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Chilean Pension Reform: Coverage Facts and Policy Alternatives

The Chilean pension reform has given rise to significant debate in the last decade. It was the first pension system in which the core mechanism for producing pensions is individual capitalization and the first to hand over its management to the private sector. This pension concept is one of the rare institutions exported from Chile to the rest of the world, including countries in Latin America, central and eastern Europe, Africa, and Asia, as well as a few developed countries such as Sweden.

A quarter of a century after its inception, it seems natural to undertake a deep evaluation of the system's outcomes, strengths, and weaknesses. Corbo and Schmidt-Hebbel make a positive macroeconomic assessment, as well as good evaluation on financial grounds based on the high average return on assets.[1] Several papers, however, argue that the level of competition is weak, which translates into high prices and high returns on equity.[2] From a public finance perspective, Arenas suggests that the fiscal burden may be significant and increasing, while the average coverage ratio appears to be low.[3] Finally, in an earlier paper, we undertake a preliminary evaluation of coverage based on affiliates' administrative data.[4] These last two

Berstein, Larraín, and Pino are with the Chilean Superintendency of Pension Fund Administrators.

This paper has benefited from exhaustive comments by Carmen Pagés, Pablo Serra, Eduardo Morón, Estelle James, and Salvador Valdés-Prieto. We also acknowledge Gonzalo Reyes, Eduardo Fajnzylber, Rubén Castro, Ximena Quintanilla, and all the staff at the Superintendency of Pension Fund Administrators for useful discussion and comments.

1. Corbo and Schmidt-Hebbel (2003).
2. See, for example, Valdés-Prieto and Marinovic (2005).
3. Arenas (2000).
4. Berstein, Larraín, and Pino (2005).

studies reveal that one of the main weaknesses of the Chilean model is its low coverage.[5]

This paper studies the reasons behind the low coverage of the Chilean pension system by focusing on one benefit—namely, old-age pensions. It departs from previous studies in that it uses individual data from administrative records, as well as socioeconomic characterization of these same individuals provided by the 2002 Social Security Survey (EPS), to project the future benefits of the generations that are now contributing to the system.[6] The use of individual data is relevant because it takes into account the large heterogeneity of individual experiences.

We use these data to simulate the distribution of old-age benefits, which is a key aspect of a defined-contributions environment. A defined-contributions system has no solvency problems, as there are few, if any, guarantees involved. Beyond the rate of return on investments, however, the final pension depends heavily on the amount, number, and timing of contributions. In a defined-benefits system, shocks affect the solvency of the system, whereas in a defined-contributions system, individuals bear much of the risk regarding the amount of the final pension.[7] In fact, while the theoretical replacement rates are high for those who contribute throughout their working lives, they may be quite low for workers with infrequent contributions.[8] The use of individual-level data allows us to identify some of the risks that generate such uncertainty in Chile's private pension system.

When the Chilean system was designed, it was expected to deliver replacement rates of around 75 percent.[9] This is the case for around one-third of affiliates. However, the strong heterogeneity of individual income and contribution density profiles means that some people will be in a very difficult situation

5. This problem is not exclusive to Chile. Rofman (2005) provides a comparative analysis of coverage in Latin American countries, while Auerbach, Genoni, and Pagés (2005) analyze the reasons behind the low rates of contribution to social security programs in developing countries. In these papers, Chile ranks relatively high in terms of the level of coverage.

6. The database is the property of the Ministry of Labor's Undersecretary of Social Protection. It is available at www.proteccionsocial.cl.

7. Consequently, any shocks to those markets have an impact on pension levels. Pensions currently paid in Chile are affected by three problems of this nature: the high unemployment rates and low salaries of the 1970s, which had an impact on the recognition bonds; the big 1982–83 recession, which was characterized by extremely high unemployment; and the underdeclaration of public sector wages as part of fiscal policy in the 1980s.

8. The replacement rate is the ratio of an individual's pension and his or her income in a given period.

9. See Margozzini (1988).

when they retire.[10] Self-employed workers (who are not mandated to contribute in Chile) and women (who have a relatively low participation rate) appear to make up the most vulnerable categories. Additionally, a considerable segment of the population shifts between salaried work and self-employment and between formal and informal employment. Even if they work most of their active life, such workers may end up with low contribution densities. Consequently, the average contribution density in the case of the Chilean pension system hides very different realities that should be considered when evaluating the system's performance.

The main results of this paper show that under current circumstances a considerable group of old-age retirees will receive pensions below the level of the minimum pension guaranteed by the state. At the same time, most of them will not be eligible for that state guarantee. This leads us to be more precise about the expected consequences of the coverage problem Chile is actually facing. The problem is not, under the current rules, that there will be a fiscal solvency or public debt problem, as some authors suggest.[11] The point is that many people will have low old-age pensions and simultaneously will not be covered by the state guarantee. For women, the main issue is that they do not have the required number of contributions to receive the guarantee. Men, on the other hand, are more likely to have a pension above the level of the minimum pension guarantee.[12]

Nevertheless, low old-age pensions do not necessarily imply economic poverty at retirement, especially in the case of women. In fact, almost half of all women who have an old-age pension below the level of the minimum pension guarantee (MPG) are married, and their husbands will receive a pension above that level. Moreover, all widows are covered by the guarantee if their husbands were retired.[13]

Given those projections, the paper goes on to analyze two adjustments to the current system. First, we analyze a variation of the MPG scheme that grants access to different minimum pension levels based on graduated levels of contributions. The impact of this measure would be significant, especially for low-income workers who do not accumulate enough funds to self-finance

10. The contribution density is defined as the number of periods contributed by each worker as a share of his or her potential contributions during his or her working life.

11. Arenas and Marcel (1999).

12. This result differs from previous studies, which argue that women would be most likely to use the state guarantee (Wagner 1990; Zurita 1994).

13. A widow will also be covered by disability and survival insurance if her husband was not retired but was contributing to the pension system.

their pension. Indeed, around 20 percent of affiliates would receive immediate MPG coverage. Most defined-benefits schemes provide no pension rights whatsoever for low contribution densities (below 25 percent). In contrast, the graduated MPG would achieve almost universal pension coverage at the lowest level of the scale. We do not compute the fiscal cost of this measure, but it might not be high if people are given sufficient information to realize that the minimum pension grows with the years of contributions.

Second, we explore a default mechanism of contributions for self-employed workers. This policy option is in the middle ground between a fully voluntary approach, like the current scheme in Chile, and a fully mandatory system. Based on reasonable assumptions drawn from the U.S. 401(k) experience with default options, we find a significant impact on final pension levels for this worker category.

The paper is organized as follows. The next section describes the Chilean model from a multipillar perspective. The paper subsequently evaluates the effect of some crucial variables on pensions in the case of a fully funded individual capitalization system, showing that the system works for those who work. The same section provides some descriptive statistics of the current situation of the pension system in Chile. We then present our simulations and projection results. A later section explores possible reforms to the current system and their potential effects, and the final section presents our concluding remarks.

Chile as a Mixed System in a Multipillar Approach

In most countries, social security has traditionally been organized around a single pillar managed by the public sector, with three different objectives: saving, redistribution, and insurance.[14] The usual scheme is a pay-as-you-go system, in which active workers contribute to finance benefits of retired workers. In many countries, such as the United States and Spain, that flow of resources is coupled with a social security trust fund in which surpluses are deposited and from which deficits can be financed, if required. The pension level is thus known ex ante, given the individual's salary and the replacement ratio promised by the pension scheme. These systems are therefore called defined-benefits systems. In many cases, such as Chile's old pay-as-you-go system,

14. Packard (2002); Gill, Packard, and Yermo (2005).

TABLE 1. Different Structures of Mandatory Social Security in the World

	Management			*Logic*		*Benefits*	
Country	*State*	*Social partners*	*Private*	*Pay-as-you-go*	*Capitalization*	*Defined*	*Uncertain*
Germany	x			x		x	
France		x		x		x	
Chile before 1981	x			x		x	
Netherlands	x		x	x	x	x	
United Kingdom	x		x	x	x	x	
United States	x		x	x	x	x	
Singapore	x				x		x
Chile after 1981			x		x		x

Source: Authors' elaboration.

the reference salary used to compute benefits is not a lifetime average salary, but the average salary earned in the last few years of working life. This can encourage opportunistic behavior by participants, and it contributes decisively to undermining the financial strength of the pay-as-you-go scheme.

These three characteristics—public sector management, pay-as-you-go financing, and defined benefits—basically describe the traditional model set up in Germany by Otto von Bismarck in the nineteenth century. As shown in table 1, several countries introduced variations to the Bismarckian model in the twentieth century. France, for example, transferred the management of social security from the public sector to social partners, while Singapore established a Central Provident Fund with personal accounts. The United Kingdom followed a somewhat different approach under the inspiration of Lord Beveridge, in which the state provides a basic flat-rate benefit, with or without means testing, supplemented by a second-tier occupational pension fund offering defined-benefits schemes.[15] This system was also used in the Netherlands.

Chile had two main reasons for reforming the old pay-as-you-go system. First, the country was facing strong fiscal pressure. The ratio of passive retirees to active workers rose from 6 percent in 1953 to 28 percent in 1969.[16] Fiscal outlays were growing much faster than revenues, which gradually created a big challenge to fiscal management. The overall fiscal deficit rose from an average of 4.6 percent of GDP between 1960 and 1964 to 7.2 percent of GDP between 1965 and 1967, partly as a result of the pension deficit.

15. Arza (2005).
16. Ffrench-Davis (1973).

The second reason for reforming the pay-as-you-go scheme was its redistributive features. While a pure pay-as-you-go system may, in principle, include an important redistributive component that favors vulnerable groups, such systems tend to be too weak to resist political pressures that may eventually lead to a different result. As Pinto states, "there is no doubt that the disordered and unfair development of a copious 'social legislation' in the last twenty-five years is directly linked with the low income per capita. . . . It is clear that the process has not only lost all relation with the economic situation, but has turned into a gigantic fiction."[17] The fairness that was possible initially disappeared with the inception of several welfare institutions (namely, *cajas*) that provided different benefits based more on the political strength of the beneficiaries than on justified economic or social factors.

In 1967 the Frei Montalva administration proposed a reform to the pay-as-you-go system, including both a parametric adjustment and the unification and rationalization of the many existing pension schemes. At the same time, and for macroeconomic reasons, the government proposed the creation of a worker's capitalization fund (known as *chiribonos*). Although its main aim was not pensions, the worker's capitalization fund included personal accounts that were to be managed by a private-public council. According to Ffrench-Davis, each personal account would receive a 5 percent contribution from the worker's salary, which would be matched by the employer.[18] The capitalization fund's resources were to be invested in private and public companies, in a system that was somewhat similar to Singapore's Central Provident Fund. Both reforms failed to pass Congress, however, and the government suffered a significant political crisis as a result.

In 1981 Chile adopted a pension reform that diverged from the traditional model in all the three dimensions that define the Bismarckian model. First, the management of the system was handed over to private firms, while the government provided guarantees and regulated and supervised the functioning of the market. Second, the new system adopted a full capitalization set-up based on individual private accounts. Finally, the Chilean model defined the contribution level rather than the benefits.

At the time of the reform, it was assumed that the state would no longer need to provide for pensions or, at least, that the accumulation of savings would be so large that the state would have only a minor role in special cases. Many interpreted this as a weakening of the social contract. As it turned out,

17. Pinto (1958).
18. Ffrench-Davis (1973).

the new system changed—but did not eliminate—the role of the state, from collecting contributions and paying pensions to a more complex involvement that differs according to each pillar of the multipillar approach.

The Multipillar Approach

The term multipillar approach was conceptually adopted in 1994 in a World Bank policy report.[19] In practice, the multipillar approach was developed over the years as a few developed countries established voluntary pension funds beyond the basic pay-as-you-go system and later when Chile created the mandatory pension fund scheme. The World Bank report emphasizes the need of a so-called first pillar, whose main aim is to avoid poverty among the elderly; a second pillar of mandatory savings intended to smooth consumption; and a third pillar of voluntary savings designed to reinforce the same objective. Many observers consider that the report gave a significant boost to pension reform based on individual capitalization and private management. After it was published, several countries adopted a pension scheme based on some version of the Chilean model.

Gill, Packard, and Yermo cast doubts on the World Bank's emphasis on each pillar.[20] They suggest that since the second pillar is not designed to prevent poverty, the informal nature of Latin American labor markets is leaving people out. Coverage should thus be the priority of any further reform. They also point out that the administrative costs of the second pillar are high, and, with the exception of Chile and to some extent Peru, portfolios are too dependent on government securities. Finally, based on surveys conducted in both Chile and Peru, they argue in favor of a stronger third pillar, relative to the second one, as people appear to be more rational than previously believed.

Hinz and Holzman propose updating the World Bank position to encompass five pillars.[21] In addition to the three already described, they recommend a universal or focused "pillar zero" designed to cover long-lived poor people. The fourth pillar is the family safety net, which provides people with access to other forms of social assistance. After more than a decade of World Bank experience on pension reform, Hinz and Holzman propose a more nuanced view and explicitly state that there are no clear-cut policy proposals. The appropriate balance among the pillars is a country-specific distinction.

19. World Bank (1994).
20. Gill, Packard, and Yermo (2005).
21. Hinz and Holzman (2005).

The Chilean Version of the Multipillar Approach

Chile's pension system was redesigned in 1981 around mandatory pension savings—the World Bank's second pillar. Since its inception, the main protagonists of this pillar are the pension fund administrators (*administradoras de fondos de pensiones,* or AFPs), but they are primarily involved in the accumulation phase of the second pillar. The disbursement phase is largely managed by the life insurance companies, which are contracted by each retiree to provide annuities, the main vehicle of retirement pensions for workers not needing the state guarantee.

The two most significant improvements of the past twenty-five years have been the creation of so-called multifunds in 2002 and the Annuities Law of 2004. Before 2002, each AFP offered affiliates a single portfolio. This reinforced a natural tendency for people to avoid involvement with pension issues, especially when young. With multifunds, each AFP offers five different portfolios made up of different combinations of variable- and fixed-income securities, which provide different combinations of return and risk. Affiliates must choose the type of fund in which to invest their account.[22] The Annuities Law, in turn, created a virtual market for annuities (known by its Spanish acronym, SCOMP) and toughened the requirements for early retirement.

The third pillar has gradually gained relative importance over time. Although voluntary savings have been allowed since 1981, the growth of these accounts was slow until 2002, when an amendment to the law increased liquidity and opened this instrument to new providers (basically banks, insurance companies, and mutual funds). The system is anchored on an income-tax deferment, and it has created a vigorous segment of the financial market. The subsidy is poorly focused, however, since those who benefit from it are mainly taxpayers who, by definition, are not the poorest people.[23]

Finally, the Chilean system includes a first pillar that has two main instruments. One is a minimum pension guarantee (MPG), which is a top-up scheme available to workers who have contributed for more than 240 months. The other is a means-tested noncontributory basic pension (the *pensión asistencial,* or PASIS), which is available to the poorest workers, depending on the assigned budget for the year.

22. If a person does not choose between funds, the default option follows a life-cycle approach.

23. By December 2005, the average income of contributors to the pension system was 15 percent below the upper limit of nontaxable income.

Coverage, Density, and Pensions

The goal of any pension system is to pay adequate pensions to all retirees. It is therefore crucial to analyze the system's performance by looking at the benefits given to the whole population. We examine coverage from different angles. First, we consider the pensions paid to those who contribute by analyzing the theoretical replacement rates of the second pillar and comparing them with those in member countries of the Organization for Economic Cooperation and Development (OECD) that have alternative pension schemes. Second, we examine standard coverage measures, which normally consist in a snapshot at one point in time. Third, we take into account not only participation at a specific period of time, but also the density and timing of contributions. Contributions paid at the beginning of the working life (say, at age twenty) are four times more important in terms of the final asset than contributions paid at the end of the working cycle. Finally, we analyze the cost of annuitization and early retirement, since they represent two key determinants of pension levels in a capitalization system.

We do not explicitly consider the role of yield rates, but this factor should not be underestimated. For a given pattern of contribution, pensions would increase by more than 100 percent if a 4 percent rate of return were doubled to 8 percent.

A Comparison of Theoretical Replacement Rates

The replacement rate obtained in the individual capitalization system has always been an important question for all social security researchers and policymakers because, given the nature of this system, the final pension level is uncertain.[24] Comparing different countries and systems therefore requires choosing a common scenario.

We compute replacement rates for Chile by comparing benefits paid with the last salary earned. To construct a suitable scenario for individual pension savings, we assume that the worker does not have any period without contributions.[25] Earnings are assumed to grow at 2 percent per year, and the worker retires at the legal age (which is sixty-five for men and sixty for women in Chile). An average fixed commission and a 2 percent minimum pension growth are included as particular characteristics of the Chilean system. With regard to

24. Uncertainty also exists in pay-as-you-go systems, but it lies on the providers' shoulders.
25. We are following OECD (2005) for this procedure.

TABLE 2. Theoretical Gross Replacement Rates for Chile and Selected OECD Countries
Percent

Country	*Low earner*[a]	*Average earner*	*High earner*[b]
Chile			
Men	58	58	58
Women	58	39	40
Sweden	88	64	66
France	84	53	49
Japan	69	50	37
United Kingdom	67	37	23
Switzerland			
Men	63	58	33
Women	90	78	68
United States	50	39	28
Germany	47	46	38
Mexico			
Men	39	36	34
Women	39	22	21
OECD average	73	57	48

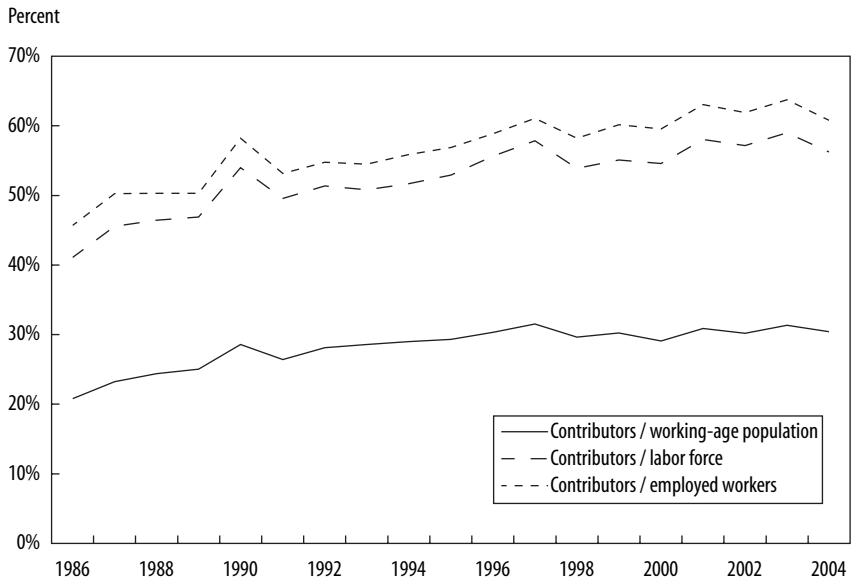
Source: OECD Countries: OECD (2005); Chile: authors' calculations, using the OECD methodology.
a. Half average earnings.
b. Double average earnings.

the rate of return, the OECD report assumes a 3.5 percent yield.[26] This is a very conservative assumption in Chile's case, where the average yield has been about 10 percent for almost twenty years. Nonetheless, for the sake of comparison with the OECD results for other countries, table 2 presents results assuming this rate of return. If we assume a 5 percent rate of return, replacement rates for the average earner increase to 82 percent for men and 54 percent for women.

Compared with OECD countries, the replacement rates estimated for Chile do not seem to be particularly low.[27] However, Chilean women seem to be worse off relative to men than are their counterparts elsewhere in OECD countries. Indeed, pay-as-you-go systems generally design pension rules without considering gender differences in life expectancies and the legal age of retirement, thereby implying a cross-subsidy from men to women (in addition to the overall subsidy given by the state). In Chile, the rule is that workers get what they saved, in the sense that the annuity is calculated according to gender life expectancy. The replacement rates for low-income females, however,

26. OECD (2005).
27. This analysis does not consider self-commitment and default risks in pay-as-you-go systems or market risk in capitalization systems.

FIGURE 1. Coverage in the Chilean Pension System[a]



Source: Superintendency of Pension Fund Administrators (AFPs) and National Statistics Institute (INE).
a. The old pay-as-you-go system and the *armed forces* system are not included.

are improved as a result of the access to the minimum pension guarantee in this theoretical exercise.

The Chilean theoretical replacement rate is thus comparable to the rates of the OECD countries for high- and average-earning males and for low-earning females. We therefore conclude that this system performs well for individuals who contribute throughout their active working period.

Traditional Coverage Measure

In Chile, there are one million more personal accounts than actual members of the labor force, so all current workers will retire with some amount saved at the end of their working lives. From this perspective, coverage is almost universal, but this is neither the best nor the traditional way to analyze coverage. Coverage of disability and survival insurance is more important.

All contributors to the pension system have such coverage. Since 1981, the number of contributors to the new pension system has gradually increased, and 55 percent of the labor force was covered in 2004 (see figure 1). Measured

as a percentage of the active population, this proportion falls to 30 percent for that same year. The new system's coverage thus is not substantially different from that of the old system.[28]

Nonetheless, these figures must be interpreted with caution. Given evidence of high labor turnover, the apparently stable 55 percent combines some people who contribute frequently and others who make only sporadic contributions. Self-employed workers are covered for one month after the contribution is paid, while dependent workers are covered for twelve months after the contribution is paid, even if they subsequently lose their job. Therefore, some unemployed or self-employed people are covered by disability and survival insurance. The coverage ratio might increase by around 12 percent of the labor force once these people are taken into consideration.

Density of Contributions

The density of contributions is defined as the number of periods contributed by each worker as a share of potential contributions during his or her working life. One of the earliest studies on the new pension system uses a density of contributions near 90 percent.[29] This study assumes that periods with no contributions are due to unemployment, which is supposed to be at a level of 7–10 percent.

It is now possible to calculate the density of contributions using two different sources: an administrative database provided by the Superintendency of AFPs and the 2002 Social Security Survey (EPS).[30] The EPS was carried out on the same sample of workers for whom the administrative database was available. The combined data sets represent an exceptional source of information, providing the real history of contributions for over twenty years, together with a broad range of socioeconomic characteristics of these individuals.

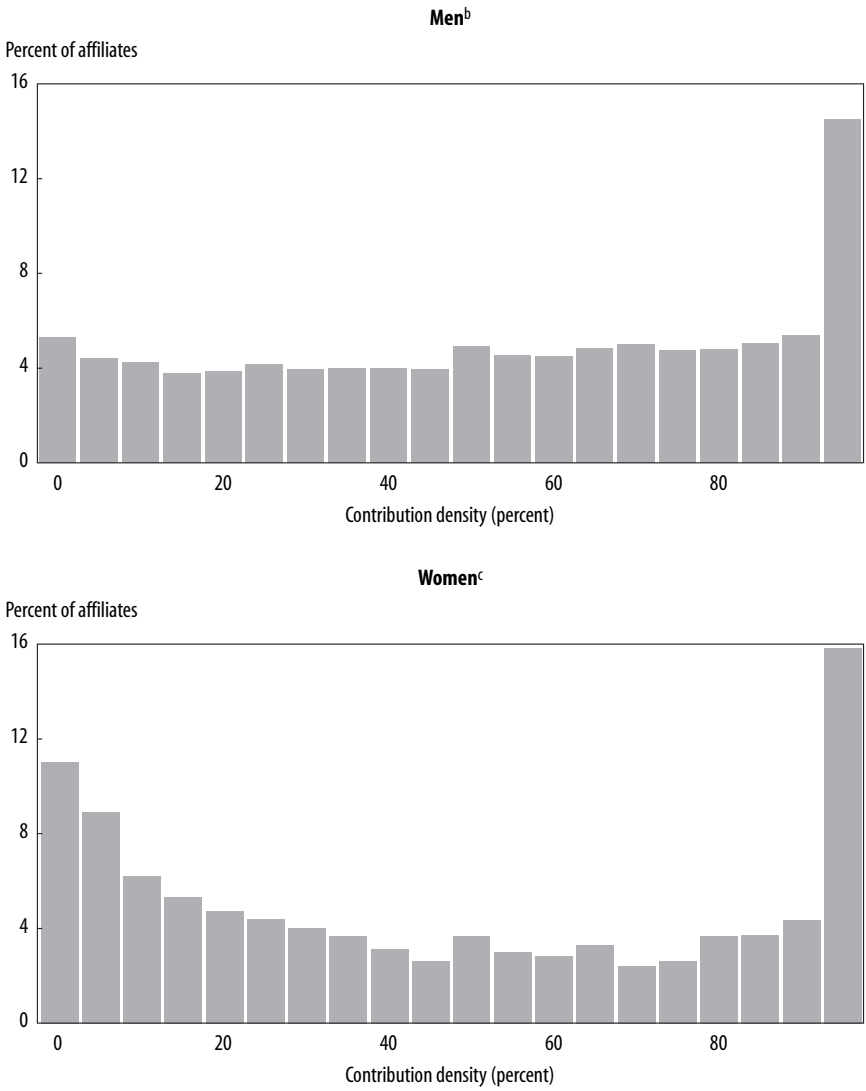
Figure 2 shows the contribution densities of men and women, using the administrative database of a sample of 24,000 individuals, where contribution density refers to the number of contributions made in a certain period of time. The distribution of contribution densities for men and women is far from a normal distribution, meaning that a combination of the mean and standard deviation cannot be used to adequately summarize this distribution. About

28. For coverage figures under the old system, see Superintendency of AFPs (2003).

29. Iglesias and Acuña (1991).

30. See Berstein, Larraín, and Pino (2005) for a detailed description of the data from the Superintendency of AFPs. The 2002 EPS was conducted by the University of Chile, under the mandate of the undersecretary of social security. The survey data include self-reported information on the individual's labor history, and it is therefore subject to recall errors. The magnitude of the bias that results from these errors is discussed in Berstein and Tokman (2005).

FIGURE 2. Contribution Density for the Whole Labor History[a]



Source: Authors' calculations, based on the administrative data set.

a. The data set covers 24,000 individuals. Contribution density is measured as the number of contributions made during the affiliate's active working period. We do not consider contributions made when the affiliate was under fifteen years of age or over sixty (in the case of women) or sixty-five years of age (in the case of men).

b. The mean is 56 percent; the median is 48 percent.

c. The mean is 48 percent; the median is 42 percent.

20 percent of both men and women are located at the top of the distribution, with a contribution density of over 90 percent, while 10 percent of men and 20 percent of women are at the bottom part of the distribution, with a contribution density of lower than 10 percent. It is therefore impossible to characterize a representative individual, and the workers' heterogeneity has to be considered in any accurate forecast analysis.

This evidence points to significant turnover among contributors. While 55 percent of the labor force contributed to the pension system in December 2004, as shown in figure 1, this group was not always composed of the same people. Other evidence based on administrative data suggests that the duration of labor contracts is shorter than expected, especially for the youngest workers.[31]

Data from the 2002 EPS survey allow us to analyze what individuals were doing when they were not working in the formal sector and thus were not contributing to the pension system.[32] The average time that men spend in each occupational status is as follows: formal employee (with a contract): 60 percent; informal employee (without a contract): 8 percent; self-employed: 19 percent; unemployed: 4 percent; and inactive: 10 percent. For women, these figures are as follows: formal employee (with a contract): 46 percent; informal employee (without a contract): 8 percent; self-employed: 7 percent; unemployed: 5 percent; and inactive: 35 percent. Thus, women are not forced to contribute to the pension system for 54 percent of their potential working lives, on average, and they apparently do not do it. Most of that time is explained by the fact that they are economically inactive, and 15 percent of the time they either are working informally (as employees without contract) or are self-employed. Given that the state guarantee only applies after twenty years of contributions, many women are excluded from the guarantee. In fact, 56 percent of women that are affiliated with the system have contribution densities below 10 percent, versus 44 percent of men. This share contrasts with the distribution of the full sample: 41 percent of women and 59 percent of men.

Both men and women spend an important part of their working life in self-employed activities (22 percent and 11 percent, respectively). During that time, they are not forced to contribute and, in fact, do not contribute. Several theories have been put forth to explain why people do not contribute to social security when they are not obligated to do so. In the case for pay-as-you-go systems, there is little relation between contributions and benefits, so many

31. Reinecke and Ferrada (2004); Fajnzylber and Reyes (2005).

32. Under certain circumstances, firms could evade contributions or even reach an agreement with employees to pay a higher salary in lieu of contributions.

workers perceive contributions as a tax. This relation is stronger in the case of individual capitalization systems, but contributions are still perceived as a tax by many workers because the benefits are far in the future and are not valued by workers, perhaps reflecting hyperbolic preferences or myopic behavior.[33] Additionally, qualitative studies on Chile indicate that self-employed workers face significant transaction costs when contributing. These contributions have to be paid every month by the individual, instead of being directly paid by the employer to the pension fund manager.

According to Berstein, Reyes, and Pino, self-employed workers represent around one quarter of workers, and their earnings are 30 percent higher than those of employees.[34] These authors illustrate that the self-employed workers do not have sources of saving that are different from employees' sources, as is usually thought. Policies can therefore be designed to increase the density of contributions in the case of these workers, as we discuss later in the paper.

Cost of Annuitization and Early Retirement

The transition from the accumulation phase to the disbursement phase in an individual capitalization system implies that the account holder must make two crucial decisions. As the system allows for early retirement, a first decision is when to retire in the case of those who fulfill the requirements. The second important decision relates to how the pension benefit is defined. Chile basically has two options: programmed withdrawal or an annuity. Contributors can also choose a combination of those two alternatives. This is not a simple decision, and the costs of the two options are not easy to compare (as they are different products sold by different providers). Moreover, acquiring an annuity implies significant transaction costs that are not always correctly evaluated by the affiliate at the time of retirement.

The early retirement option is an important feature of the Chilean system, and it has been taken by most workers who fulfill the requirements. According to Berstein, Larraín, and Pino, 64 percent of men and 18 percent of women retired early in Chile, and the average retirement age for those groups in 2004 was fifty-six and fifty-four, respectively.[35] Early retirement has thus been a significant determinant of pension levels since, for a given amount of savings, the earlier the person retires, the smaller the pension. James, Martínez, and

33. On hyperbolic preferences, see Laibson, Reppeto, and Tobacman (1998); on myopic behavior, see Feldstein (1985).

34. Berstein, Reyes, and Pino (2006).

35. Berstein, Larraín, and Pino (2005).

TABLE 3. Number and Average Amount of Retirement Benefits Paid, December 2004

	Programmed withdrawal		*Temporary withdrawal*[a]		*Life annuity*		*Total*	
Type of retirement	*Number*	*Average amount*[b]	*Number*	*Average amount*[b]	*Number*[c]	*Average amount*[b]	*Number*	*Average amount*[b]
Normal retirement	84,528	153	1,207	759	49,899	314	135,634	218
Early retirement	20,102	342	4,115	845	201,880	300	226,097	314
Total	104,630	189	5,322	825	251,779	303	361,731	278

Source: Programmed and temporary withdrawals: Superintendency of AFPs; annuities: Superintendency of Securities and Insurance (SVS).

a. Temporary withdrawal is a mixture of a programmed withdrawal and an annuity.

b. The numbers for annuities may differ from figures published by the Superintendency of AFPs, as they are calculated using the SVS Annuities Background Report, a database with information related to retirement or disability annuity policies (both immediate and deferred) that is bought directly by insurers at insurance companies.

c. Average amounts are in U.S. dollars.

Iglesias point out that delaying consumption too much may result in nonoptimal oversaving.[36] However, if myopic behavior is the reason that most pension systems in the world include compulsory restrictions on early retirement, then Chile's early retirement rates might also reflect this tendency. If this is the case, those who retire early with a low pension may regret that decision when old.

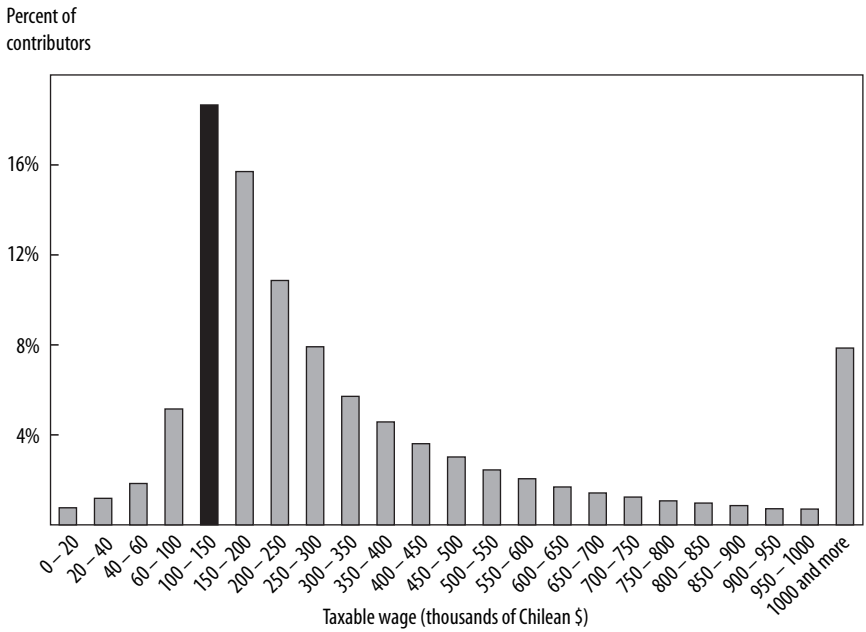
At the time of retirement, whether before or at the legal retirement age, the assets accumulated over the affiliate's working life have to finance consumption throughout retirement. If the future pensioner chooses an annuity, he or she must pay a transaction cost for transferring the funds from one industry to another. This cost is far from being low. The transaction costs on annuities increased steeply in the 1990s, reaching an average of 5.9 percent of the affiliate's assets at the moment of retirement in 1999. The credible threat that the government would pass a law to address these excessive costs led the industry to reduce this figure to 2.7 percent in 2003. A new law was finally approved in 2004 to create an innovative semi-blind market for retirement products (SCOMP). The average cost dropped to 2.1 percent after the promulgation of the law. Furthermore, information is now presented more clearly, and pensioners have access to all relevant offers available in the market, allowing them to choose the best one. Pensions have increased as a result of these two changes.

Pensions Paid under the New System

Table 3 shows the aggregate retirement statistics published by the Superintendency of AFPs. The table does not include affiliates who have washed

36. James, Martínez, and Iglesias (2004).

FIGURE 3. Contributors' Wage Distribution, December 2004



Source: Superintendency of AFPs

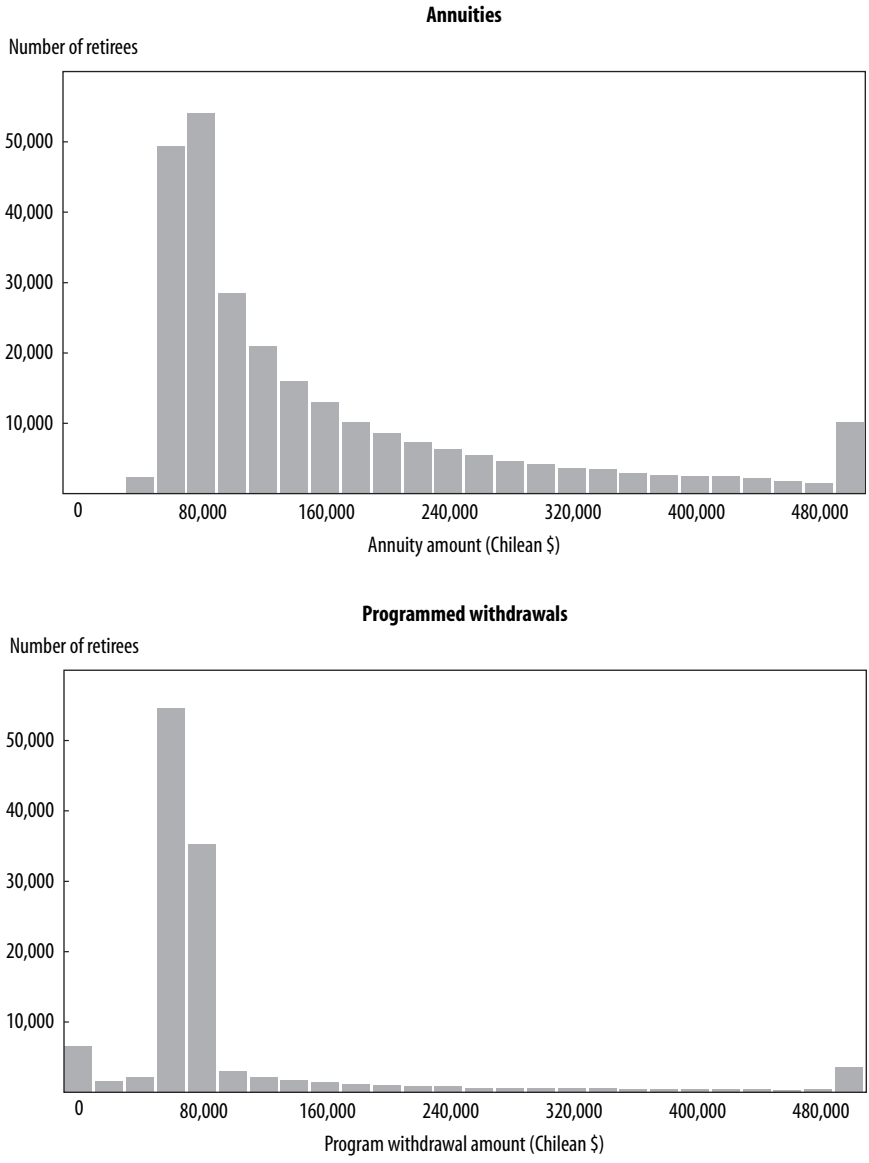
out the balance in their individual account and do not have a state guarantee. The average wage of AFP contributors in December 2004 was U.S.$540. Based on that benchmark, we can compute an effective replacement ratio, as opposed to the theoretical replacement ratio reported previously. The resulting average replacement ratio is 48 percent, lower than the theoretical one.

To illustrate the extent of workers' heterogeneity, figure 3 shows the distribution of contributors' income in December 2004. The distribution is strongly concentrated around the minimum wage (about U.S.$200 in December 2004). The second peak in the distribution stems from the contribution limit (over U.S.$1,800 in December 2004).[37]

Figure 4 presents the distribution of old-age pensions paid as life annuities and programmed withdrawals. The two panels illustrate a broad range of

37. The contribution is legally set at 10 percent of the wage, with a limit of 60 U.F. (around U.S.$1,800 in December 2004). The U.F. is an inflation-indexed unit of account (see Shiller 2002).

FIGURE 4. Old-Age Annuities and Programmed Withdrawals by Payout Amount, December 2004[a]



Source: Authors' calculations, based on data from the Superintendency of AFP and the Superintendency of Securities and Insurance (SVS).
a. Pensioners without payment are not included in the calculations.

situations among pensioners, but in general, significantly higher pensions are paid under life annuities. Programmed withdrawals demonstrate a strong bias around the level of the minimum pension guarantee. This reflects a legal mandate that retirees who do not have enough savings to buy an annuity equal to or above the level of the minimum pension guarantee must choose programmed withdrawals.

As in table 3, figure 4 excludes pensioners who currently are not receiving any benefits because their funds have been exhausted. These account for approximately 60 percent of the total number of pensioners who opted for programmed withdrawals.[38] Not all of these people are in a precarious situation, however, for three reasons. First, around 15 percent of these pensioners are receiving a pension from the old pay-as-you-go system. They contributed to the new system for just a few years after retiring from the old system, and they then received a pension from the new system for some years until their funds were depleted. Second, some affiliates died before their funds were depleted; payments were therefore suspended and the remaining savings were distributed to the heirs. Finally, women whose old-age benefits have been exhausted may be receiving a widow's pension. The rest are pensioners that received programmed withdrawals until their funds were exhausted but did not fulfill the requirements for obtaining the minimum pension guarantee.

When we look at the number of retirees instead of the number of payments (including retirees who are not receiving payments because their funds are exhausted), we find that 46 percent of total pensioners (annuities plus programmed withdrawals) receive a pension below the level of the minimum pension guarantee, as shown in the table 4.

This analysis indicates that a significant number of pensioners are receiving benefits below the minimum pension level and yet are not eligible for the minimum pension guarantee. The system is still in a transitional stage, however, so the pensions currently being paid do not necessarily reflect future benefit levels. The next section estimates future pensions to determine whether this will continue to be the case once the system matures.

Current pensions are the outcome of at least two elements. First, recognition bonds were set up to acknowledge contributions made to the old system and were computed on the basis of wages paid between 1976 and 1980. This

38. This estimation is not accurate, however, since the AFPs have no incentives to preserve data for affiliates without payment. In fact, some of these pensioners could have died and yet still be included in the data, because their families do not have to notify their AFP if they do not have an inheritance to receive.

TABLE 4. Stock of Pensioners by Pension Amount, December 2004[a]

	Programmed withdrawal		*Life annuity*		*Total*	
Pension amount	*Number*	*Percent*	*Number*[b]	*Percent*	*Number*	*Percent*
Pensions above the MPG at age 65	59,600	23	218,254	87	277,854	54
Pensions equal to or below the MPG at age 65	204,167	77	33,525	13	237,692	46
Total	263,767	100	251,779	100	515,546	100

Source: Author's calculations, based on information from the Superintendency of AFPs and the SVS.

a. Includes retirees who are not receiving benefit payments.

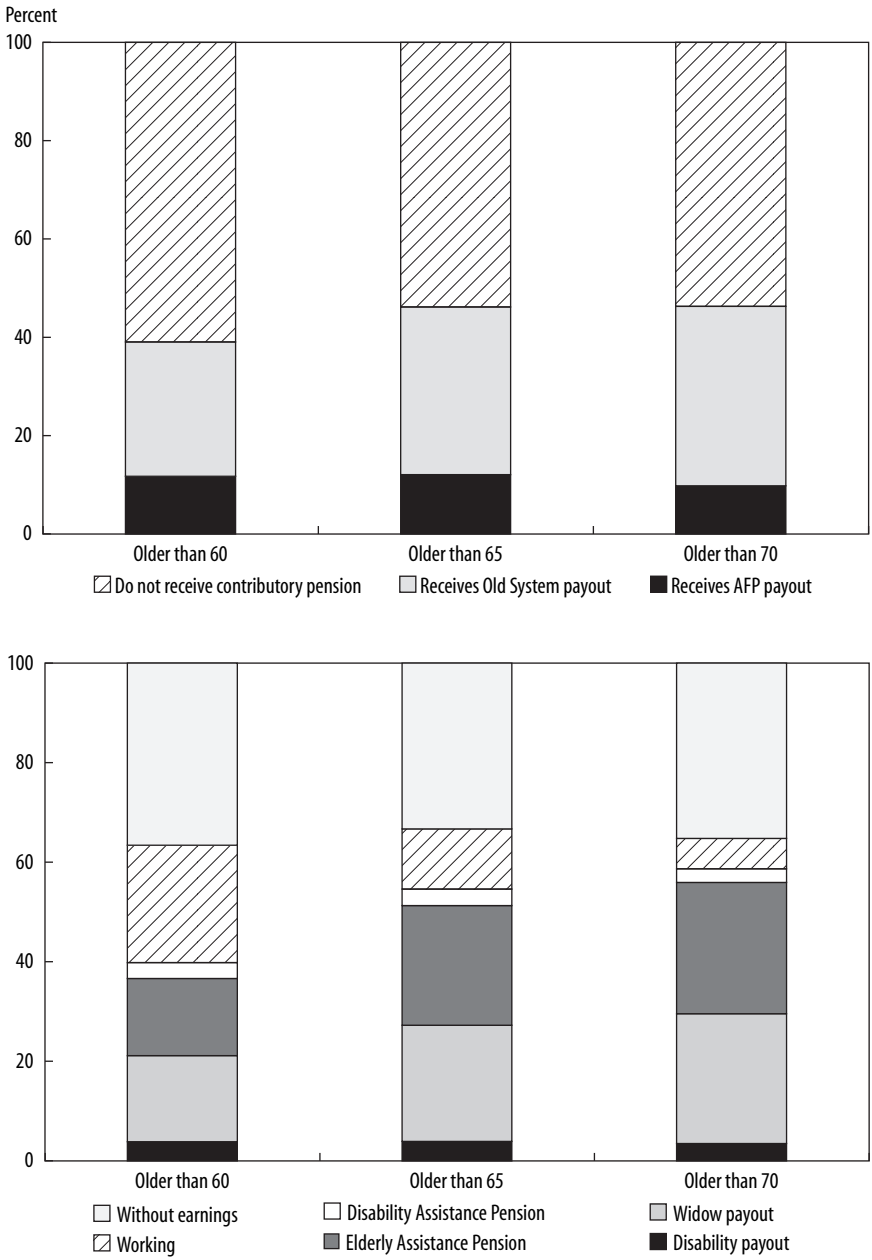
b. The numbers for annuities may differ from figures published by the Superintendency of AFPs, as they are calculated using the SVS Annuities Background Report, a database with information related to retirement or disability annuity policies (both immediate and deferred) that is bought directly by insurers at insurance companies.

period was characterized by high unemployment, and the result was low-value bonds for low-salary workers or no bonds at all for people without a job. Second, unemployment continued to be high and even increased in the early 1980s, which affected the contribution density of workers already affiliated with the new system. Therefore, although the rate of return was particularly high during those years, the impact of the high returns was modest for a vast share of the population, because the balances in individual accounts were low. This particularly affected people with high job turnover or with employment in the informal sector.

Figure 5 reveals the situation of individuals without a contributory pension, based on a national representative survey. Slightly over 50 percent of the whole population aged sixty-five or over receives an old-age contributory benefit from the old or new system. Of those who do not receive a contributory pension, almost 15 percent still work, 40 percent receive a disability or assistance pension, and around 25 percent receive a widow's pension. Thus, less than 20 percent of those who do not receive an old-age contributory benefit do not receive any income.[39] This does not necessarily imply, however, that there is no coverage problem. In fact, it might be an issue of causality: those who work in old age do so because they cannot make a living otherwise. Additionally, a significant number of people receive elderly assistance pensions. Finally, given that the new system is still not mature, projections are needed to undertake a complete coverage diagnosis.

39. However, they might have other sources of income and, therefore, not be vulnerable in old age.

FIGURE 5. Sources of Income in Old Age



Source: The 2003 National Socioeconomic Survey (CASEN).

Prospects: Pension Projections

Payout projections are an active area of economic research in Chile. Some economists concentrate their efforts on the fiscal impact of the reform.[40] Most of these studies use a representative individual to forecast contributions. Only Costabal and his coauthors use individual data, but he introduces some simplifications that could significantly affect his results. Other recent studies investigate the determinants of the pension level, including coverage, density, or both.[41]

In an earlier paper, we considered the heterogeneity of individuals and made payout projections using panel data regressions with random effects.[42] However, that study only considered administrative data, which weakens the projections and limits further analysis of the general situation of individuals after retirement.

Methodology

This paper uses a unique data set that merges the administrative information of a sample of individuals with the EPS survey conducted on these same individuals in 2002. The administrative data set contains the Pension Fund Administrators' full records of every contribution or withdrawal made by each of the sampled individuals (24,000 approximately) from 1981 to 2004.[43] The 2002 EPS survey, in turn, collects data related to the affiliates' retirement and savings behavior.[44] Only 56 percent of the original sample was interviewed. The merged sample thus includes a total of 10,878 individuals.[45] Although incorporating the survey information reduced the sample size, it allowed us to deepen our analysis by including variables such as education, number of children, parents' education, and marital status.[46]

40. Wagner (1990); Zurita (1994); Arenas and Marcel (1999); Costabal and others (1999); Asociación de AFP (2000).

41. On coverage, see Arenas (2000); Uthoff (2001); Benavente and Molina (2002); Valdés-Prieto (2002). On density, see Arenas, Behrman, and Bravo (2004). For a study combining coverage and density, see Medrano (2004).

42. Berstein, Larraín, and Pino (2005).

43. See Berstein, Larraín, and Pino (2005) for a detailed description of the administrative information.

44. A description of the EPS and summary statistics may be found in Undersecretary of Social Protection and University of Chile (2004). See also Berstein and Tokman (2005) for a comparison of the EPS with a national survey.

45. More individuals were interviewed, but not all were considered in the merged data owing to consistency errors. Recent versions of these merged data have increased the number of individuals, but they are not considered for this paper.

46. The appendix provides summary statistics using the merged data.

We adopt a very simple framework to project old-age pensions. Since contributions are the outcome of a wage multiplied by the fixed contribution rate, we need to forecast individual wages. We also need to predict the probability of contributing, given that workers may suffer unemployment or move out of the formal sector into self-employment, the informal sector, or dependent status.

For the purpose of our projections, we assume that all individuals retire at the legal retirement age. We further assume that any affiliates who retired early during the sample period did not receive pension benefits until the legal retirement age. Their last observed balance is increased by the assumed real rate of return until age sixty-five in the case of men and sixty in the case of women.

INCOME PROJECTION. Individual monthly wages in 2004 pesos were estimated using a Mincer earnings equation. The variable used to capture experience, however, is the number of contributions made by the worker, instead of the usual variable used in a Mincer equation (namely, age minus six). The equation to be estimated using panel data, with random effects, is the following:

$$\begin{aligned}\ln y_{it} = {} & \alpha + \beta_1 \mathrm{Age}_{it} + \beta_2 \mathrm{Age}_{it}^2 + \beta_3 \mathrm{Age}_{it}^3 + \beta_4 \mathrm{Educ}_{it} \\ & + \beta_5 \mathrm{Married}_{it} + \beta_6 \mathrm{Child6}_{it} + \beta_7 \mathrm{Exp}_{it} + \beta_8 \mathrm{Exp}_{it}^2 + \beta_9 \mathrm{Cohort}_2 \\ & + \mathrm{K} + \beta_{21} \mathrm{Cohort}_{14} + \beta_{22} \mathrm{Time}_3 + \mathrm{K} + \beta_{43} \mathrm{Time}_{24} \\ & + \beta_{44} \mathrm{Unemp}_t + \beta_{45} \ln \mathrm{Minwage}_t + \upsilon_i + e_{it}.\end{aligned}$$

The observed variables include age, which is the observed age of person i at time t (Age); a dummy identifying the cohort of the person according to the year of birth (Cohort); a period dummy (Time); and an experience variable (Exp). The time dummies were normalized as proposed by Deaton, which prevents collinearity between age, cohort, and the time dummies.[47] Unemp represents the unemployment rate, while lnMinwage is the log of the minimum wage. The self-reported variables are the educational level of the person measured in years (Educ), a dummy variable for married people (Married), and a dummy for people with children under six years old (Child6).

Although the model includes individual characteristics, we conducted a Breusch and Pagan test to identify whether there was unobservable heterogeneity. The null hypothesis of the test was rejected in favor of random effects, in both the men's and women's equations.[48] We therefore included a random effect (υ_i) in the regression.

47. Deaton (1997).

48. Fixed effects were not considered as an alternative model because the inclusion of individual characteristics implies collinearity with fixed effects.

The base scenario assumes that the minimum wage and minimum pensions are kept constant in real terms and that unemployment stabilizes at 8 percent.[49]

Table 5 shows the result for two specifications of the Mincer equation.[50] Most of the variables were significant and had the expected signs. This is the case for schooling, which has a positive effect on wages for men and women, and for experience, which also has a positive effect on both genders. In the first specification, unemployment has a negative sign for men and women. Some variables, however, produce a different sign for each gender, which is basically related to the effect of marriage and child nursing on women's employment. Finally, we used the first specification to project wages, since it had the least mean quadratic error for a ten-year in-sample projection.

PROBABILITY OF CONTRIBUTING. The previous wage equation is conditional on the worker being employed in the formal sector. To compute individuals' final balance, we must therefore estimate the probability of being employed in the formal sector until the legal age of retirement. We use a probit regression model for this estimation. Most of the explanatory variables are the same as in the Mincer equation. The cohort effect, however, is included as a variable instead of as a dummy, and it is interacted with age. An additional variable is built as the contribution density of the previous year (Dens). We also include the random effect from the wage equation to capture heterogeneity and a random effect for this specific equation. We assume that the random effect of the Mincer equation might be capturing ability or some other unobservable factor that turns out to be significant for the probability of contributing. We report four results for men (in table 6) and four for women (in table 7). We chose equation 4 as it had the minimum mean quadratic error in a ten-year in-sample projection. The general equation is the following:

$$\begin{aligned}\mathrm{Pr}_{it} = {} & \alpha + \beta_1 \mathrm{Age}_{it} + \beta_2 \mathrm{Age}_{it}^2 + \beta_3 \mathrm{Educ}_{it} + \beta_4 \mathrm{Married}_{it} + \beta_5 \mathrm{Child6}_{it} \\ & + \beta_6 \mathrm{Cohort}_i + \beta_7 \mathrm{Cohort}_i \cdot \mathrm{Age}_{it} + \beta_8 \mathrm{Unemp}_t + \beta_9 \mathrm{Minwage}_t \\ & + \beta_i \mathrm{Dens}_{it-1} + \beta_{11} \upsilon_i + \vartheta_i + e_{it}.\end{aligned}$$

The probit regression model shows that married women are less likely to contribute than singles, whereas marriage increases the likelihood of contribution in

49. The unemployment rate in Chile has been 10.4 percent, on average, for the last ten years, according to the University of Chile's unemployment indicator. The assumption is that unemployment converges to 8 percent in four years.

50. The second specification eliminates unemployment and the minimum pension, as suggested by a referee.

TABLE 5. Income Regression[a]

	1		*2*	
Explanatory variable	*Men*	*Women*	*Men*	*Women*
Age	0.139	0.121	0.141	0.119
	(27.65)**	(19.21)**	(58.72)**	(31.56)**
Age^2	−0.003	−0.003	−0.003	−0.003
	(51.17)**	(26.35)**	(52.25)**	(25.91)**
Age^3	0.000	0.000	0.000	0.000
	(41.37)**	(22.69)**	(42.03)**	(22.12)**
Schooling	0.088	0.081	0.088	0.081
	(66.62)**	(49.77)**	(67.78)**	(49.84)**
Dummy, married	0.065	−0.010	0.062	−0.009
	(22.10)**	(2.56)*	(21.21)**	(2.53)*
Experience	0.006	0.005	0.006	0.005
	(87.81)**	(66.10)**	(93.88)**	(68.99)**
Experience^2	−0.000	−0.000	0.000	0.000
	(39.79)**	(15.66)**	(40.29)**	(15.71)**
Unemployment	−0.010	−0.007		
	(16.93)**	(9.21)**		
ln(Minwage)	0.278	0.341		
	(24.38)**	(23.11)**		
Dummy, children under six		−0.035		−0.036
		(15.13)**		(15.63)**
Constant	5.701	4.749	9.782	8.544
	(21.18)**	(7.63)**	(19.40)**	(18.06)**
Summary statistic				
No. observations	737,092	377,883	750,487	382,735
No. individuals	6,120	4,390	6,128	4,396
R^2 (within)	0.27	0.32	0.27	0.32
R^2 (between)	0.41	0.49	0.41	0.49
R^2 (overall)	0.33	0.42	0.33	0.42

Source: Authors' calculations.

* Statistically significant at the 5 percent level.

** Statistically significant at the 1 percent level.

a. The dependent variable is the log of the contributable wage. The regressions include cohort effects and Deaton time composition. Absolute value of *z* statistics are in parentheses.

the case of men. Opposite signs are also found for the dummy variable for children under the age of six. Other important variables are minimum wage, cohort effects, and age, which all have the same sign for men and women. The unemployment variable is shown to be negative for men and positive for women, indicating that in periods of high unemployment, women enter the labor force to raise household income. This result is consistent with the evidence on added work.[51]

51. Serneels (2002); Cunningham (2001).

TABLE 6. Probability of Contribution: Men[a]

Explanatory variable	*(1)*	*(2)*	*(3)*	*(4)*
Age	0.098	0.069	0.072	0.058
	(16.21)**	(254.16)**	(266.86)**	(192.00)**
Age^2	−0.001	−0.001	−0.001	−0.001
	(23.47)**	(288.58)**	(304.74)**	(212.87)**
Schooling	0.040	0.022	0.023	0.014
	(21.91)**	(923.13)**	(977.89)**	(517.33)**
Dummy, contributed last period	2.502	2.913	2.901	2.093
	(617.57)**	(14698.89)**	(14590.45)**	(7472.35)**
Dummy, married	0.097	0.070	0.070	0.031
	(10.90)**	(209.58)**	(211.79)**	(87.09)**
Dummy, children under six	−0.001	0.026	0.023	0.009
	(0.18)	(109.27)**	(99.96)**	(36.44)**
Cohort	0.067	0.091	0.094	0.084
	(4.69)**	(154.35)**	(160.16)**	(130.12)**
Age*cohort	−0.003	−0.003	−0.003	−0.002
	(9.27)**	(227.15)**	(240.44)**	(154.38)**
Minimum wage	−0.000	−0.000	−0.000	−0.000
	(4.02)**	(107.21)**	(102.75)**	(125.12)**
Unemployment	−0.009	−0.002	−0.002	−0.001
	(12.88)**	(64.76)**	(67.33)**	(19.63)**
Mincer equation random effect			0.142	0.098
			(763.96)**	(459.68)**
Last year density				1.592
				(4569.29)**
Constant	−2.943	−2.876	−2.935	−3.148
	(16.28)**	(371.55)**	(378.48)**	(367.08)**
Summary statistic				
No. observations	1,096,171	3.97e+08	3.96e+08	3.81e+08
No. individuals	5,569			
Pseudo R^2		0.63	0.63	0.69

Source: Authors' calculations.
* Statistically significant at the 5 percent level.
** Statistically significant at the 1 percent level.
a. The dependent variable is the probability of contributing. Absolute value of *z* statistics is in parentheses.

Contrary to what might have been expected, the regressions show a negative cohort effect for men and women, based on the cohort variable and the interaction of cohort and age. This could be due to sample selection, because older cohorts are only observed if they contributed to the new system for the first time after age forty. Workers who first contributed to the old system and then never contributed again are not in the sample. In contrast, all the younger cohorts are included in the sample, even if they contributed for short periods and then stopped. Consequently, the older people in the sample are more likely to be in the formal market than the younger ones.

TABLE 7. Probability of Contribution: Women[a]

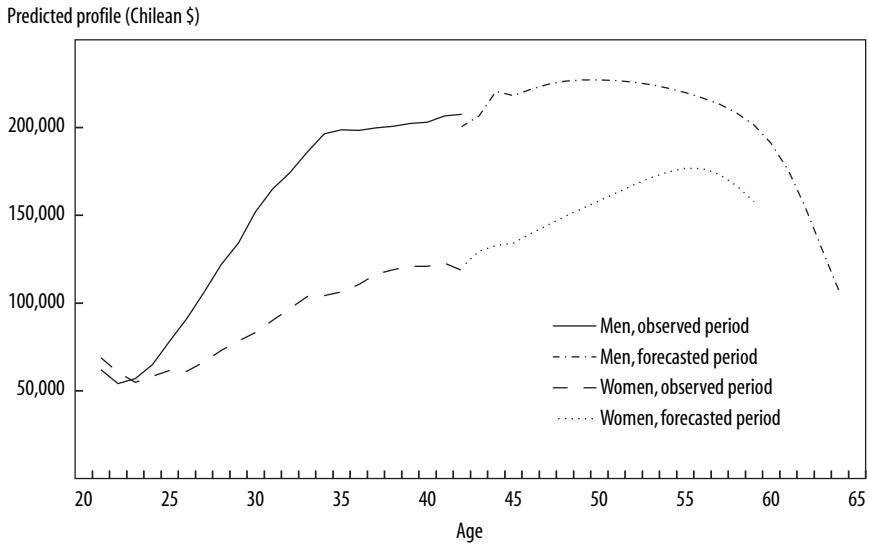
Explanatory variable	*(1)*	*(2)*	*(3)*	*(4)*
Age	0.089	0.069	0.075	0.086
	(10.15)**	(189.87)**	(204.12)**	(203.01)**
Age^2	−0.001	−0.001	−0.001	−0.001
	(12.25)**	(185.10)**	(199.23)**	(204.00)**
Schooling	0.063	0.040	0.039	0.022
	(31.11)**	(1165.31)**	(1142.69)**	(574.89)**
Dummy, contributed last period	2.708	3.111	3.090	2.270
	(503.79)**	(12945.85)**	(12787.22)**	(6249.89)**
Dummy, married	−0.216	−0.168	−0.181	−0.114
	(18.89)**	(514.04)**	(554.27)**	(307.95)**
Dummy, children under six	−0.155	−0.120	−0.121	−0.078
	(21.43)**	(429.03)**	(431.91)**	(240.73)**
Cohort	0.047	0.084	0.092	0.122
	(2.41)*	(119.27)**	(129.96)**	(150.49)**
Age*cohort	−0.005	−0.004	−0.004	−0.004
	(10.72)**	(210.77)**	(221.13)**	(185.63)**
Minimum wage	−0.000	−0.000	−0.000	−0.000
	(2.37)*	(108.07)**	(120.37)**	(65.77)**
Unemployment	0.005	0.007	0.007	0.001
	(4.67)**	(171.97)**	(181.26)**	(20.72)**
Mincer equation random effect			0.206	0.130
			(807.34)**	(434.58)**
Last year density				1.616
				(3667.69)**
Constant	−2.586	−2.993	−3.086	−3.961
	(10.23)**	(310.06)**	(318.39)**	(356.25)**
Summary statistic				
No. observations	735,837	3.01e+08	3.00e+08	2.82e+08
No. individuals	4,397			
Pseudo R^2		0.70	0.70	0.76

Source: Authors' calculations.
* Statistically significant at the 5 percent level.
** Statistically significant at the 1 percent level.
a. The dependent variable is the probability of contributing. Absolute value of *z* statistics is in parentheses.

Self-Financed Pensions for Future Retirees

We use the previous estimations to predict wages and the probability of contributing. The combination of these two aspects results in contribution profiles for each individual over his or her whole lifespan. Figure 6 shows observed and predicted contribution profiles for men and women for the cohort born in the period 1956–61. This cohort has two interesting features. First, about half the working life of these people is known, based on twenty years of observations, while the next twenty years need to be predicted using the above models. We

FIGURE 6. Observed and Predicted Profiles of the 1956–61 Cohort



Source: Authors' calculations.

use the estimated equations to predict contributions to complete their lifespan and thus the projected final balances of their individual accounts. The second aspect is that this cohort generally does not have recognition bonds or, if they do, they are negligible.

In the case of older cohorts, the final balance of the individual account relies more heavily on recognition bonds. For these workers, recognition bonds finance an important part of future pensions. The administrative data available include the value of these bonds for most of the individuals entitled to receive it, but the full information on these bonds will not be available until the person retires.

The base scenario assumes a benchmark real rate of return of 5.8 percent per year for the pension fund over the next twenty-five years.[52] Once the balance for each individual is computed, an expected pension is calculated assuming

52. The 5.8 percent rate of return corresponds to the average rate of return of the last ten years for the pension funds' portfolio as of December 2004. We used the following securities to construct this average: domestic and foreign fixed-income securities and domestic and foreign equities. This follows Berstein and Chumacero (2006).

that programmed withdrawals are paid out. The pension is the expected sum of all pension payments divided by life expectancy. This calculation has to be made, because while a programmed withdrawal may be high at the beginning, it could fall below the MPG level after a number of years. If the individual has more than twenty years of contributions, his or her pension has to be adjusted to the MPG.[53] Once the fund is depleted, the pension continues to be paid out from government funds.[54] Mathematically,

$$E(PW) = \frac{\sum_i \Pr(l_o = 1 / l_0 = 1) \cdot \overline{PW_i}}{\sum_i \Pr(l_i = 1 / l_0 = 1)}$$

where E(PW) is the expected programmed withdrawal; $\Pr(l_i = 1/l_0 = 1)$ is the probability of being alive in year *i,* conditional on being alive in period 0; and

$$\overline{PW_i} = \begin{cases} \text{self-financed } PW_i & \text{if } \left(PW_i \geq MPG_i\right) \middle| \left(PW_i < MPG_i \text{ and } m < 240\right) \\ MPG_i & \text{if } PW_i < MPG_i \text{ and } m \geq 240 \end{cases}$$

where m is the number of periods contributed at retirement age.

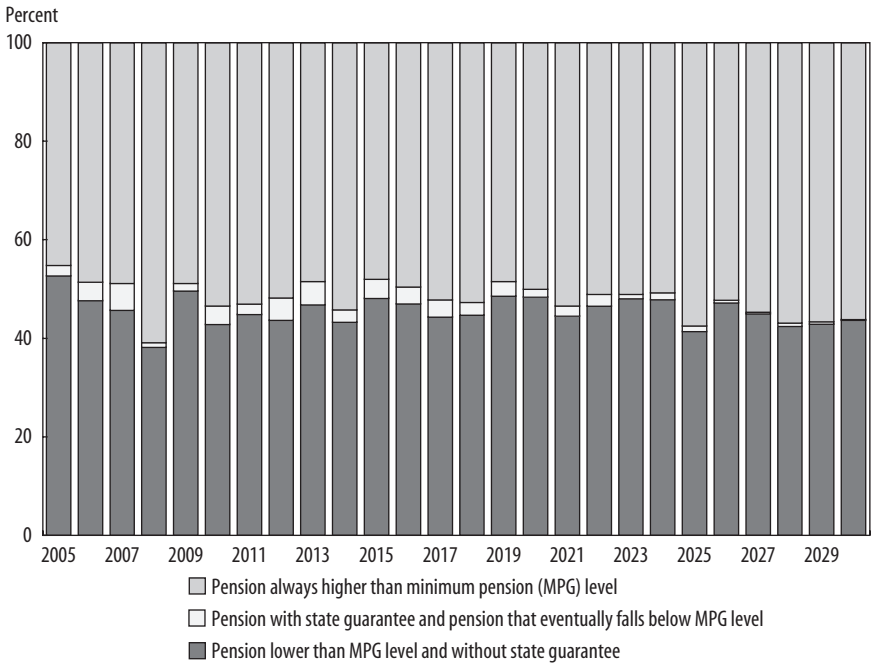
Figure 7 displays projection results for affiliates retiring each year and classifies them in the following three categories: affiliates who achieve a pension above the level of the MPG financed by their own funds; affiliates who require additional funds to achieve this level and have access to the minimum pension guarantee; and affiliates who do not have enough funds and do not have access to the state guarantee. Each individual is considered in a specific category according to the expected time he or she spends in each category.[55] The most remarkable outcome is that contrary to what many people expect, not many people will use the minimum pension guaranteed by the state under current requirements. In fact, our estimations indicate that just 2 percent of

53. The MPG is assumed to be constant in real terms for the base scenario, since this is the current adjustment rule.

54. See Pino (2005) for a detailed analysis of the new life expectancy tables used to calculate the programmed withdrawal payments.

55. For example, a woman might receive a pension under a programmed withdrawal that is above the minimum pension for the first year of retirement. If she did not complete the twenty years of contributions, she does not have access to the MPG. Then, her pension will decrease over time and will fall below the minimum pension when she reaches the age of 90. In figure 8, she will be counted as 90 percent in the group of pensions above the MPG level and 10 percent in the group of pensions below the MPG.

FIGURE 7. Expected Distribution of Retirees by Year of Retirement



retirees will make use of the guarantee by 2020, assuming that the MPG is constant in real terms. The fiscal liability under the current rules thus does not seem to be outrageously high, in contrast with the estimations of Arenas and Marcel.[56] Two hypotheses could explain this result: either the MPG is too low, or few people reach the twenty-year condition.

The first hypothesis probably is not the case. Of the workers who will retire in 2020, only 6 percent will use the MPG if its level increases at the same rate as wages. Even if this number increases significantly, the MPG does not seem to pose a major fiscal burden. In addition, the marginal beneficiaries would be in a better financial situation than those benefiting under the current rules. Increasing the MPG level thus does not protect more vulnerable people. An exercise to asses the appropriateness of the current MPG level is to compute the implicit rate of return on contributing at the minimum wage for twenty years and then receiving the MPG when retired. If the twenty years of contri-

56. Arenas and Marcel (1999).

butions are uniformly distributed over the affiliate's active life, the rate of return is 4.86 percent for married men and 6.92 percent for women.[57] These figures are probably higher than any realistic assumption for future rate of return on savings, especially in the case of women. The second hypothesis seems to be more relevant, since almost 50 percent of affiliates would not reach the required twenty years of contributions. We explore this issue further later in the paper.

The fact that few people were using the MPG would not pose major problems if most of the population were getting pensions above the level of the guarantee. However, almost 45 percent of the affiliates will have pensions below that level and will not be eligible for the guarantee. Figure 8 shows the gender decomposition of the above result. There is no significant difference between the percentages of women and men receiving a minimum pension guarantee. However, women receive a significantly larger amount from the state than men given their higher life expectancy. This is consistent with Berstein and Tokman, who find that the minimum pension guarantee is a benefit that favors women relatively more than men.[58]

While it may seem striking that almost 45 percent of the affiliates will have a pension below the MPG, most of these individuals have very few contributions during their working lives. Figure 9 shows that around two-thirds of these workers had less than ten years of contributions in 2005. This figure will increase to 85 percent by 2025, partly because the first cohort had a better contributions record than the average worker. As the system matures, almost every worker will be represented in the estimations, even those that contributed for very few periods when young and then went out of the labor force, either to the informal sector or to self-employment. In most contributory pension schemes, including the main plans of the old Chilean pay-as-you-go system, a person who contributes for fewer than tens years receives no benefits at all.[59]

The key question, however, is whether these affiliates will have other sources of income. Will their spouses be able to support them in their old age? Or will they be poor and need to ask for an assistance pension? Pino uses the same projection model and the 2002 EPS survey to analyze the current socioeconomic

57. Pino (2005) computes the cost of the MPG. In the case of men, the cost for the spouse is not considered. The rate-of-return computation does not consider the fixed and variable commissions during active working life.

58. Berstein and Tokman (2005).

59. The *Servicio de Seguro Social,* the most popular welfare institution under the old pay-as-you-go system, paid pensions starting at ten years of contributions for women and about sixteen years of contributions for men.

FIGURE 8. Expected Distribution of Retirees by Year of Retirement and Gender

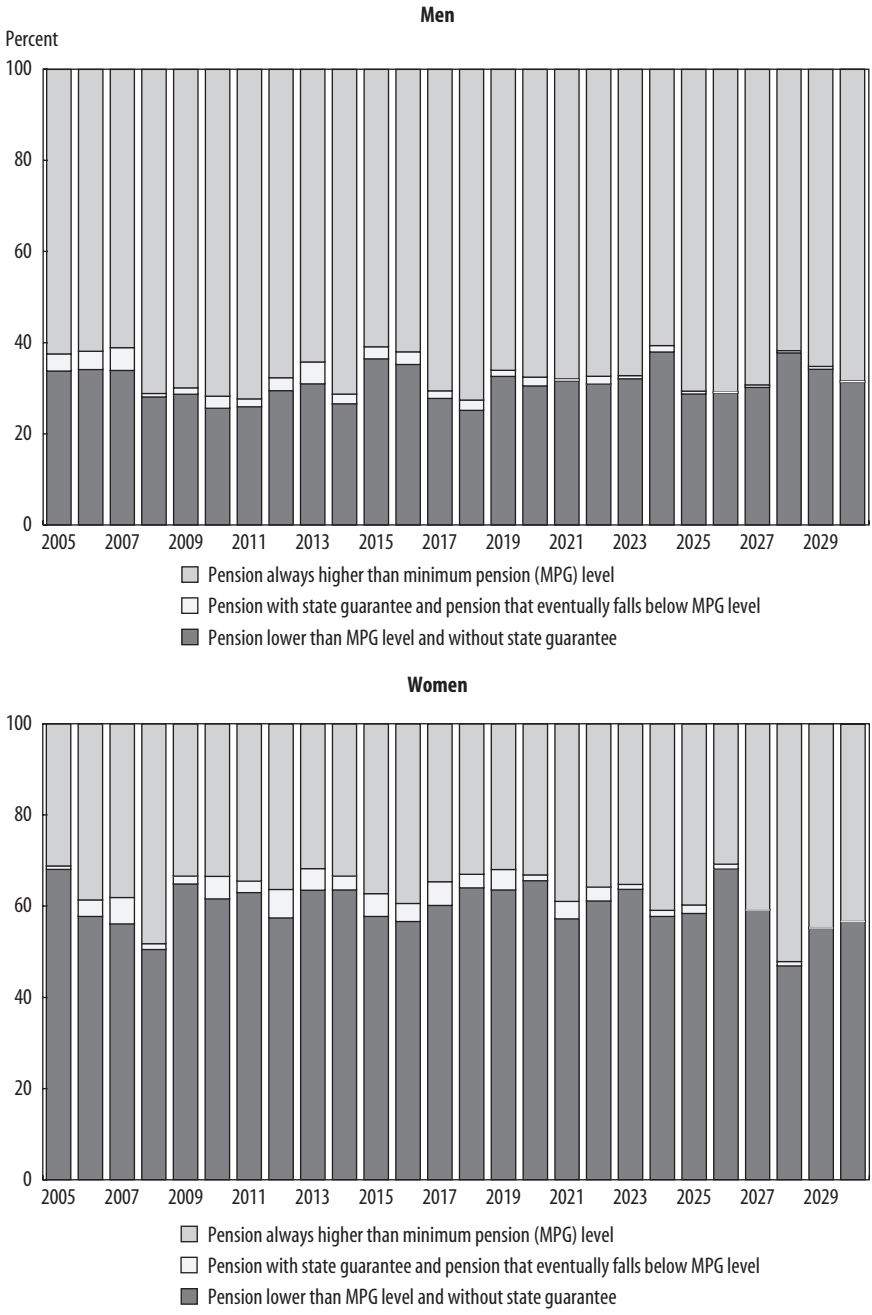
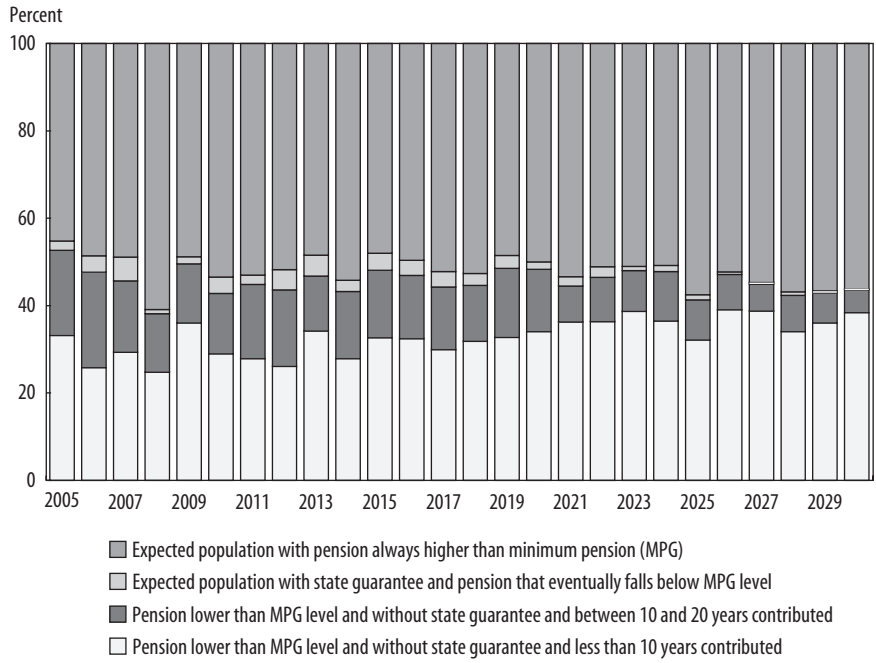


FIGURE 9. Expected Distribution of Retirees by Year of Retirement and Years of Contributions



characteristics of people who would receive pensions below the MPG level and who would not be eligible for the state guarantee.[60] He shows that in the case of men, around 90 percent do not have other sources of income derived from assets such as rental incomes, shares, deposits, or money from other family members. Moreover, 70 percent do not have any savings. On the other hand, most of these people could save in the future: 88 percent were working when the EPS was conducted, with 54 percent as self-employed workers and 46 percent as employees.

In the case of women, Pino distinguishes between married (68 percent) and single (32 percent) women, given the relevance of the spouse's income.[61] About 20 percent of single women received child support or money from other members of the family, or held sporadic jobs, while 94 percent of married women did not. Moreover, 64 percent of all women (single and married)

60. Pino (2006).

61. Ibid. The married category includes women living with a partner; single includes women who are divorced or widowed.

declared not to have savings. Pino estimates that almost 73 percent of married women can rely on a husband whose pension will be above the MPG. Additionally, even if their husbands get a very low pension, the current regulation provides widows with a pension equal to the MPG if they have no other sources of income.

Expected Replacement Rates

Although a large portion of affiliates would receive a low pension, this appears to be mainly a consequence of scarce contributions. An alternative way of assessing the benefits paid by the system is by computing theoretical and actual replacement rates. In both cases, Chile presents ratios that are similar to some OECD countries. Moreover, if we assume a rate of return of 5 percent, Chile displays relatively high theoretical replacement rates. As this ratio measures the ability of individuals to maintain their living standard after retirement, it is possible to conclude that the Chilean pension system has worked reasonably well so far in terms of consumption smoothing. However, none of these measures gives the real replacement rate. We thus need to project future replacement ratios, especially considering that the system is still in a transitional stage.

The undetermined replacement ratios, characteristic of a defined-contributions model, depend on the timing and density of contributions made throughout the affiliate's working life and the real rate of return on investment.[62] Consequently, there may be little relation between the pension and later wages.

One example may shed light on the difference between the two systems. Assume a male worker contributed for only ten years at the end of his active life for a high salary. Under a defined-benefits plan, he would have a high replacement rate, provided that the ten years granted him access to benefits. In a defined-contributions system, however, he will have a very low replacement rate. Moreover, all affiliates in a defined-contributions system receive back as a pension whatever they have contributed plus the return on those funds, so even small pensions could be paid. By contrast, defined-benefits systems often pay no benefits at all to affiliates with few periods of contribution, so these workers are not counted when average replacement rates are computed.

62. We skip the discussion of administrative fees as, with the exception of the fixed commission (which most likely will disappear in the future), fees are charged to the worker's wages rather than to the fund.

TABLE 8. Average Replacement Rates by Pensioner Category, 2020–25[a]
Percent

	Replacement rate		
Affiliate category	*Definition 1*	*Definition 2*	*Definition 3*
All affiliates	44	44	121
Affiliates with self-financed pension above MPG	66	66	121
Affiliates with more than ten years of contributions	62	63	114

Source: Authors' calculations.

a. The replacement rate definitions are as follows: (1) last observed wage; (2) average wage of last three years before retirement; and (3) average lifetime contributed wage.

We employ three alternative definitions for computing expected replacement rates for future retirees in the private pension system in Chile. The first considers the most common definition used in the literature on defined-benefits systems: namely, the pension relative to the last observed wage. The second definition takes into account the average wage of the last three years before retirement. Under the third definition, we calculate a replacement rate based on the contributions made throughout the affiliate's working life, to get an idea of the system's performance beyond labor market features that imply low contribution densities because of informality, unemployment, and self-employed work. This last definition considers the amount paid as pension with respect to average life-time earnings, including periods without contributions.

Table 8 presents the replacement rates for each of these three definitions. For the average affiliate, projected replacement rates are around 44 percent with respect to both the last wage and the last three years of wages. However, the replacement rate for lifetime earnings is remarkably high, at 121 percent. The difference between the two figures illustrates the relevance of nonfinancial factors in determining the pension level. This is partially due to the workings of the labor market. The poor average replacement rates computed in the first row compared with the last two are due to the very low rates of people with less than 10 years of contributions.

Table 9 breaks down replacement rates by educational attainment and gender. As expected, more educated workers achieve higher replacement rates. The gap closes significantly under the definition that considers average lifetime contributions. This evidence supports the fact that less educated workers have lower contribution densities and, therefore, lower pensions.

With regard to gender, the table highlights the worrying situation of women, who have significantly lower rates than men under every definition considered.

TABLE 9. Replacement Rates by Gender and Educational Level, 2020–25[a]
Percent

	Replacement rate					
	Definition 1		Definition 2		Definition 3	
Education level	Men	Women	Men	Women	Men	Women
Primary school	47	11	47	11	133	91
Secondary school	60	16	60	16	134	106
University	108	29	110	30	155	105

Source: Authors' calculations.

a. The replacement rate definitions are as follows: (1) last observed wage; (2) average wage of last three years before retirement; and (3) average lifetime contributed wage.

This is consistent with the findings of Berstein and Tokman, who argue that the earning gap between men and women increases at retirement.[63]

Access to the Minimum Pension Guarantee (MPG)

The MPG is granted to affiliates who have contributed more than 240 months during their working lives.[64] Table 10 summarizes the main trends, with the sample divided by gender and educational attainment. The MPG is estimated to be used by a significant share of men with primary schooling, and men's access to the MPG is decreasing on educational attainment. Women display a different pattern, with many women with secondary education having access to the MPG. Most women with lower educational attainment do not meet the requirements for MPG coverage under the current rules.

If we take life expectancy into account, women appear to use the MPG more intensively. The interpretation is that fewer women have access to it, but those who meet the requirements use the MPG longer than men. On the whole, the degree of effective use of the MPG decreases with educational attainment for both genders.

These estimates all indicate that only a small fraction of the population has access to the MPG. It would be surprising if the associated fiscal outlays were large. The fiscal problem is thus related to people with low pensions who are not currently covered by the MPG scheme.

63. Berstein and Tokman (2005).

64. The law establishes that for a retiree to be eligible for the MPG, he or she must not have other sources of income that add up to an amount above the level of the guarantee. This exercise does not consider this requisite.

TABLE 10. Estimated Access to MPG, 2020–25[a]
Percent

Gender and education level	*Affiliates using the MPG at least once*	*Expected affiliates using the MPG*	*Average expected time self-financing a pension above MPG*
Men			
Primary school	23	2	50
Secondary school	14	1	71
University	5	0	81
Women			
Primary school	9	3	9
Secondary school	14	3	26
University	9	1	65

Source: Authors' calculations.

a. Column 1 shows the percentage of people using the MPG at least once in their lives, even if this happens at a very old age. In column 2, we compute the expected value of people using the MPG; this is the average of people using the MPG times the probability of being alive at the age the MPG will be used.

Alternative Policy Options to Improve Benefits in the Chilean Pension System

The above analysis of the performance of the individual capitalization system in Chile shows that an important share of the population does not contribute regularly and therefore would not have access to an adequate pension. This results from periods of informality, unemployment, self-employment, or inactivity during the potential working life of an individual, during which no contributions are made.

An important source of noncontribution, especially in the case of men, is self-employment. As mentioned earlier, self-employment explains, on average, almost half the time that men are not contributing.[65] Consequently, an important challenge is to increase coverage during self-employment periods. This section explores a default mechanism aimed at encouraging self-employed workers to contribute. This policy would have a relatively low impact on women, who are identified in this paper as a vulnerable group; however, specific measures to improve the situation of women are beyond the scope of this paper.[66]

65. See Berstein, Reyes, and Pino (2006) for an in-depth analysis of this issue.

66. Berstein and Tokman (2005) provide a detailed diagnosis of the situation of women. Berstein and Tokman (2006) explore different policy alternatives to improve pensions for women, such as the graduated MPG and recognizing each child as one year of contribution for the MPG requirement.

Another important conclusion that can be drawn from our analysis is that very few people have access to the minimum pension guarantee. Low government spending on this guarantee could be seen as a sign of the system's success if it stemmed from the fact that everyone was able to self-finance an adequate pension. This is simply not the case, however: access is limited primarily because the requirements for the MPG are too severe.

Given that a certain number of contributions are required, the minimum pension guarantee represents insurance for affiliates that contribute actively to the system. From this perspective, it is insurance against contributing too late or against poor performance of investment returns. This insurance is valuable for people who have contributed for twenty years, but late in their lives or on the basis of low incomes. Few people match these characteristics, however. If this type of insurance is considered a positive element that can motivate people to contribute to the system, it might be worth extending the guarantee to provide better coverage and increase incentives.

The rest of this section explores two policy approaches to improving coverage and raising the level of benefits in the Chilean pension system. First, we consider a default mechanism to induce contributions by self-employed workers. Second, we analyze a graduation of the MPG requirements.

Default Contribution Scheme for Self-Employed Workers

Formal and informal self-employed workers together account for one-third of total employment in Chile. Unlike most developed countries, however, Chile does not legally force self-employed workers to contribute to social security. The pension coverage of these workers is close to 5 percent, whereas the coverage of dependent workers reaches 80 percent. Any attempt to improve coverage must consider this group.

As shown earlier, the pattern of saving among self-employed workers is not significantly different from those who work as employees. Self-employed workers thus are not compensating for their lower pension savings. Using information from the Internal Revenue Service, Berstein, Reyes, and Pino find that 63 percent of self-employed workers file a tax return.[67] Of these, almost 80 percent do not pay taxes, however, because their earnings are lower than U.S.$11,000 per year.

The proposed scheme uses the tax system to offer taxpayers a default option of contribution. The Chilean tax system works as follows. Every month, all

67. Berstein, Reyes, and Pino (2006).

TABLE 11. Time Worked in Self-Employment: Distribution of Affiliates
Percent

Time in self-employment[a]	*Men*	*Women*	*Total affiliates*
0–20 percent	54	90	73
21–40 percent	4	3	4
41–60 percent	4	2	3
61–80 percent	7	2	4
81–100 percent	11	2	16

Source: Authors' calculations.
a. Percentage of time not in formal employment that is worked in self-employment.

formal self-employed workers pay 10 percent of their monthly income as an advance on their yearly taxes. In April, all workers must file their annual income tax return for the preceding year. The actual tax is calculated on annual income. If the workers' prepayments exceed the actual annual tax, then the state refunds the difference. According to Berstein, Reyes, and Pino, about 94 percent of self-employed workers receive money back from the state—that is, their average income tax is less than 10 percent.[68]

Following the behavioral economics literature, we propose a scheme in which a share of the tax refund is assigned as a default contribution to the pension system.[69] Evidence on the U.S. 401(k) default options suggests that this can be a powerful mechanism, especially if it is enhanced with additional benefits such as disability and survival insurance coverage. Anyone who did not want to contribute could voluntarily refuse the default option. Thus, in contrast to a compulsory contribution system, this scheme should not have an impact on the decision of whether to belong to the formal sector.

To evaluate this proposal, we carried out the following exercise for the generation that will retire between 2020 and 2025. For each worker, we computed the time worked in self-employment as a percentage of the total time not worked in formal employment, based on the EPS Survey (see table 11). We then assigned a minimum wage contribution in periods currently without contributions, using the self-employment frequencies mentioned above.

The probit approach is not useful for projecting contributions because we need to apply contributions to periods that currently do not have them, rather than predict the probability of contribution in each period. We therefore use an alternative methodology, called the hot-deck procedure.[70] This methodology

68. Berstein, Reyes, and Pino (2006).
69. See Choi and others (2002).
70. Toder and others (2002).

has some advantages and disadvantages relative to the previous procedure. We assume that the future contributions of each individual have the same pattern as the contributions of previous generations for the same age, gender, and education level. The generations considered as donors were born between 1937 and 1955. Their contribution history is used to assign the future contributions of the generations that will retire between 2020 and 2025. Specifically, we use data from 1995 to 2005 from the histories of the donor generations.

This methodology captures the heterogeneity of the sample by building a pattern of contributions and no contributions, period by period, for each individual. However, it does not consider cohort effects or the economic cycle, which affected contributions in the ten-year period used to project the next twenty years.

With regard to the cohort effect, the regressions show a negative effect for both men and women, which is contrary to what might have been expected. This could be due to sample selection, because workers in the older cohorts are only observed if they contributed for the first time in the new system after the age of forty. Therefore, those who contributed for the first time in the old system and never contributed again are not in the sample. On the other hand, all individuals in the younger cohorts are included, even workers who contribute for very few periods and then stop. The hot-deck procedure produces an upward bias in the contribution density of this last type of worker. Consequently, the pension projections drawn from this exercise are higher than those shown earlier. Since there are fewer periods with no contributions, there are fewer potential periods to fill in using the default mechanism. In this sense, the exercise provides a lower limit for the potential impact of this policy.

The procedure is designed such that each year, when self-employed workers declare their taxes, they must decide whether to contribute. Therefore, the effective number of periods in which the default would be accepted is unknown in advance. For the purpose of the exercise, we use two alternative levels for the probability of a person accepting the default in each period: low (40 percent) and high (80 percent).

Table 12 presents our projections for the cohorts that will retire between 2020 and 2025. As expected, the policy has a larger impact on men than on women. This is mainly because men are more likely to be self-employed than women. In terms of the MPG, the percentage of people who would have access to the guarantee increases slightly. On the one hand, more people would achieve the 240 months required for the guarantee, while on the other, more contributions might imply that more people would be able to self-finance a pension of that level.

TABLE 12. Default Contribution for Self–Employed Workers: Group Composition
Percent

	Share of people using the default					
	0 percent (base scenario)		*40 percent*		*80 percent*	
Pension type and level	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*
Self-financed pension above twenty-year MPG	70	37	78	38	83	40
Twenty-year MPG	4	11	6	12	5	12
Pension below twenty-year MPG	26	52	16	49	13	48

Source: Authors' calculations.

Changes in replacement rates are shown in two different ways: by education level (see table 13) and by percentage of time in self-employment (see table 14). For both tables, we consider the second definition of replacement rate (that is, the pension payment as a proportion of the last income). Again, the impact is larger for men than women, especially in the case of less educated workers. The default contribution is based on the minimum wage, so it is more significant for low-income workers.

As expected, the effect on the replacement rates of workers who are self-employed for a larger portion of their working lives is higher than for workers who spend more time unemployed, inactive, or working in the informal sector. The replacement rates almost double in the case of women who are self-employed for 80 percent of the time or more.

Graduated MPG

As illustrated by our earlier analysis, few people will meet the requirements for the MPG and then make use of it. MPG coverage could be increased by

TABLE 13. Replacement Rates by Education Level
Percent

	Share of people using the default					
	0 percent (base scenario)		*40 percent*		*80 percent*	
Education level	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*
Primary school	45	15	50	27	55	36
Secondary school	53	20	57	24	59	29
University	54	26	62	28	63	28
Average	51	21	56	26	59	30

Source: Authors' calculations.

TABLE 14. Replacement Rates by Percentage of Time Worked in Self-Employment
Percent

	Share of people using the default					
	0 percent (base scenario)		*40 percent*		*80 percent*	
Time in self-employment[a]	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*
0–20 percent	51	21	51	21	51	21
21–40 percent	50	19	51	20	53	21
41–60 percent	43	20	47	22	50	26
61–80 percent	43	23	47	27	49	31
81–100 percent	43	17	52	23	58	36

Source: Authors' calculations.
a. Percentage of time not in formal employment that is worked in self-employment.

relaxing the twenty-year contributions constraint. The rationale for this option is twofold. First, the mere fact of reducing the requirement automatically extends the guarantee to people that were previously not covered. Second, the cost-free provision of insurance by the state, albeit contingent on behavior, may encourage risk-averse agents to contribute. Workers might experience a negative incentive right after they become entitled to the new level of the minimum pension, since further contribution would add no additional insurance. This effect can be minimized by adopting a series of improvements in benefits. Hence, any disincentive effect arising from the achievement of a minimum level of insurance can be offset by the provision of additional benefits that are conditional on new contributions. We call the net outcome of these two opposing effects the behavioral effect. Overall, this scheme combines protection to previously uncovered workers with incentives to continue contributing.

Table 15 presents an initial proposal of a benefits scheme under this alternative policy. The shaded column displays the current MPG scheme, which consists of three levels according to age. The other columns show the proposed graduated MPG scheme, based on the years of contributions at retirement age. The amount that would be guaranteed for each step is proportional to the amount currently provided under the twenty-year requirement (that is, the ratio of the number of years required for that step to the current twenty years.

We use the same methodology followed earlier to compute the MPG pensions under the new scheme. Table 16 summarizes the results for the cohorts that retire between 2020 and 2025, which will be the first cohort with a whole labor history in the new pension system. No behavioral effect is considered for this exercise. The results show that relative to the base scenario (the cur-

TABLE 15. A Possible Graduated MPG Scheme[a]
U.S. dollars

	Years of contributions				
Age	*Ten*	*Fifteen*	*Twenty*	*Twenty-five*	*Thirty*
Under 70 years	66.89	100.33	133.77	167.22	200.66
70–75 years	73.14	109.70	146.27	182.84	219.41
Over 75 years	76.55	114.83	153.10	191.38	229.66

Source: Authors' calculations.
a. The shaded cells show the current minimum pension.

rent twenty-year guarantee, or MPG-20), slightly more retirees have a pension equal to or above the thirty-year guarantee (MPG-30) and slightly fewer have a pension under the ten-year guarantee (MPG-10). The distribution of pensions is thus shifted upward.

As shown in the table, the proposed scheme implies that there are currently people who would reach the requirements for each step and would not have enough funds to self-finance a pension of the corresponding level. For this exercise, we consider a 5.8 percent rate of return; the share of people entitled to the guarantee who would require state financing would be larger if yields are lower. This implies that a larger share of people is protected by the guarantee than might make use of it under a specific outcome of the rate of return. In fact, if the rate of return were high enough, no one would need additional funding, but this would not mean that no one was protected.

Under the current scheme, 15 percent of retirees with pension levels equivalent to the MPG-20 and MPG-25 may use government funding, in expected terms (see table 17). About the same number of people would be in that situation under the graduated MPG scheme, but there are now additional retirees

TABLE 16. Payout Distribution
Percent

	Base scenario			*Graduated MPG*		
Pension level	*Total*	*Men*	*Women*	*Total*	*Men*	*Women*
Over MPG-30	38	53	23	41	57	25
MPG-25 to MPG-30	6	7	5	6	6	6
MPG-20 to MPG-25	11	10	11	8	8	8
MPG-15 to MPG-20	3	4	3	6	6	6
MPG-10 to MPG-15	6	6	7	7	5	8
Under MPG-10	35	20	48	32	18	45

Source: Authors' calculations.

TABLE 17. Expected Pensions Financing
Percent

	Base scenario		*Graduated MPG*	
Pension level	*Self-financed*	*With MPG*	*Self-financed*	*With MPG*
Over MPG-30	100	0	99	1
MPG-25 to MPG-30	100	0	90	10
MPG-20 to MPG-25	85	15	86	14
MPG-15 to MPG-20	100	0	84	16
MPG-10 to MPG-15	100	0	91	9
Under MPG-10	100	0	100	0

Source: Authors' calculations.

with between ten and twenty years of contributions who previously had no coverage at all. The same is true of retirees with twenty-five to thirty years of contributions. Nevertheless, very few people would make use of the MPG-30, because individuals with more than thirty years of contributions generally have higher incomes and started contributing earlier.

One of the key objectives of the MPG is to provide insurance against longevity, low wages, contributions timing, and low yields.[71] The effect on average expected replacement rates might, in fact, be small, but it reduces uncertainty for retirees with a pension close to the MPG level who comply with the MPG requisites. The graduated MPG performs better than the current simple system in this area: for the cohort of reference, the expected beneficiaries under the current MPG scheme are projected to be just 2 percent. A larger population is potentially covered, however, if yields decrease significantly or longevity increases. The reported exercise, in which yields fall to 3 percent, shows that the coverage of the current MPG scheme against longevity and low yield can be estimated at 32 percent of the population.[72] Given the twenty-year requirement, the covered population has, by definition, a relatively high contribution density.

The graduated MPG has both a higher level of potential beneficiaries and higher coverage against longevity and low yield. The expected beneficiaries double to 4 percent under the graduated MPG, and coverage rises to 53 per-

71. Berstein, Larraín, and Pino (2005).

72. To compute the share of affiliates covered against longevity and low yield, we assume that every retiree who potentially uses MPG is counted, even if he or she uses the MPG at the age of ninety or a hundred (that is, affiliates are not counted in expected terms); the rate of return is assumed to drop to 3 percent in real terms.

cent. Both improvements are basically due to the fact that the proposal gives automatic coverage to people with low contribution densities.

Although this exercise did not take into account behavioral effects, one might expect the minimum pension guarantee to have some impact on the probability of contributing. On the one hand, the existence of the guarantee might give workers an incentive to contribute, so they can meet the contribution requirements and thus have access to the guarantee. On the other hand, workers who have already accumulated the required number of contributions may have a strong disincentive to contribute. It is hard to find evidence that supports these hypotheses, mainly because account holders do not have enough information about the MPG amount and requirements.[73]

Given that contributing is compulsory for those who work in the formal market, the expected effects are small. However, there is a margin of decision for some individuals, who might choose between informal and formal employment. According to the 2003 National Socioeconomic Survey (CASEN), the informal sector encompasses about 20 percent of all employment in Chile. Additionally, contributing is voluntary for self-employed workers, so this is a decision they must address.

We developed three scenarios to incorporate these potential incentive effects into the analysis. The first considers that positive incentives are strong by assuming that all affiliates who are halfway to the next level would make an effort to contribute for the additional years to reach that level. We thus uniformly distributed extra contributions into each projected profile, until the contributions condition is completed. The second exercise assumes that disincentive effects are strong, so all those who are halfway between one level and another would stop contributing. For this case, contributions are uniformly dropped from projected profiles. In the third scenario, both things happen simultaneously. Table 18 shows the results for both men and women. Retirees with fewer than ninety months of contributions were excluded from these tables, since they will not be influenced by the incentive and disincentive effects.

If incentive and tax effects are uniformly distributed and affect affiliates that are halfway to the next level, the former would be stronger than the latter. In the combined effect exercise, less educated women increase their replacement rate by 35 percent relative to the base scenario.

73. According to 2002 EPS, 78 percent of affiliates did not know either the MPG amount or the MPG requirements.

TABLE 18. Incentive and Tax Effects: Men's and Women's Replacement Rates[a]
Percent

Gender and education level	*Base scenario*	*Graduated MPG*	*Incentive effects*	*Disincentive effects*	*Combined effects*
Men					
Primary school	60	63	65	62	64
Secondary school	67	69	70	68	70
University	123	124	125	124	125
Women					
Primary school	23	29	33	26	31
Secondary school	25	28	29	26	28
University	36	36	37	36	36

Source: Authors' calculations.
a. Retirees with more than ninety months of contributions.

Conclusions

Despite the success that the Chilean pension reform has had in terms of financial development and its impact on overall economic growth, coverage seems to be one of the subjects where more work has to be done in the future. Chile's per capita GDP has tripled since the reform was adopted, yet traditional coverage measures have not improved, and the density of contributions is smaller than was initially projected. Moreover, the distribution of densities varies significantly by type of worker and gender. This implies that, contrary to what has been argued in the past, the Chilean pension system will not converge to a single-pillar pension system—that is, to a purely capitalized system. Although the original institutional design included a first pillar, it was mostly conceived as being residual, in that it would receive all affiliates who were not able to accumulate enough resources to self-finance a pension in the second pillar.

We have shown that the system actually works for all affiliates who are able to contribute continuously, in the sense that it delivers very high replacement ratios. When we consider only the periods in which contributions were effectively made, we find replacement ratios of 87 percent, on average, for all affiliates. The problem is that the median contribution density is 48 percent for men and 42 percent for women. The underlying problem of coverage in the Chilean pension system clearly lies with the performance of the labor market. Without quick and significant changes in that market, the current coverage and densities call for a better-designed first pillar.

This paper argues that, in a declared conservative scenario, a significant number of people will continue to depend on public support. This requires a

vocational, rather than a residual, first pillar. Projections for the next twenty-five years show that almost half of all old-age pensioners will self-finance a pension above the MPG, while the other half will not. The MPG will not provide enough insurance, since the minimum contributions requirement is hard to meet. What is striking in our forecasts is that the distribution of people who are not eligible for the MPG is not particularly different twenty years from now from what we see today. Those who are in that category are mostly women, self-employed workers, and informal workers, although they could have other sources of income.

The paper explores two main policy options: the adoption of a graduated minimum pension guarantee and the implementation of a default-based scheme for independent workers. The graduated MPG increases access to a guaranteed pension, especially for people with low contribution densities. The dramatic increase in coverage could increase the fiscal liability, which would require further assessment.[74] Finally, the default contribution mechanism increases coverage of self-employed workers. The estimated effect appears to be higher for men, because they spend more time in self-employment than women. This suggests that the situation of women must be tackled separately, through focused measures rather than general rules. Berstein and Tokman consider some alternatives in this respect.[75]

Appendix: Data Description

Our merged database is built from two main sources: individual data from administrative records provided by the Superintendency of Pension Fund Administrators, and a socioeconomic characterization of these same individuals garnered through the 2002 Social Security Survey (EPS, available at www.proteccionsocial.cl). The sample includes an average of 10,878 individuals, with a total of 4,893,454 observations covering 288 periods (from January 1981 to December 2004). Table A1 breaks down the number of observations by year. Table A2 provides summary statistics by gender for 2004.

74. Fajnzylber (2006) analyzes the fiscal implications of implementing a universal pension, as compared to this graduated minimum pension scheme.

75. Berstein and Tokman (2006).

TABLE A1. Number of Observations, by Year

Year	*Number*	*Frequency (percent)*
1981	12,217	0.6
1982	27,096	1.3
1983	31,252	1.6
1984	36,123	1.8
1985	41,693	2.1
1986	47,707	2.4
1987	54,246	2.7
1988	61,631	3.1
1989	68,621	3.4
1990	74,345	3.7
1991	79,821	4.0
1992	86,350	4.3
1993	92,758	4.6
1994	98,635	4.9
1995	103,783	5.2
1996	108,749	5.4
1997	113,403	5.6
1998	117,864	5.9
1999	121,329	6.0
2000	124,618	6.2
2001	126,743	6.3
2002	126,706	6.3
2003	126,193	6.3
2004	125,739	6.3

Source: Authors' calculations.

TABLE A2. Summary Statistics by Gender, 2004

Summary statistic	*Men*	*Women*
Age	41	40
Wage (in 2004 Chilean pesos)	314,446	278,056
Density[a] (percent)	52	40
Married (percent)	79	76
Primary school (percent)	32	24
Secondary school (percent)	44	43
University (percent)	25	34

Source: Authors' calculations.
a. Density is measured as the number of periods contributed in 2004.