

DRAFT: May 1999

REVISED: July 1999

SECOND REVISION: August 1999

**SOCIAL SECURITY REFORM
and
LABOR MARKETS: THE CASE OF CHILE***

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ABSTRACT

In 1981, Chile reformed its social security system. An inefficient and insolvent pay-as-you-go regime was replaced by system based on individual retirement accounts. Over the years Chile's reform has been widely praised, and has been carefully studied by policy makers throughout the world. In this paper we focus on a neglected aspect of Chile's social security reform: its impact on labor market outcomes, including unemployment and wages. We develop a model of the labor market where we assume that, as is the case in most emerging markets, a formal and an informal sectors coexist side by side. According to our model, a social security reform that reduces the implicit tax on labor in the formal sector, will result in an increase in the wage rate in the informal sector and will have an undetermined effect on aggregate unemployment. Results from simulation exercises suggest that in the case of Chile the reforms resulted in an increase in informal sector wages between 2 and 2.5%. These results also suggest that the reforms made a positive contribution to the reduction of Chile's aggregate of unemployment.

* We are indebted to Manuelita Ureta for helpful discussions, and to Alejandro Jara and Rajesh Chakrabarti for assistance.

I. Introduction

In recent years policy makers, politicians and academics have become deeply concerned about the future of social security. The specter of a massive insolvency crisis has generated, through out the world, a frantic search for a solution to what the World Bank (1994) has called the “old age crisis.” Conferences have been organized, wise-men groups have been assembled, and blueprints for reform have been discussed. Throughout this process, and in an effort to learn from lessons of experience, many analysts have focused on Chile’s pioneering social security reform. In 1980 Chile replaced an insolvent and highly inefficient government-run social security system, by a privately managed system based on individual retirement accounts. Almost twenty years after the launching of this privatization effort, the Chilean experience has become a required case study for anyone interested in reforming social security.¹ Most analyses of Chile’s experience have concentrated on three aspects of this privatization program: (1) Its effect on the fiscal accounts, including its effect on public sector’s contingent liabilities. (2) The effects of the new system on old-age pensions, including a comparison of replacement rates under the old a new regime. And (3) the effects of the reform on aggregate national savings.²

Surprisingly, very few studies of the Chilean episode have dealt with the overall labor market implications of the social security reforms. This, however, is not unique of the Chilean case. In fact, while a number of studies for a variety of countries have analyzed the way in which social security systems affect labor market incentives for older individuals, very few authors have analyzed formally the way in which a major social security reform affects *overall* labor market outcomes.³ And yet, it may be argued that a reform that (in principle) changes the rate of payroll taxes, and affects the relationship between social security contributions and future earnings will have substantial effects on the aggregate and (sectoral) demand and supply for labor. This would be clearly the case if contributions to the pay-as-you go system are considered (at least in part) a tax, and

¹ On Chile’s reforms, see Edwards and Edwards (1991) and Bosworth, Dornbush and Laban (1994).

² See, for example, the discussion in Diamond and Valdes-Prieto (1994).

³ The papers collected in Grueber and Wise (1999) analyze in great detail the way in social security affects labor force decisions of older persons in eleven industrialized countries.

contributions to individual retirement accounts are seen largely as deferred compensation.⁴

The privatization of social security – either partially or fully – is likely to have a particularly significant effect on overall labor markets outcomes in emerging economies, including in former socialist nations. Most emerging countries are characterized by segmented labor markets, where a modern and an informal labor market coexist. Under these circumstances, only those employed in the “modern” segment will be covered by labor market regulations, including social security. Those employed in the so-called informal sector work without formal contracts, generally don’t pay taxes, are not affected by minimum wages laws, and are excluded from the formal safety net.

The purpose of this paper is to analyze the way in which a social security reform of the Chilean-type affects labor market outcomes in an economy characterized by a segmented labor market. Our main interest is to evaluate the way in which Chile’s social security reform affected the country’s level of employment, its rate of unemployment and wages in different sectors. In order to do this we develop a model of the labor market in an emerging economy, and we simulate it using parameter values for Chile. We also use micro survey data to investigate some key features, such as coverage, of Chile’s privatized social security system. The paper is organized as follows: Section I is the introduction. In Section II we provide a brief evaluation of Chile’s social security reform. Section III deals with the effects of social security reform on wages, income distribution, employment and unemployment. The section begins with a general discussion of Chile’s labor market reforms. We next develop a model of a segmented labor market to analyze the way in which policies aimed at reducing the tax component of social security contribution affect the key labor market variables. In section IV we analyze empirically the case of Chile. We first use micro survey data to analyze the extent of coverage of the new privatized system. We also use these data to analyze whether, as expected by the architects of the reforms, individual participants consider contributions into the new system as deferred compensation. In Section V we calibrate the model, using parameters that capture Chile’s economic structure, and we simulate the

⁴ Siebert (1998), Lorz (1998) and Edwards (1998b) constitute some of the few papers that analyze the possible effects of social security reforms on labor markets.

way in which a social security reform that lowers the pay roll tax affects labor market outcomes. The results from our simulation exercise suggest that the effect of the reform on Chile's aggregate employment was rather modest. The results also suggest that the reforms resulted in an increase in average wages. Finally, in section VI we provide some concluding remarks.

II. The Privatization of Chile's Social Security System

In late 1980 Chile's military regime, led by General Augusto Pinochet, privatized the country's traditional pay-as-you-go social security system. The decision to replace the government-run program by one based on privately managed individual retirement accounts was part of an ambitious program aimed at transforming Chile into a market-oriented economy. Almost twenty years after Chile's social security reform, most observers agree that Chile's program was a true pioneer, and that there is much to learn from it. In this section we provide a brief discussion of the main aspects of the reform. Readers interested in greater detail are referred to Diamond and Valdes-Prieto (1994), and Edwards (1998a, b).

II.1 The Old Pay-as-you-go System

Chile's original social security system was adopted in the 1920s, and was supposed to work as a collective capitalization fund. Accumulated funds, however, were poorly managed, and benefits -- especially for the better to do -- escalated quickly. For all practical purposes, and in spite of the original intentions of its founders, by the 1970s the system had become an insolvent pay-as-you-go regime, characterized by very high contribution rates. In 1973, for example, total contributions to the retirement plan -- by employers and employees -- averaged 26 percent of wages. Once contributions to the national health system were included, total contributions exceeded, for some workers, 50 percent of wages. What made things worse was that there was almost no connection between retirement contributions and (perceived) benefits. Contributions were largely seen as taxes, while benefits received from the social security system were seen as entitlements (Cox Edwards 1992, Diamond and Valdes-Prieto 1994).

While in 1955 there were 12 active contributors per retiree, by 1979 there were only 2.5. As a result of this, and of a highly inefficient management, the Chilean system

became increasingly unfunded. By the early 1970s the system as a whole was already running a dramatic deficit. The gap between revenues and outlays -- administrative costs plus pensions -- was made up by the public sector. By 1971 the central government's contributions to the retirement system amounted to almost 3% of GDP, and the present value of the system's contingent liabilities exceeded 100% of GDP.

II.2 The Privatization of Social Security in Chile

In 1980 the military government decided to introduce a sweeping reform to the retirement system. In an effort to increase the attractiveness of the new system, and in order to reduce political opposition, contribution rates under the new system were lowered; as a result, those individuals that joined the new system experienced an average increase of net take-home pay equal to 10% (Iglesias and Vittas, 1992). It was expected that, given the anticipated higher rates of return on the accumulated funds, the lower contributions would be enough to finance higher replacement rates for pensions.

The core of Chile's new system are individual retirement accounts managed by private companies known as "*Administradoras de Fondos de Pensiones*", AFPs. Each AFP can manage only one retirement fund; likewise, each participant can have only one retirement account. A key feature of the system is that it is *mandatory* for individuals working for a formal employee. Participants can freely decide which AFP will manage their retirement funds, and are free to transfer their funds across the different management firms. On retirement, individuals can choose to buy an annuity, or to withdraw their funds according to a predetermined (actuarially fair) plan. The system also has a survivor's term life insurance component, and a disability program funded with an additional insurance premium. In the reformed system, the State continues to play an important role. It regulates and monitors the operation of the management companies, and guarantees "solidarity in the base" through a minimum pension⁵.

Contributions to the retirement component of the system are equal to 10% of income, considerably lower than the 26% (on average) under the old system. Total contributions for retirement, health and survivorship insurance add up to 20% of wages, with a cap equivalent to an annual wage rate of US\$40,000 per year. A detailed

⁵ In case an accumulated fund does not provide for an annuity above the minimum pension, the state complements the funds, so long as the individual has made contributions for a minimum of twenty years.

regulatory framework -- enforced by an institution especially created for this purpose, the Superintendency of AFPs -- regulates investment portfolios, ensures free determination of fees and commissions and free entry into the industry.

Self employed workers are *not* required to participate in the system. They have the choice, however, to set retirement accounts which are (basically) subject to the same regulations as those of formal sector employees. In 1998 the percentage of active contributors -- that is those making deposits into their retirement accounts -- stood at 58% of total employment; in addition 4% of workers were still affected by the old system. This means, then, that in 1998 the total *coverage* of the Chilean retirement system amounted to 62% of employment. The 38% that is not covered by the social security system corresponds, largely, to those that work in the informal sector, or to the self employed (for details on the actual characteristics of those not covered by the new system, see the discussion in section III of this paper). At 62% of employment, the current coverage of the system is similar to that of the old pay-as-you-go system. The lack of universal coverage represents an important weakness of the privatization scheme, and is explained by two basic factors: first, the self-employed -- which are not legally required to participate in the system-- have very little incentives to make voluntary contributions. Second, the existence of a government-guaranteed (universal) minimum pension creates a moral hazard situation among low income workers, many of which are self employed. For these individuals it pays to contribute only sporadically, and only enough as to obtain the minimum pension once they retire.⁶

The volume of pension funds privately managed by the AFPs has increased dramatically. Between 1985 and 1997 they increased from 10% of GDP to almost 45% of GDP. Furthermore, recent simulations suggest that by year 2010 the accumulated funds will represent 110% of GDP, and that by 2020 they would have reached 134% of GDP (Fuentes, 1995). The type of assets the retirement funds can invest in are tightly regulated. During the early years, funds were largely restricted to government securities, bank deposits, investment grade corporate bonds and mortgage bonds. At this time, however, a number of equities, both domestic and foreign, are allowed.

⁶ See Edwards (1998a) for details on the system's operative aspects.

During the early years of the reform the real (inflation adjusted) average rate of return of accumulated funds was very high, averaging during 1982-1995, 12.8 percent per annum. More recently, however, the rate of return has declined significantly, and has averaged, between 1995 and 1997, 1.9%. Existing regulations impose a floor on the return individual AFP pay to their members. In any given year an AFP cannot pay a return lower than 2 percentage points of the system's average. If the actual return of a particular AFP falls below this minimum, the difference has to be made up by using funds from a specially set "reserve fund." The restriction on a minimum rate of return, coupled with the regulations that each AFP cannot have more than one fund, and that individuals cannot distribute their funds across funds, has reduced the extent of competition of the system, and has resulted in the different AFPs holding extremely similar portfolios.

The new system allows men to retire at 65, and women at 60, or earlier if they have accumulated enough funds to finance a pension of 70 percent of their (pensionable) salary. When an individual retires he can choose between two systems: (A) he can use the accumulated funds to buy an annuity from an insurance company; or, (B) he can chose to enroll in a "programmed withdrawal" scheme, where the accumulated funds are drawn according to an actuarially determined schedule. By 1997 there were already 250,000 retirees receiving pensions under the new system. Of these, approximately one half had opted for annuities, and one half for programmed withdrawal. Using a sample of 4,064 individuals that have retired under the new system Baeza and Burger (1995) estimated that the average replacement rate had amounted to 78%, significantly higher than under the old pay-as-you-go regime.

The new system also establishes that, for those individuals that qualify, there is a minimum pension guaranteed by the state, which as of December 1998 was equal to 85% of the minimum wage. From an international comparative perspective, replacement rates have been quite high in Chile – indeed higher than under most industrialized countries' systems.⁷

⁷ On industrial countries replacement rates see, for example, Davis (1998) and the papers in Grueber and Wise (1999). Naturally, since this is a defined contribution system, future replacement rates may vary.

II.3 The Transition from the Pay-as-you-go to the Privatized System

Most proposals to privatize social security, struggle with issues related to the transition. Chile dealt with this problem in a simple, and yet effective manner. All transitional costs were borne by the government and were paid out of the general budget. Individuals that had been contributing to the old system received government bonds – the so-called “recognition bonds”. These bonds yielded per annum 4% in inflation adjusted terms, and were placed in the each individual retirement account. The value of the bonds received by each person was determined using a formula that took into account their history of contributions to the old system. From a fiscal point of view the transition was rather expensive, representing almost 5% of GDP in the peak year of 1983. It is estimated that by 2015 these costs would have almost disappeared (Edwards 1998a).

II.4 Chile’s Social Security and Labor Market Reforms

The reform of social security was only one component of a broad effort to transform Chile into a modern market economy. During the second half of the 1970s the military government implemented a number of fundamental reforms, including a major overhaul of the tax system, the opening up of the economy to international competition, the privatization of most state owned enterprises, and the creation of a modern financial market. In the early 1980’s the scope of the reforms was broadened to include labor markets and social security.

In 1979, and under considerable international pressure, the military government initiated an effort to reform Chile’s labor legislation. The main objectives of these policies were: (a) To reform job security legislation, by limiting the extent of severance payments. These were reduced from “one month per year of service, with no limit”, to “one month per year of service, with a 5 months limit.” (b) To reduce unions’ power by decentralizing collective bargaining, and eliminating the old “close-shop” practice. And (c), reduce payroll taxes. This last measure was to be achieved, partially, by the social security reform, discussed above.⁸

Between 1985 and 1997, Chile’s labor markets performed remarkably well.⁹ What makes this experience particularly interesting is that between 1983-85 and 1993-95,

⁸ See Edwards and Edwards (1999) for details on the labor reforms.

⁹ Strictly speaking this improved performance began in 1985-86, after Chile recovered from the debt crisis.

Chile went from rates of unemployment usually associated with some European countries, to unemployment rates similar to those traditionally prevailing in the U.S. While during 1983-85 the open rate of unemployment averaged 17.3%, by 1993-95 it had declined to 5.8 percent. And all of this while real wages experienced rates of growth in excess of 5% per year.¹⁰ An interesting question is which of the components of the labor-related reforms – the reduced degree of job security, the reformed collective bargaining, or the social security reform -- were more important in helping Chile improve its labor market performance. Although providing a full answer to this question is beyond the scope of this paper, in section III we develop a model that allow us to quantify the effect of the social security reform on some of the key labor market variables. We proceed as follows: we first develop (in Section III) a model of segmented labor market, and investigate the way in which changes in taxes on labor in the “covered or modern” sector impact labor market outcomes. Next, in Section IV, we use micro survey data to analyze the extent to which participants truly considered the new system as a “deferred compensation” scheme. Finally, in Section V, we calibrate and simulate the model for the case of Chile. Our findings suggest that the social security reform had a modest effect on Chile’s labor market performance. This, however, needs not be the case in other countries: the actual impact of a Chile-style social security reform on unemployment, wages and income distribution will depend on the specific values of the relevant parameters.

IV. A Model of Social Security Reform and Labor Markets

Labor markets in emerging economies in general – and in Chile, in particular –, have a number of institutional features that set them apart from labor markets in industrial nations. The most important among these features are:

- In emerging countries labor markets are usually characterized by a rather large “informal” segment. This segment is, de facto, not directly affected by labor market regulations, such as minimum wages, job security legislation or social security. The informal sector coexists with a “modern” sector, where labor market regulations are fully in effect. The fact that in Chile the social security system covers only 62% of

¹⁰ The initial level of wages was, however, highly depressed (Edwards and Edwards, 1991).

those employed, provides some evidence of the existence of this segmented structure. Moreover, Basch and Paredes (1996) present micro-based evidence for Chile that supports the view that the country's labor market is characterized by the coexistence of these two labor segments.

- Contributions to social security are often seen as a (partial) tax on labor, rather than as deferred compensation, or an insurance program. At the same time, benefits from these programs are seen by individuals as an entitlement (Cox Edwards 1992). The percentage of the contribution that is actually considered a pure tax depends on the nature of the social security system and, more specifically, on the perceived connection between contributions and benefits (Diamond and Valdes-Prieto 1994). In the case of Chile, Torche and Wagner (1997) have argued that, although the reform reduced the tax component of contributions to social security, it did not fully eliminated it. In section III of this paper we use micro survey data to investigate this issue in detail.

Formally, assume that, as is the case in many developing and transitional economies, the labor market is segmented. There is a “*modern*” or “*covered*” sector subject to a minimum wage and to social security coverage, and an “*informal*” or “*unprotected*” sector with no social security coverage, and competitively determined wages. With other things equal, workers will rather be employed in the “protected” sector. The problem, however, is that there are not enough jobs in that sector; individuals that apply for a job in the modern sector face a probability (p) of obtaining it, and a probability ($1-p$) of being unemployed. In equilibrium, and under the assumption of risk neutrality, the wage rate obtained in the *informal* segment is equal to the expected (take home) wage rate in the *protected* sector. We further assume that every period employment in the modern sector turns over fully, so that the probability of getting a job there is equal to the ratio of openings to applicants.¹¹

We also assume that prior to the reform workers in the *protected* sector are subject to a payroll tax – whose purpose is to fund the social security system—equal to T_1 . We also assume that there is a disconnect between social security contributions and

¹¹ This mechanism is similar to the one consider in migration models of the Harris-Todaro type. In our model, however, there is no migration. The assumption of risk neutrality is not essential; all the results will follow if individuals have a constant degree of risk aversion.

benefits. More specifically, we assume that social security contributions are considered by individuals to be fully a tax. Notice, however, that the analysis that follows would not be affected by the assumption that only a fraction of the contribution was considered to be a tax. Workers employed in the modern sector receive a “take home” wage rate equal to the minimum wage (W_{\min}). The cost of labor to firms operating in this sector is equal to minimum wage rate plus the payroll tax. The social security reform will result in a reduction of this tax. There are two sources for this reduction: first, as was the case in Chile, the reform itself may entail a reduction in the contribution. Second, the replacement of the old pay-as-you-go system by individual retirement accounts, reduces the disconnect between contributions and benefits. In the post reform period, at least part of the contribution will be considered as deferred compensation (see Section IV for an estimate.)

Equations (1) - (4) describe the wage determination process in this economy. Equation (1) establishes that in equilibrium the wage rate in the informal sector (W_I) is equal to the expected (net of taxes) wage rate in the modern sector $E(W^N_M)$. According to equation (2) the probability of finding a job in the modern sector is equal to the ratio of openings – that is employment in that sector (L_M) – to applicants. The latter is given by the sum of openings plus the total number of unemployed ($L_M + U$). It is assumed, for simplicity, that the unemployed received an income equal to S . Equation (3) says that the cost of labor in the modern sector is equal to the minimum wage inclusive of the payroll tax (T_1). In equation (4) we present the demand for labor equations in the modern and informal sectors. P_M and P_I are good prices in each sector, $f(\cdot)$ and $g(\cdot)$ are physical marginal productivity of labor functions, and K_M and K_I are the stock of capital used in the modern and informal sector, respectively.

- (1)
$$W_I = E(W^N_M) = p W_{\min} + (1 - p) S$$
- (2)
$$p = [L_M / (L_M + U)]$$
- (3)
$$W_M = W_{\min} (1 + T_1)$$
- (4)
$$W_M = P_M f(L_M, K_M); \quad W_I = P_I g(L_I, K_I).$$

Equation (5) is the resource constraint in the labor market, and establishes that employment in the modern sector, plus employment in the informal sector plus unemployment has to be equal to total labor supply (L_s). According to equation (6), labor supply is a positive function of real wages; O represents “other” factors affecting the supply of labor.¹² Equation (7) define the aggregate price index and the aggregate wage rate. In order to simplify the analysis, in equation (8) we have assumed that the modern sector corresponds to tradable goods and that, as a consequence, P_M is given by international prices (P_M^*).¹³ Equation (9) establishes that product prices in the informal sector are a positive function of wages in that sector. We further assume that an increase in W_I , will have a less than proportional effect on prices of goods produced in the informal sector:

$$\begin{aligned}
 (5) \quad & L_M + L_I + U = L_s \\
 (6) \quad & L_s = h(W/P, O); \quad h' > 0. \\
 (7) \quad & P = P_I^\beta P_M^{(1-\beta)}; \quad W = W_I^\theta W_M^{(1-\theta)} \\
 (8) \quad & P_M = P_M^*; \\
 (9) \quad & P_I = z(W_I); \quad z' > 0.
 \end{aligned}$$

Equation (10) is the resource constraint for capital, and says that the sum of capital used in each sector has to equal the total stock of capital. Equation (11) says that the allocation of the capital stock across sectors will depend on the relative product prices. Notice that in order to simplify the computations, and to focus on the issues at hand, we have assumed that there is no net investment.

$$\begin{aligned}
 (10) \quad & K_M + K_I = K \\
 (11) \quad & K_M = j(P_M/P_I); \quad K_I = v(P_M/P_I).
 \end{aligned}$$

¹² We have abstracted from intertemporal issues. Although our results will still go through in an explicit intertemporal context, the computations would become significantly more complex.

¹³ This simplification allows us to maintain product prices in the modern sector constant. An alternative assumption, and one that would not affect the basic aspect of the analysis, is that the modern sector is comprised of both tradable and non-tradable goods. In this case, we would need a product market clearing condition for modern sector goods.

The initial (pre reform) labor market is depicted in Figure 1, under the simplifying assumption that the unemployed get no assistance ($S = 0$). Distance $O_M - O_I$ is total labor supply, L_M and L_I are the demand for labor schedules, and yy is a rectangular hyperbola, that satisfies the equilibrium condition in equation (1). The wage rate and the level of employment in the informal sector are determined by the intersection of the yy and L_I schedules. W_{min} is the minimum wage which, as stated above, is assumed to be set in net take-home bases. T_I is the payroll tax, and W_M is the cost of labor in the modern sector. W_I is the wage rate in the informal sector. The initial level of employment in the modern sector is given by distance $O_M - L_M^1$; distance $O_I - L_I^1$ depicts initial employment in the informal sector. The total number of unemployed is equal to distance $L_M^1 - L_I^1$. In this model a social security reform that replaces a pay-as-you-go regime with a capitalization one, has the effect of reducing the (perceived) tax component of social security contributions. That is, there will be a reduction of T_I , to some lower level, possibly even to zero. This would unleash a series of effects, including a higher demand for labor in the modern sector, a change in aggregate labor supply, and changes in wages and in employment in the informal sector.

Formally, the model given by equations (1) - (11) can be solved to obtain the effects of a social security reform, on a number of variables, including informal sector wages (W_I), the volume of unemployment (U), and product prices of in the informal sector (P_I). In order to simplify the exposition, we follow a long tradition in international trade theory – the Ricardo-Viner approach – and we assume that capital is fixed in its sector of origin. We begin with the effects of changes in the tax component of the social security contribution ($d \log T$) on informal sector wages ($d \log W_I$):

$$(12) \quad d \log W_I = \Delta^{-1} \{ - [\alpha_U (U / (L_M + U)) (1 / \eta_M)] \\ - [(U / (L_M + U)) \alpha_M (1 / \eta_M)] \} (T_I / (1 + T_I)) d \log T.$$

Where,

$$(13) \quad \Delta = - \alpha_U - [\alpha_I (U / (L_M + U)) (1 / \eta_I) (\mu - 1)] \\ - [(U / (L_M + U)) \phi (\alpha_I + \mu \beta)].$$

α_I , α_M and α_U are the shares of employment in the informal sector, employment in the modern sector, and unemployment in the labor resources constraint (5). η_I and η_M are the inverse of the elasticities of the demand for labor with respect to wages in the I and M sectors, respectively, and are negative.¹⁴ ϕ is the supply elasticity of labor, and is positive. μ is the elasticity of the price of informal sector goods (P_I) with respect to the wage rate in that sector, and is greater than zero and smaller than one. It follows from equation (13), then, that Δ is negative. Consequently, according to equation (12), the following result holds:

$$(d \log W_I / d \log T) < 0.$$

This means that a social security reform that reduces the pay roll tax, will unambiguously generate an increase in the wage rate in I, the sector that is not covered by the by the social security system. Notice that, by construction, net (take home) wages in the modern sector are not affected by the reform. This is because we have assumed that the minimum wage is set in take-home bases, and that the reform does not affect it. The more general case where the reform generates an increase in net wages in the M sector is discussed below.

The effect of the reform on aggregate unemployment (U), is given by:

$$(14) \quad d \log U = \Delta^{-1} \{ (\alpha_I / \eta_I) - [\alpha_I (U / (L_M + U)) (1 / \eta_I) (1 / \eta_M) (\mu - 1)] \\ - [(U / (L_M + U)) \phi (\alpha_I + \mu \beta) (1 / \eta_M)] \} (T_I / (1 + T_I)) d \log T.$$

The sign of equation (14) is undetermined. It follows from this that within the framework developed in this paper, a reduction in the payroll tax in the modern sector will have an ambiguous effect on the number of unemployed. Whether the level of unemployment will increase or decline will depend on two basic factors: the supply elasticity of labor in the economy -- parameter ϕ in equation (14) --; and the demand

¹⁴ That is, $\eta_I = (d \log W_I) / (d \log L_I)$.

elasticity of labor demand in the informal sector. The more elastic is the supply for labor and the more inelastic is the demand for labor in the informal sector, the more likely it is that the reform will result in an *increase* in the level of unemployment.

Equation (15) gives the effect of the reform on product prices in the informal sector, and is positive:

$$(15) \quad d \log P_I = \Delta^{-1} \{ - (U / (L_M + U)) (\alpha_M / \eta_M) \\ - \alpha_U (U / (L_M + U)) (1 / \eta_M) \} (T_1 / (1 + T_1)) d \log T.$$

The working of the model is illustrated in Figure (2), where it is assumed that the reform reduces the social security tax from T_1 to T_2 . The new cost of labor in the modern sector is W_M^2 . Distance $O_I - O_I'$ is assumed to be equal to the increase in the amount of labor supplied to the economy. Because of this increase in aggregate labor supply, the original demand for labor in the informal sector has to be redrawn as L_I' . Since the product price of I has increased, the demand for labor in the informal sector shifts up, and is represented in Figure 2 by $L_I'(P_I^1)$. The wage rate in the informal sector is now determined by the intersection of a new rectangular hyperbola $y'y'$ and a new demand for labor in sector I, and is given by W_I^2 . Employment in the informal sector has changed from distance $O_I - L_I^1$ to distance $O_I' - L_I^2$. Because of the reduction in W_M , employment in the modern sector has increased from L_M^1 to L_M^2 . The new level of unemployment, which as indicated by equation (13), could be either higher or lower than the initial level of unemployment, is given by distance $L_M^2 - L_I^2$.

The results in equations (12) – (15) assume that there is no change in the take-home wage in the modern sector. In Chile, however, the government mandated an increase in take-home wages equal to 10 percent, for those that opted for the privatized regime (Edwards 1998a). In the context of our model, an increase in the take-home wage in the sector covered by social security can be modeled as an exogenously determined increase in the minimum wage rate. Formally speaking, then, this more general policy package corresponds to a situation where both the minimum wage (W_{\min}) and the payroll tax, change (in opposite directions). In this case the change in the wage rate in the informal sector will be given by:

$$(16) \quad d \log W_I = \Delta^{-1} \{ [- [\alpha_U (U / (L_M + U)) (1 / \eta_M)] \\ - [(U / (L_M + U)) \alpha_M (1 / \eta_M)] \} \{ T_I / (1 + T_I) \} d \log T \\ + d \log W_{\min} \}.$$

The change in the level of employment, in turn, will now be given by:

$$(17) \quad d \log U = \Delta^{-1} \{ (\alpha_I / \eta_I) - [\alpha_I (U / (L_M + U)) (1 / \eta_I) (1 / \eta_M) (\mu - 1)] \\ - [(U / (L_M + U)) \phi (\alpha_I + \mu \beta) (1 / \eta_M)] \} \{ T_I / (1 + T_I) \} d \log T \\ + d \log W_{\min} \}.$$

In this case, then, the final effect of the policy package will depend on the way in which the changes in the payroll tax and in the minimum wage are related to each other. A reasonable assumption – and one that captures the case of the Chilean reforms – is that the increase in the take-home wage in the modern sector, is equal to a fraction of the (percentage) reduction in the payroll taxes. Under these assumptions the qualitative results derived above for the more simple version of the model still apply: a social security reform will increase the wage rate in the informal sector, but will have an ambiguous effect on the level of unemployment.

Although the model developed here is simple, and has some limitations, it has enough structure to provide insights into some of the most important effects of a pension reform on labor markets.¹⁵ In Section IV we use micro survey data for 1994 to analyze some important characteristics of Chile's privatized social security system. In Section V we use the model developed here to simulate the effect of the social security reform on Chile's labor market outcomes.

¹⁵ Some of the limitations of the model include the fact that it does not consider all the channels through which the reform will feedback to the rest of the economy. Also, it does not consider explicitly the (possible) effect on the labor supply of the elimination of the expected future benefits of the entitlement component of the old system. This effect, however, is likely to be small and could be easily incorporated into the system by amending equation (6).

IV. Chile's New Pension System: Who Is Covered? How Much Do Participants Value The System?

In this section we use micro survey data to analyze some key characteristics of Chile's privately managed social security system. Our basic data set is the CASEN (*Caracterización Socioeconómica Nacional*) national survey for 1994. This is a nationally representative household survey put together by the National Planning Office. The sample contains a total of 178,057 individual observations, including children and the elderly. Of these, 111,643 correspond to individuals living in the urban areas, and 66,414 correspond to those in the rural areas. An urban area is defined as a grouping of dwellings with a population in excess of 2,000 individuals. The survey collects information on demographics, education, type of dwelling, health care, occupation, employment, and income, among other variables. We are interested on two specific, and interrelated, questions:

- What is the coverage of Chile's privatized social security system? Or, in other words, what percentage of those with a paying job, participate in the system? This is a key issue within the context of the model developed in Section III of this paper, where it was assumed that only a fraction of those in the labor market – those employed in the “formal” sector – participate in the social security system in an active way, making contributions to their own personal retirement accounts.
- To what extent do participants in the system – and, more specifically, those that are required by law to make contributions -- consider it a deferred compensation scheme? A different way of putting the question is, to what extent is the new system seen as having a tax component? This is an important question within the model developed in this paper. In particular, it plays a fundamental role in the simulation exercise on the effect of the reform on labor market outcomes, and that we present in Section V.

Ideally we would like to use comparable data for the pre and post reform era. This would allow us to understand the way in which the reform affected individual's

behavior, and individuals perceptions. Unfortunately, however, detailed survey data have only been collected since 1990.

IV.1 Extent of Coverage of Chile's New Social Security System

According to the 1981 social security reform, those individuals that have an employment contract are required to make contributions to their personal retirement accounts.¹⁶ The self-employed and those in the informal sector may, if they so wish, make voluntary contributions to the pension system. Table 1 presents summary data, for 1994, on coverage of the social security system. These data correspond to those individuals in the sample that had a paying job at the time of the survey, and have been organized by urban-rural sectors, age and gender. "AFP" refers to what percentage of individuals in that particular group was making contributions to a privately managed retirement fund (an AFP). "Other" refers to the percentage of individuals that were making contributions to other retirement systems, including the old pay-as-you go system and the armed forces retirement fund; "No" refers to those individuals that had not made contributions to any retirement system.

The table is rather self-explanatory, and shows that as recently as 1994 Chile's system fell considerably short of universal coverage. Urban males have the highest rate of total coverage – defined as contributing to any retirement scheme --, at 69.9 percent. The lowest coverage corresponds to males in the rural sector, with 47.2%. It may also be seen that, with the exception of rural males, those in the 16 to 39 year-old had the highest degree of coverage. For the sample as a whole, in 1994 the coverage rate of the formal retirement systems was 60.2%. Data from the CASEN survey suggests that there is a very high degree of compliance with respect to required contributions. More that 95% of employees with an employment contract made contributions, as required by law, to a retirement system.

Although there are no comparable survey data for the pre reform period, existing estimates indicates that Chile's old pay-as-you-go system covered 58% of those employed. This means, then, that after the privatization reform there has only been a

¹⁶ In many models of segmented labor markets, workers in the "formal" sector are defined as those with an employment contract. However, a broader definition – and one that we adopt in this paper – is that workers in the "formal" sector are those with employment contracts, plus those without contracts, but that are covered by the formal pension system.

small increase in the coverage of the formal retirement system. The fact that younger workers exhibit a higher coverage ratio may indicate, however, a secular trend towards greater participation in the system.

IV.2 Deferred Compensation or Taxes?

The model developed in section III of this paper assumes that a reform of the social security system implies a reduction in the (implicit) tax on labor. More specifically, we assume that while under the pay-as-you-go system, contributions are (largely) seen as taxes, under the privately managed regime they are seen as a deferred compensation scheme. In this subsection we use data from the CASEN survey to investigate the extent to which, on average, individuals indeed value the new privatized system, and consider it as a component of their total compensation package.

For an individual employed in the formal sector, total labor compensation will be equal to his take-home (cash) salary, plus a proportion of his mandated contribution to the retirement system. If contributions are fully seen as deferred compensation, that proportion will be equal to one. If on the other hand, contributions are fully seen as taxes, that proportion will be equal to zero, and the total compensation will be only equal to the take-home salary.¹⁷

In principle, the value attached by individuals to the pension system can be estimated by comparing wages from jobs that are equivalent in all respects, except with regard to contributions to the retirement program. If individuals value being enrolled in the pension's program, we would expect that, for otherwise equivalent jobs, the take-home pay of those that participate in the system will be lower than that of individuals that do not make contributions. The actual difference in the (cash) take-home pay can, then, be attributed to the value that individuals attach to being members of the retirement system.

Chile's specific institutional arrangements, however, complicate our task of estimating the imputed value of mandated social security contributions from a wage equation. The main difficulty stems from the fact that the law requires individuals to make contributions not only to the retirement system (at 10% of wages), but also to the

¹⁷ This, however, is only a first order approximation. The actual proportion of the contribution will depend on the individual's rate of discount, and the pension fund's rate of return, among other things.

health system (7%) and to a mandated life insurance program (3%). Total contributions for this “package,” stand at 20% of wages (up to a maximum), significantly lower than the 43% required under the traditional system. A second complication is that individuals have a choice with respect to the health care component of the package. They can either opt for a basic, public sector-run program known as FONASA, or they can use the 7% health contribution towards the purchase of a privately provided health insurance policy. This latter option is known as ISAPRE, and its cost tends to exceed the 7% mandated health contribution. This means that, in practice, those that participate in the system have to choose between a “*retirement-cum-basic health*” package, or a “*retirement-cum-private health insurance*” package. Our estimation of a wage equation, explicitly takes this option into account.¹⁸

In Table 2 we present the results obtained from the estimation of a wage equation for 1994. The sample has 6,934 observations, and is comprised of civilian workers in the urban sector, that held a paying job, did not receive retirement benefits at the time of the survey, and whose salary was in the top quintile of the wage distribution. The dependent variable is the log of hourly net (take-home) wages; the notation used for the independent variables is provided in Table 3. We control for the usual variables that explain wage differentials, including schooling, experience, geographical location, gender and industry. We also control for earnings in excess of the maximum amount subject to social security contributions: “MAX” is a dummy that takes a value of one if the individual’s salary exceeds that maximum. Our main interest is to obtain an estimate of the effect of contributions on wage differentials. We do this by introducing two dummy variables into the analysis: “AFP_HEALTH_BA” is a dummy that takes a value of one if the individual in question has made contributions to the “*retirement-cum-basic health*” package. “AFP_HEALTH_PR” is a dummy that takes a value of one if the individual in question has opted for the “*retirement-cum-private health insurance*” package. These variables were introduced both on their own, as well as interacted with the MAX dummy.

As may be seen from Table 2, the estimated coefficients for the traditional variables – schooling, experience and experienced squared – are along the line of what is

¹⁸ This choice is affected by income. By focusing our estimation effort on the top quintile of the distribution we hope to capture the relationship between contributions and wages, rather than between income and the choice of health program.

expected, and are consistent with previous estimates for Chile and other emerging economies. The coefficient for the geographical dummy capturing the metropolitan area is significant, as are most of the coefficients for industry. More important for our analysis, however, is that the estimated coefficient for both the AFP_HEALTH_BA and AFP_HEALTH_PR dummies are negative and highly significant. Their point estimates, -0.147 and -0.089 respectively, however, are smaller (in absolute value) than the mandated contribution of 20%. This suggests that, after controlling for other factors such as schooling, experience, industry, and geographical region, individuals that make required contributions to the retirement-health-insurance system, have lower hourly net earnings than those individuals that are not in the system.¹⁹

To the extent that an individual freely chooses to be employed in a job that requires him to make contributions, rather than in one that does not require them, the coefficients of AFP_HEALTH_BA and AFP_HEALTH_PR can be interpreted as capturing the value attached to these packages. The fact that the estimates of both contribution dummies are lower (in absolute terms) than the 20% mandatory contribution rate, suggests that, although individuals attached a positive value to the social security package, they attached a value that was somewhat lower than the actual contribution..

The results in Table 2 also indicate that the coefficient of AFP_HEALTH_BA interacted with MAX is insignificantly different from zero. We interpret this as indicating that individuals with income above MAX, that are enrolled in the “*retirement-cum-basic health*” package, attach to it the same value participants with income below MAX. Interestingly enough, the coefficient of AFP_HEALTH_PR interacted with MAX is significantly positive, with a point estimate of 0.114. Moreover, it is not possible to reject the hypothesis that the sum of AFP_HEALTH_PR and (AFP_HEALTH_PR * MAX) is different from zero. The F-statistic for this restriction is 0.46 and has a p-value of 0.49. This result can be interpreted as indicating that those in the upper tail of the income distribution place no value to mandatory contributions.²⁰ A limitation of the estimates in table 2, is that it is not possible to precisely disentangle by how much

¹⁹ This is strictly the case if the individual wage is below the maximum wage subject to contributions. See the discussion below.

²⁰ This, however, is not relevant for our simulation exercise. What matters is the *marginal* value attached to the system. This is captured by the contribution dummy variables.

participants value each of the components of the mandatory package. In the simulation exercises presented in section V we assume that the proportional value is the same across the three components of the package.

In order to investigate for the robustness of the results reported in Table 2, we estimated additional earnings equations for alternative samples. We also used a two stages procedure to deal with possible endogeneity problems. The results obtained from these alternative estimations, confirmed those reported in Table 2, and are not presented here due to space considerations. In section V of this paper we use the estimates reported in Table 2 as an input into our simulation exercises.

V. Chile's Pension Reform And The Labor Market

In this section we present the results from simulation exercises, based on the model derived in section III, on the effects of the social security reform on Chile's labor market. Values for the key parameters were taken from other studies of the Chilean economy, as well as from the econometric results presented in the previous section.

In Table 4 we present the values of the parameters used in the simulation exercise. The elasticities were taken from Coeymans and Mundlack (1993). The data on the labor force and the rate of unemployment were taken from Banco Central de Chile. The percentage of workers in the informal sector was taken from the analysis reported in section IV of this paper. The parameter for μ was taken from a number of studies on Chile's inflation. We assumed that under the traditional pay-as-you-go system, contributions to the social security system (at an average rate of 26% of wages) were fully considered to be a tax; as pointed out above, benefits during the pre-reform era were considered to be an entitlement. Finally, we assumed that in the post reform period, mandated contributions to the pension system had a tax component equal to 4.1% of wages. That is, we assume that individuals considered that approximately 40 percent of the required contribution to the pension fund constituted a tax. This figure is based on the econometric results reported in the preceding section. More specifically, it was obtained after averaging the imputed "tax" component obtained from the two "contribution" dummies in the regression reported in Table 2, and assuming that the

estimated “tax” component of contributions to the pension-health-insurance package, is equal across the three components of the package.²¹

In Table 5 we present the simulation results for the case where the reform reduces the (implicit) tax on labor, but where there is no increase in the take-home pay for those enrolled in the system. These results were obtained after calibrating equations (12) and (14) in Section III. Table 6, on the other hand, contains the results from the simulation exercise, when it is assumed that the reform results in a 10% increase in net take-home pay for those enrolled in the system, and correspond to equations (16) and (17). In both tables we have presented a “low” and a “high” case scenario. As may be seen, these results suggest that, by reducing the implicit tax on labor, Chile’s pension reform had a positive effect on wages in the informal sector, at the same time as it contributed to a reduction in the rate of unemployment.

The results in Table 6, which are based on assumptions that closely capture Chile’s experience, suggest that the actual effect of the pension reform on labor market outcomes was rather modest with respect to unemployment reduction. According to our simulation exercise, in the high case scenario, the reforms only contributed 1.1 percentage points to the reduction of the rate of unemployment. The *total* effect on net wages was significant, however: first, net wages in the formal sector increased by 10%; second, wages in the informal sector increased between 1.8 and 2.2 percent. This translates into a weighted average increase for net wages in the range of 6.3 to 6.6%. From a distributional point of view, these results indicate that the benefits of the reforms were greater to those in the formal and covered sector, where wages and job conditions usually tend to be better than in the informal sector.

VI. Concluding Remarks

In 1981, Chile reformed its social security system. An inefficient and insolvent pay-as-you-go regime was replaced by system based on individual retirement accounts. Over the years Chile’s reform has been widely praised, and has been carefully studied by

²¹ The results in Table 2 suggest that, after controlling for other factors, those individuals that are subject to mandated contributions (at a 20% rate), have a take-home pay that is on average 11.8% below that of individuals that don’t participate in the system (This is the average of the two dummies point estimates:

policy makers throughout the world. In this paper we have focused on a neglected aspect of Chile's social security reform: its impact on labor market outcomes, including unemployment and wages. We develop a model of the labor market where we assume that, as is the case in most emerging markets, a formal and an informal sectors coexist side by side.

According to our model, a social security reform that reduces the implicit tax on labor in the formal sector – as was the case in Chile --, will result in an increase in the wage rate in the informal sector. The effect of this type of reform on aggregate unemployment is undetermined, however. Results from simulation exercises suggest that in the case of Chile the reforms resulted in an increase in informal sector wages between 2 an 2.5%. These results also suggest that the reforms made a positive contribution to the reduction of Chile's aggregate of unemployment.

$0.118 = (0.147 + 0.089) / 2$. The estimated perceived tax of the pension component is, then, calculated as $(1 - 0.118 / 0.2) \times 0.1 = 0.041$.

APPENDIX

To Contribute or not to Contribute? That is the Question

According to the 1994 CASEN survey, 25.8% of individuals that were not required by law to be enrolled in the system, still made voluntary contributions to an individual retirement account.

What are the characteristics of those individuals that voluntarily participated in the retirement system? In order to address this issue, we estimated a number of probit equation for the probability of making (voluntary) contributions. In estimating this regression we defined a dummy variable that took the value of one if the individual in question had made contributions to a retirement account, and zero if he did not make contributions. The results obtained from the basic regression are reported in Table A1. In this estimate, the sample had 11,019 observations, corresponding to urban sector individuals with a paying job, and that did not have an employment contract. As is customary, we report the change in the probability of being enrolled as a result of a change in the independent variable (column dF/dx). A detailed description of the notation for the independent variables used in the probit regression analysis is provided in Table 3 in the text of the paper.

Several interesting results emerge from the probit regressions reported in Table A1. First, after controlling for other factors, a higher hourly salary increases slightly (but significantly) the probability of making voluntary contributions to a retirement account. Second, a higher number of years of schooling, also increases the probability of contributing to a retirement account. Third, age increases the probability of contributing, but at a decreasing rate (the coefficient of age squared is significantly negative). Fourth, only two of the sectoral dummies are significant. Those in financial services have a higher probability of contributing, while those in the industrial sector have a lower probability of doing so. Fifth, only one regional dummy – the one corresponding to the center of the country -- is significant. Sixth, working in a firm with more than six co-workers increases the probability of making voluntary contributions. Finally, after controlling for other factors, women have a significantly lower probability of participating in a privately managed retirement system.

In order to check for the robustness of these results, we estimated similar Probit regressions for different samples, including one with over 35,000 observations, corresponding to urban workers with and without an employment contracts. Generally speaking, the results obtained from those estimates, coincide with those obtained with the smaller sample and reported in Table A1. The only important difference refers to the sectoral dummies. According to these estimates – available on request – those in the construction, commerce and agriculture sector have a lower probability of making contributions to the retirement system.

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**Table 1: Coverage of Chile's Social Security System, 1994:
Urban and rural, by age and gender***

A. URBAN

	16 to 39 years	40 to 59 years	60 plus years	Total
URBAN				
Males				
AFP	68.87	60.01	35.02	63.36
Other	3.09	9.84	18.95	6.58
No	28	30.15	46.04	30.03
no answer	0.04	0	0	0.02
Total	100	100	100	100
URBAN				
Females				
AFP	66.56	52.89	24.57	59.63
Other	2.46	9.27	16.72	5.57
No	30.98	37.6	58.71	34.72
no answer	0	0.24	0	0.08
Total	100	100	100	100
B. RURAL				
Males				
AFP	44.85	39.12	21.02	40.79
Other	2.65	11.33	13.47	6.41
No	52.49	49.56	65.51	52.8
No answer	0.01	0	0	0.01
Total	100	100	100	100
RURAL				
Females				
AFP	48.79	41.69	17.83	44.93
Other	1.59	6.25	13.63	3.64
No	49.62	52.06	68.54	51.44
Total	100	100	100	100

* Totals may not add up to 100 due to rounding errors.

Source: calculated by the authors using raw data from Casen 94

Table 2: Earning Functions Estimation: Survey Data for Urban Workers, 1994 (Ordinary Least Squares)*

Source	SS	df	MS	Number of obs = 6934		
Model	1071.20294	18	59.5112747	F(18, 6915) =	310.82	
Residual	1323.99656	6915	.191467326	Prob > F =	0.0000	
				R-squared =	0.4472	
				Adj R-squared =	0.4458	
Total	2395.1995	6933	.345478076	Root MSE =	.43757	

logwage	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
yschool	.0220988	.0017813	12.406	0.000	.018607	.0255907
ex	.0028238	.0014872	1.899	0.058	-.0000916	.0057391
ex2	.0000257	.0000295	0.872	0.383	-.0000321	.0000835
AFP_HEALTH_BA	-.1467927	.0172221	-8.524	0.000	-.1805532	-.1130321
AFP_HEALTH_PR	-.0894047	.0136311	-6.559	0.000	-.1161257	-.0626836
MAX	1.03937	.0328764	31.614	0.000	.9749224	1.103818
(AFP_BA * MAX)	.1139482	.0382275	2.981	0.003	.0390106	.1888858
(AFP_PR * MAX)	-.0854414	.0712165	-1.200	0.230	-.2250476	.0541648
woman	-.0037146	.0126461	-0.294	0.769	-.0285048	.0210756
METRO	.0637241	.0109306	5.830	0.000	.0422968	.0851514
AGRI	.0955659	.026491	3.607	0.000	.0436353	.1474964
MINI	.1322994	.0234114	5.651	0.000	.0864058	.178193
INDU	.0766575	.0179838	4.263	0.000	.0414037	.1119113
UTIL	.018041	.0434465	0.415	0.678	-.0671274	.1032094
CONS	.0202519	.0225292	0.899	0.369	-.0239122	.0644161
COMM	.0990478	.0174364	5.681	0.000	.064867	.1332285
TRAN	.0787835	.0212229	3.712	0.000	.03718	.120387
FINA	.0820661	.0190765	4.302	0.000	.0446702	.1194619
_cons	6.81159	.0346884	196.365	0.000	6.743591	6.87959

* For the notation used see Table 3. T refers to the t-statistic.

Table 3: Notation Used in Empirical Analysis

logwage:	log of hourly wages
yschool	Years of schooling
ex	Experience
exp	Experience squared
AGRI	Dummy for agriculture
MINI	Mining
INDU	Industry
UTIL	Utilities
CONS	Construction
COMM	Commerce
TRAN	Transportation
FINA	Financial services
METRO	Workers in the two largest metropolitan areas
MAX	Dummy that takes value of one if wage exceeds maximum subject to social security contributions
AFP_HEALTH_BA	Dummy that takes value of one if individual is enrolled in the social security program and in the basic health service program
AFP_HEALTH_PR	Dummy that takes value of one if individual is enrolled in the social security program and in a private health insurance program
(AFP_BA * MAX)	Variable that interacts AFP_HEALTH_BA and MAX
(AFP_PR * MAX)	Variable that interacts AFP_HEALTH_PR and MAX
Woman	Dummy that takes a value of one if the individual is a woman

Table 4: Parameter Values Used in Simulation Exercises*

PARAMETER	DESCRIPTIPON	VALUE
F	Total labor force (thousand of people)	3,700
L_M	Employment in modern sector (thousands)	1,850
L_I	Employment in “informal” sector (thousands)	1,450
U	Unemployed (thousands)	400
μ	Wage “passover coefficient” in prices in Informal sector goods	0.3 to 0.5
ϕ	Supply elasticity of labor with respect to wages	0.5
β	Weight of informal sector prices in price level	0.3
$(1/\eta_I)$	Demand elasticity for labor in informal sector	-0.5 to -0.7
$(1/\eta_M)$	Demand elasticity for labor in modern sector	-0.4 to -0.6
T_1	Initial implicit tax on labor	26.0 %
T_2	Post reform implicit tax on labor	4.1%

* These parameter values were taken as representative of Chile’s conditions in 1981, when the reform was launched.

Source: see text.

TABLE 5:
Chile's Pension Reform and the Labor Market:
Simulation Results ^a
(Equations 12 and 14)

	Low Case Scenario	High Case Scenario
Percentage change in real wage in informal sector	4.1 %	5.1 %
Change in rate of unemployment (in percentage points)	- 1.6 %	- 2.3 %

a: This exercise assumes that there is no change in the net take-home pay for those in the “formal” segment of the labor market.

Source: Calculated by the authors on the bases of the model developed in section III of this paper.

TABLE 6:
Chile's Pension Reform and the Labor Market:
Simulation Results ^a
(Equations 16 and 17)

	Low Case Scenario	High Case Scenario
Percentage change in real wage in informal sector	1.8 %	2.2 %
Change in rate of unemployment (in percentage points)	- 0.7 %	- 1.1 %

a: This exercise assumes that, at the time of the reform, there is a 10% increase in the net take-home pay for those in the “formal” segment of the labor market.

Source: Calculated by the authors on the bases of the model developed in section III of this paper.

Table A1: Contributors among Civilian Workers Not Required to Contribute (self employed and employees without contracts)

Probit Estimates Number of obs = 11019
chi2(20) = 600.04

Log Likelihood = -5991.4309 Prob > chi2 = 0.0000
Pseudo R2 = 0.0477

contr	dF/dx	Std. Err.	z	P> z	x-bar	[95% C.I.]
salarloh	.0000209	4.38e-06	4.78	0.000	543.83	.000012	.00003	
yschool	.0140523	.0012457	11.25	0.000	8.86959	.011611	.016494	
age	.0107557	.0018747	5.73	0.000	38.2814	.007081	.01443	
age2	-.000092	.0000223	-4.12	0.000	1629.07	-.000136	-.000048	
AGRI*	-.0208325	.0158046	-1.29	0.195	.124512	-.051809	.010144	
MINI*	-.0274786	.0354607	-0.75	0.453	.014339	-.09698	.042023	
INDU*	-.0370054	.0146957	-2.43	0.015	.127507	-.065808	-.008202	
UTIL*	-.0577195	.0641543	-0.83	0.406	.003267	-.18346	.068021	
CONS*	.0151046	.0155179	0.98	0.325	.143389	-.01531	.045519	
COMM*	.0050619	.0129518	0.39	0.695	.27988	-.020323	.030447	
TRAN*	.0026499	.0165642	0.16	0.873	.101552	-.029815	.035115	
FINA*	.1381073	.0308374	4.84	0.000	.026953	.077667	.198548	
REG1*	.0257467	.0160953	1.60	0.110	.498412	-.005799	.057293	
REG2*	.0845879	.0188047	4.67	0.000	.221073	.047731	.121444	
REG3*	.0268874	.0184528	1.48	0.139	.19666	-.009279	.063054	
t6_9*	.0616362	.0222535	2.90	0.004	.045739	.01802	.105252	
t10_49*	.1726473	.0170998	10.87	0.000	.091478	.139132	.206162	
t50_199*	.1617451	.0261941	6.69	0.000	.035393	.110406	.213085	
t_200*	.3308905	.0332646	10.36	0.000	.021508	.265693	.396088	
woman*	-.0622602	.0097629	-6.16	0.000	.278065	-.081395	-.043125	
obs. P	.2580089							
pred. P	.2488856	(at x-bar)						

(*) dF/dx is for discrete change of dummy variable from 0 to 1
z and P>|z| are the test of the underlying coefficient being 0

Figure 1

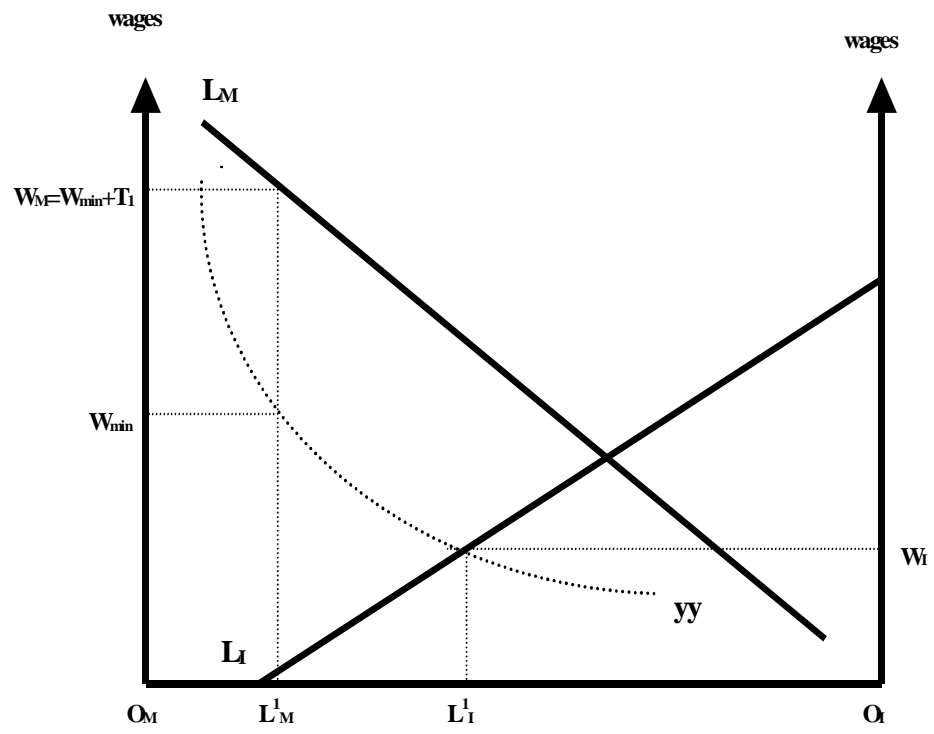


Figure 2

