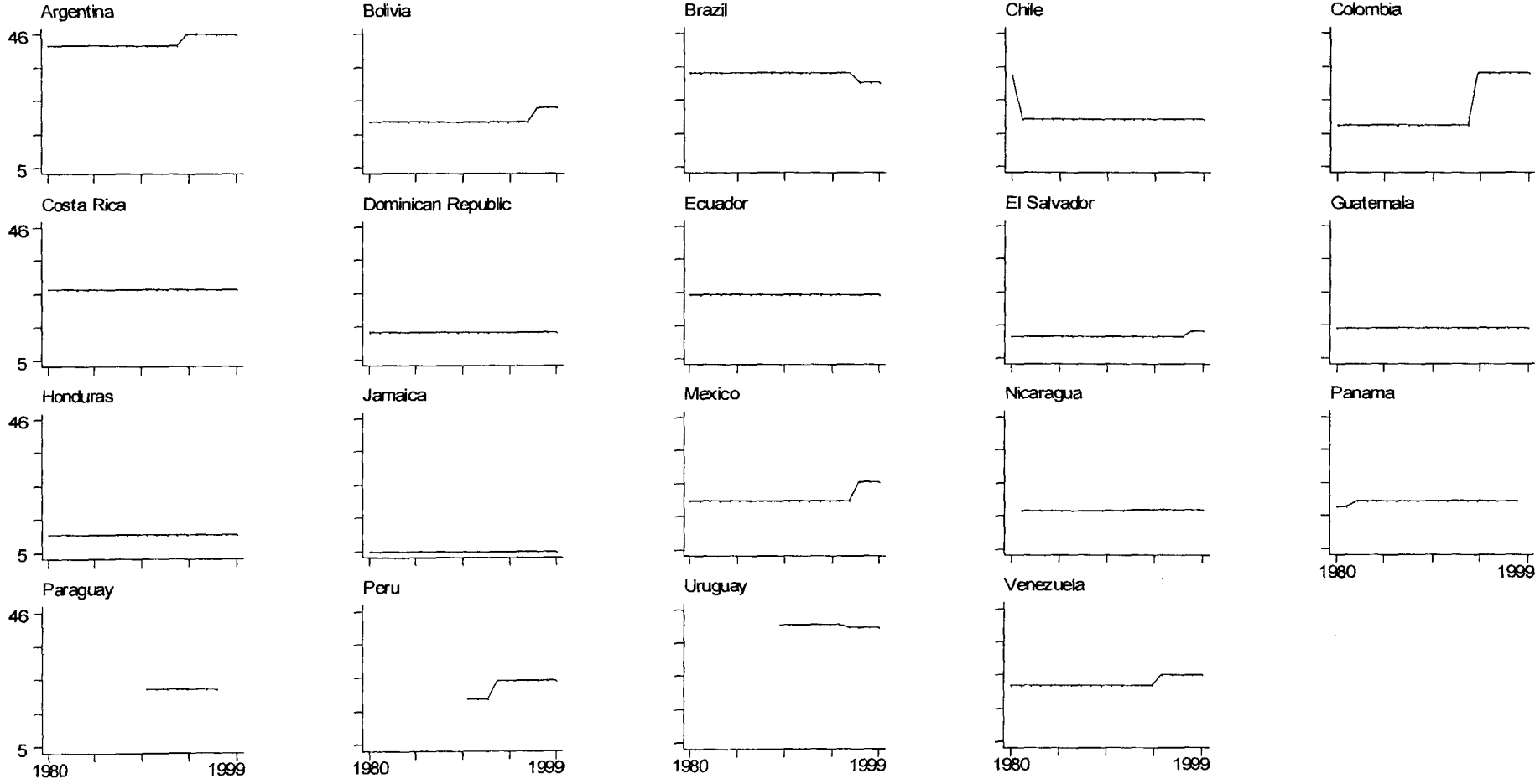


Figure 4b. Portion of Social Insurance Tax Accumulating in Individual Retirement Account (% of Total Payroll Tax)

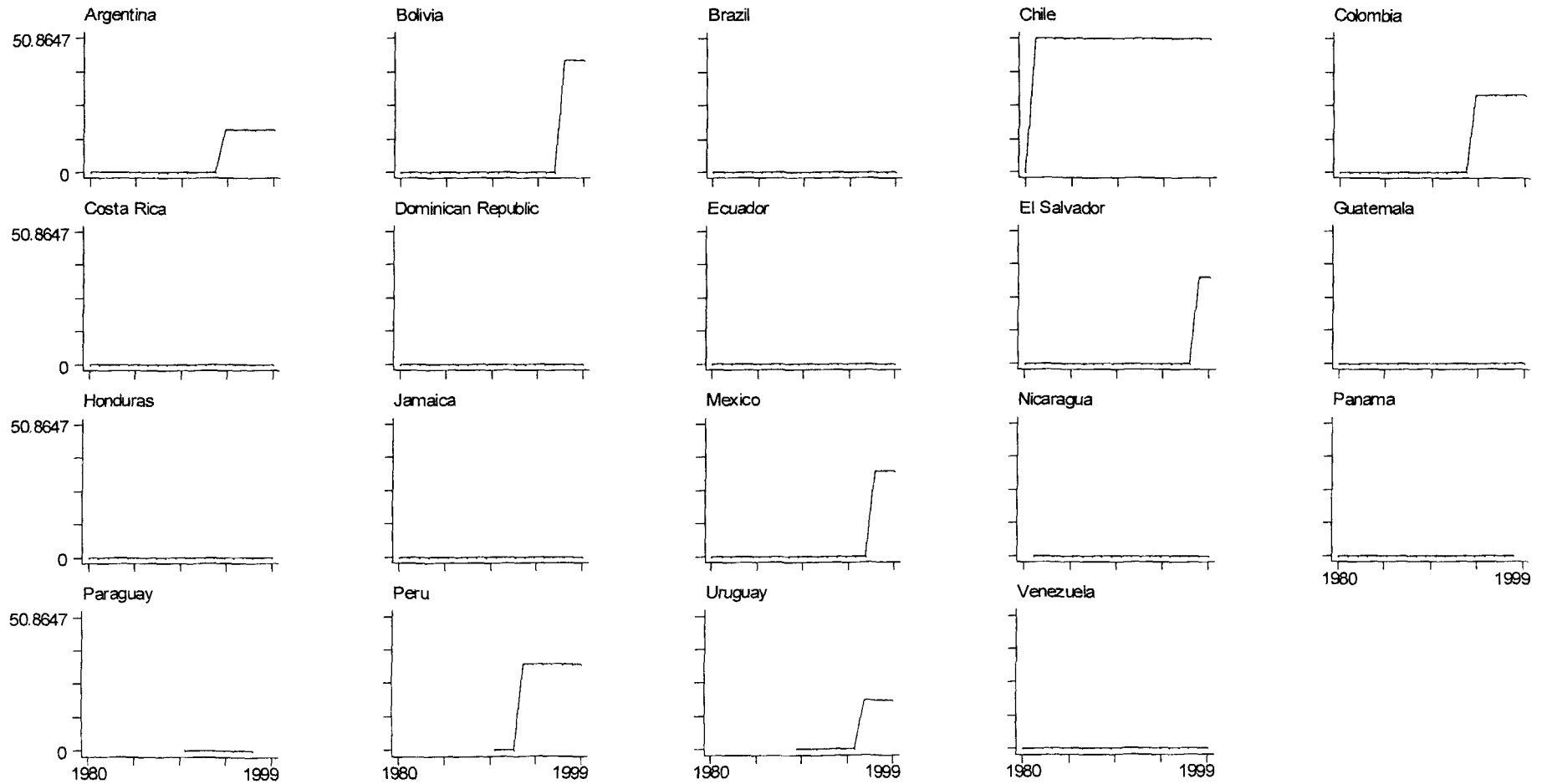
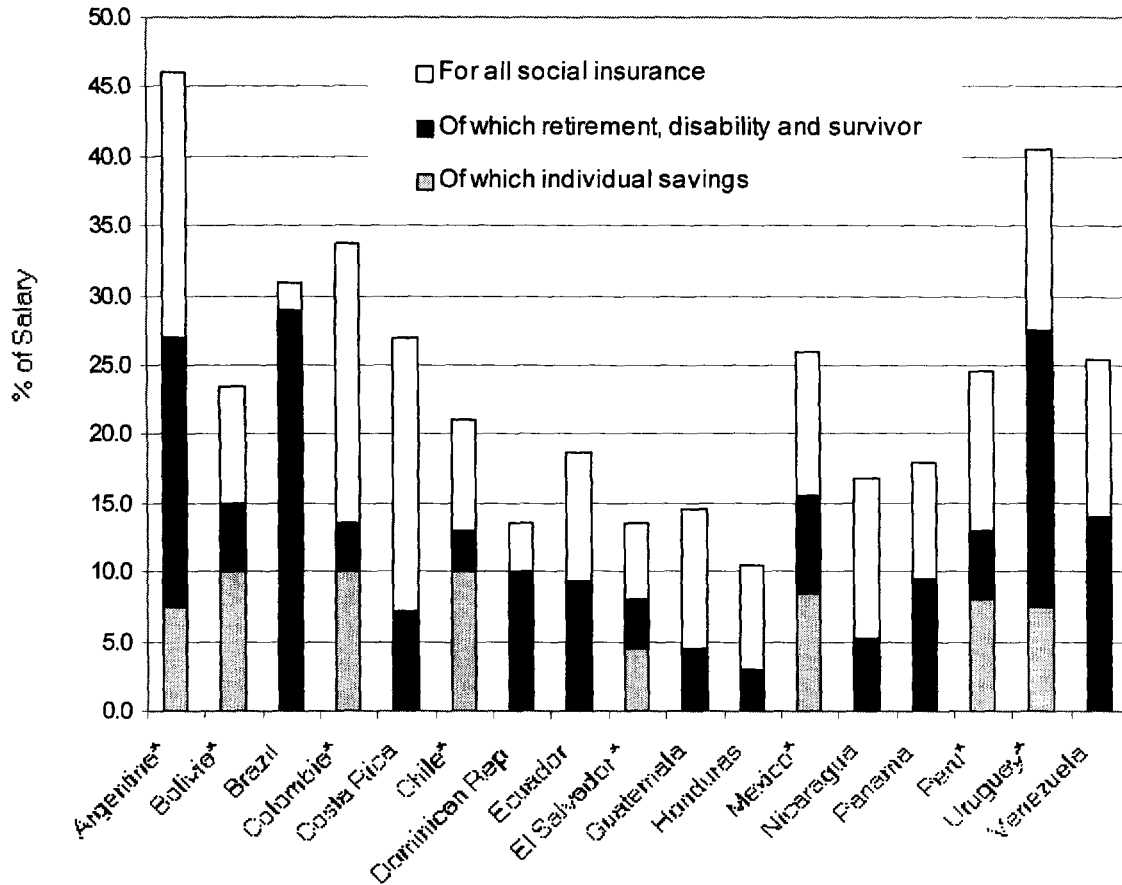


Figure 5. Payroll Taxes for Social Insurance (Including Health) in Latin America, 1998



Source: World Bank

Note: The portion of the bar "of which individual savings" is the variable "IRA" in the panel regressions

Figure 6. Changes in the Share of Contributors in the Years Following Introduction of Individual Retirement Accounts

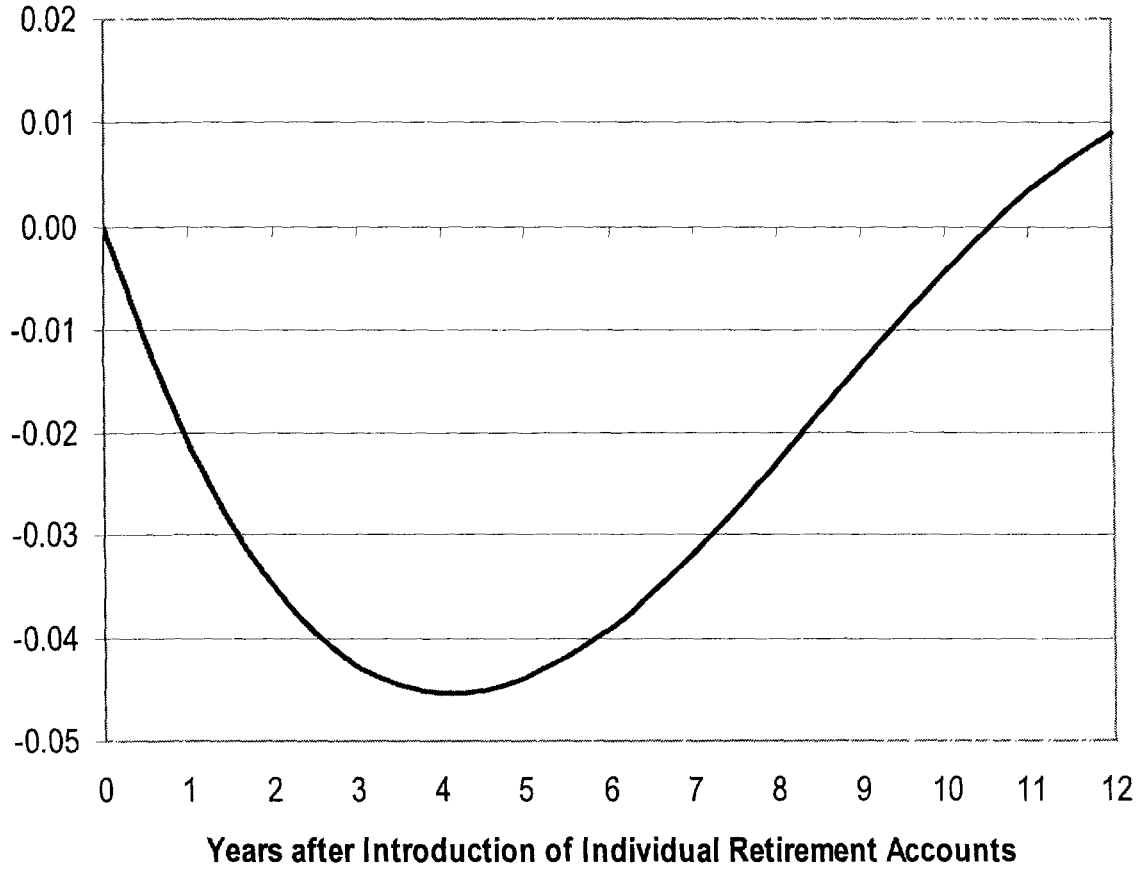


Table 1. Principal Features of Reformed Social Security System in Latin America

	Chile	Peru	Colombia	Argentina	Uruguay	Mexico	Bolivia	El Salvador
Year of reform	1981	1993	1993	1994	1996	1997	1997	1998
Public PAYGO system?	closed	remains	remains	remains	remains	closed	closed	closed
Total payroll tax rate, pre-reform (% of wage)	33	19	17.8	42	41	20	19	11.8
Total payroll tax rate, post-reform (% of wage)	20	24	33.8	46	40	26	24	13.5
Private System								
Affiliation of new workers	mandatory	voluntary	voluntary	voluntary	voluntary ^a	mandatory	mandatory	mandatory
Fund managers	AFP	AFP	AFP	AFJP	AFAP	AFORE	AFP	IAFP
Contribution to IRA (% of wage)	10	8	10	7.5	7.5	6.5 + subsidy	10	4.5 ^b
Fees & Insurance premia (% of wage)	2.94	3.72	3.49	3.45	2.62	4.42	3.00	3.5
Measure of privatization^c	51	33	30	16	18.5	30	42	33
Fund transfers	2 x p.a. ^d	2 x p.a.	2 x p.a.	2 x p.a.	2 x p.a.	1 x p.a.	2 x p.a.	2 x p.a.
Minimum rate of return on investment	relative to industry average	unregulated	relative to industry average	relative to industry average	absolute	no	no ^f	relative to industry average
Minimum guaranteed pension	yes	no	yes	yes	yes	yes	no	yes

Adapted from Queisser (1998)

Notes:

- a) Participation in the funded system in Uruguay is determined by income level
- b) Contribution rate will be increased gradually to 10%
- d) Indicates workers can transfer their IRA to a different fund manager twice annually
- e) IRA contribution – net of fees and premia – as share of total payroll tax
- f) Guarantees required from the fund managers

Table 2. Variables Used in Estimated Contribution Equation

Variable Name	Definition
conteap	share of economically active population contributing to the social security (pension) system - DEPENDENT VARIABLE
lgdppc	log GNP per capita
δ unemp	difference in rate of open unemployment
lifeexpf	continuous, life expectancy of women at birth ¹⁴
femlab	continuous, share of women in the economically active population
sstax	continuous, mandated payroll contributions for all social insurance (pensions and health)
ira	continuous, share of payroll contributions for all social insurance accumulating in individual retirement account – inter-temporal transfer mandated by the government but privately administered (denominator: sstax)
privsys	dummy, 1 if country has a pillar of individual retirement accounts, 0 otherwise
yr	continuous, number of years since the introduction of a pillar of individual retirement accounts
cyr	interactive, dummy for Chile * “yr” number of years since the introduction of a pillar of individual retirement accounts
y_t (t = 80, ..., 99)	dummy, 1 for each year t in time series from 1980 – 1999

¹⁴ We use life expectancy of women rather than men. The correlation coefficients between male life expectancy and some of the other control variables in the model raises the risk of multicollinearity. Life expectancy of women is less correlated with the control variables, but highly correlated and significant at the 1% level with male life expectancy.

**Table 3. Contributors to National Social Security System (Share of EAP),
Various Estimations**

	Pooled OLS	RE	FE
lgnppc	0.035 (0.016)**	0.124 (0.025)***	0.094 (0.033)***
lifeexpf	0.011 (0.002)***	0.009 (0.003)***	0.007 (0.003)**
δ unemp	-0.428 (0.203)**	-0.246 (0.072)***	-0.263 (0.070)***
femlab	0.473 (0.144)***	-0.059 (0.265)	0.085 (0.315)
sstax	0.36 (0.107)***	-0.388 (0.217)*	-1.189 (0.355)***
ira	0.272 (0.110)**	0.057 (0.064)	0.153 (0.076)**
yr	-0.012 (0.024)	-0.025 (0.009)***	-0.025 (0.008)***
yr²	0.002 (0.004)	0.004 (0.001)***	0.004 (0.001)***
yr³	-0.00009 (0.0001)	-0.0001 (0.000)***	-0.0002 (0.000)***
Year dummies included	yes	yes	yes
Observations ^{a)}	287	287	287
Number of countries ^{a)}	18	18	18
R-squared	0.53	0.29 (within)	0.31 (within)

Standard errors in parentheses

* significant at 10% level; ** significant at 5% level; *** significant at 1% level

^{a)} Colombia removed from the sample – 20 observations dropped

F Test of joint significance of FE, H₀: OLS accepted

F(17, 241) = 131.50 P > F = 0.0000

Hausman Specification Test, H₀: Difference in RE and FE not systematic

χ^2 (28) = 27.68 P > χ^2 = 0.4816

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