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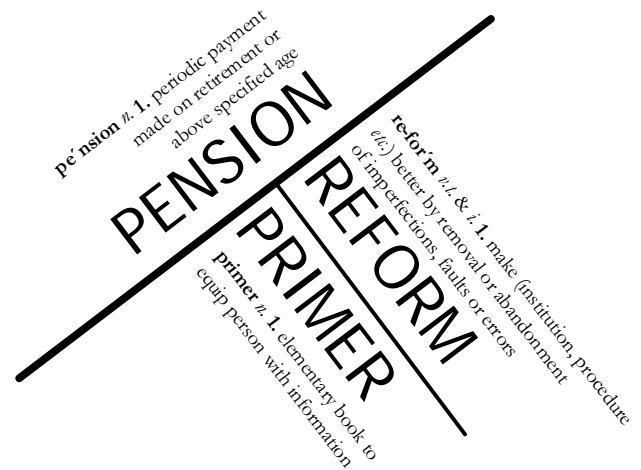
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Abstract

The disability insurance system in Chile is much less well-known than the pension part, but it is equally innovative. It differs from traditional public disability insurance in two important ways: 1) it is largely pre-funded--through the accumulation in the retirement account and later through an additional payment made when the person becomes permanently disabled, sufficient to cover a lifetime defined benefit annuity; and 2) the disability assessment procedure includes participation by private pension funds (AFPs) and insurance companies, who finance the benefit and have a direct pecuniary interest in controlling costs. Survivors' insurance is handled in the same way, through a combined D&S fee. We argue that pre-funding will raise disability fees in the early years of a new system as funds are built up but reduce them in the long run as benefits are covered out of accumulated funds. We further hypothesize that the participation of private pension funds in the assessment procedure will keep system costs low, by cutting the incidence of successful disability claims. Finally, we expect that these incentives will also lead to cost-shifting—to other AFP's by selection and to the public treasury via the minimum pension guarantee (MPG). Using simulations based on a special data set that was provided to us by the Association of AFPs and applying the Cox proportional hazard model to a retrospective sample of new and old system affiliates (ESP 2002), we conclude that these hypotheses are broadly consistent with observed behavior.

JEL Classification: J18, H55, J14

Keywords: Disability, Pensions, Insurance, Cox Proportional Hazard

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Introduction

Social security systems in many countries face problems of high and escalating disability costs. This has been ascribed, alternatively, to demand-side factors such as unemployment rate and generosity of benefits, versus supply-side factors such as eligibility rules and assessment procedures. (See, for example, Duggan and Imberman 2006, Autor and Duggan 2006, Autor and Duggan 2003, Rupp and Stapleton 1995 and 1998, Gruber 2000, von Wachter et al 2007). Assessment procedures and the incentives they embody potentially play an important role in determining system costs. Furthermore, disability is a more subjective condition than old age, and such programs are therefore prone to errors of false positives and false negatives. The procedures used to evaluate claims can influence the balance between these two types of errors and through it the accuracy and equity of the program.

Countries that have adopted old age pension systems that include individual accounts (funded, privately managed defined contribution plans) face an additional issue—the need to integrate disability benefits into their new structure. The defined contribution system might generate reasonable replacement rates for workers who contribute throughout their lifetimes, but very low replacement rates for those who become disabled when young. Yet, if disabled people continue to receive their benefits from the traditional pay-as-you-go (PAYG) system, this will take an increasingly large percentage of total social security taxes in the future. Moreover, it may encourage workers with small accumulations to apply for disability rather than old age benefits, which will raise taxpayer costs further.

This paper analyzes how Chile, the country that pioneered individual account systems, handles disability insurance and has cut disability costs. The disability insurance system in Chile is less well-known than the old age pension part, but it is equally innovative. It differs from traditional public disability insurance in two ways:

1) it is largely pre-funded--through the accumulation in the retirement account and later through an additional payment made when the person becomes permanently disabled, sufficient to cover a lifetime defined benefit annuity; and

2) the disability assessment procedure includes participation by private pension funds (AFPs) and life insurance companies, who finance the benefit and have a direct pecuniary interest in controlling costs and reducing adverse selection.

Survivors' insurance is handled in the same way, through a combined D&S fee. These fees are strikingly lower in Chile than in countries with pure public PAYG systems. The insurance fee is currently about 1% of wages, with 2/3 of this—approximately .7% of wages--for lifetime disability benefits. D&S insurance fees are .9%-1.7% of wages in other Latin American countries that adopted systems with similar features to the Chilean model (AIOS 2005 and Grushka and Demarco 2003). For comparison, the disability cost is 1.8% of wages and running into financial difficulties in the US (covering the disabled only until normal retirement age), over 3% in most other OECD countries and up to 10% in some European countries (US Social Security Advisory Board 2001; Andrews 1999). The flow of age-specific newly disabled beneficiaries is also much lower in Chile. While many factors besides system incentives help account for these differentials, we argue that pre-funding and participation of private pension funds in the assessment procedure are important parts of the story. This paper attempts to separate out these two effects.

Part I compares simulated insurance fees in a funded versus a PAYG disability system that has the same size and incidence of benefits. Simulations predict that pre-funding will raise disability fees in the early years of a new system but will reduce them in the long run. In steady state, under reasonable assumptions, funds in the workers' retirement accounts will cover half of disability costs. Pre-funding will make costs more sensitive to interest rate changes but less sensitive to population aging. Part II hypothesizes that AFPs and insurance companies have strong financial incentives to keep costs low by cutting the incidence of successful disability claims, and their participation in the assessment procedure gives them the opportunity to do so. Part III predicts that the Chilean system will also lead to cost-shifting—from one AFP to another by selection of affiliates and to the public treasury via the minimum pension guarantee (MPG).

These hypotheses are broadly consistent with observed behavior: 1) Using a special data set that was provided to us by the Association of AFPs, we find a pattern of falling insurance fees through time in the new Chilean system, compared with disability payouts, which proxy fees in an equivalent break-even PAYG scheme. This decline has come to a temporary halt as interest rates have declined in recent years, but is likely to continue further as accounts build up and the population ages. 2) Applying the Cox proportional hazard model to a recent retrospective sample survey (ESP 2002), we find significantly decreased disability hazards in the new system. Specifically, the hazard of workers becoming disability pensioners is only 20-35% that in the old system, after controlling for age, gender, marital status and unemployment rates. Further, the new system appears to accurately target the disabled with more severe medical conditions, as measured by higher mortality rates among new-system disability pensioners. 3) Association of APF data show a differential incidence of disability claims that is negatively correlated with successful appeals rates among AFP's with different selection and monitoring strategies. And 4) data from the AFP regulator indicate that the disabled have a high propensity to fall back on the minimum pension guarantee. The Conclusion considers how features of the Chilean model could be adapted by other countries that wish to cut their disability costs, whether or not they have individual accounts.¹

I. Disability Costs and Insurance Fees in the Chilean system vs. PAYG

In this section, we simulate costs in a pre-funded Chilean-type disability insurance scheme and compare these with costs in a traditional PAYG system, under alternative scenarios, abstracting from the incentive effects described in Part II. We assume that the probability of successful disability claims is the same in the two systems, in order to isolate the impact of pre-funding. That impact is shown to be 1) a shift in costs through time—higher in the short run and lower in the long run, under pre-funding; 2) economies stemming from the joint supply of old age and disability benefits—both are supported by the same funds accumulated in workers' accounts; and 3) increased sensitivity of insurance fees to interest rate changes but reduced sensitivity to population aging.

How disability insurance works in Chile

Disability insurance in Chile starts with the mandatory retirement accounts, to which each individual must contribute 10% of wages. This contribution is invested in the pension fund company (AFP) of his choice. Old age pensions depend on these defined contributions plus investment earnings. In contrast, if a worker becomes disabled before retiring, he receives a defined benefit whose cost may exceed his accumulated contributions. Both the additional funding and the defined benefit annuity itself are provided through the private insurance market, with detailed regulations and back-up guarantees by the government.

Specifically: Each insured worker is guaranteed a benefit that is 70% of his average wage if he or she becomes totally disabled, 50% if partially disabled, indexed to inflation. During an initial three-year period of temporary disability, this benefit is paid directly by the AFP. After the provisional period, if the worker is certified as permanently disabled, the entire lifetime benefit is funded. Part of this benefit is covered by his or her own retirement account. The remainder is covered by a term group insurance policy, which provides the top-up (the “additional payment”) needed to finance an annuity that equals the specified defined benefit. Each AFP is required to purchase this insurance policy for its affiliates. The typical contract shares the risk: the AFP covers costs up to a ceiling and keeps most of the savings beneath that ceiling, while the insurance company takes over after the maximum rate has been reached (for details see Appendix 1). Survivors’ insurance for workers is covered in the same way, by the same insurance policy, in exchange for a combined D&S insurance fee that is passed on to workers by the AFP.

Thus the total future pension is fully pre-funded at the point when the individual is certified as permanently disabled—partly out of his own retirement savings and partly by the group insurance policy purchased by the AFP. The disabled worker uses these funds to purchase a lifetime annuity or a programmed withdrawal pension that follows a formula set by the regulator.²

The D&S insurance fee is included in the general administrative charge that each worker pays the AFP. Each AFP sets its own fees and, apart from a small flat component, is required to charge all its affiliates the same percentage of their wage—

regardless of age, gender, occupation, health status or account size. AFP fees currently average around 2.4%. The combined fee for the group D&S insurance is about 1% of wages, of which the disability portion is 2/3 (authors' estimates).

A simple model for determining the group insurance premium

We develop a model that determines this fee and its evolution over time, compared with fees that would be necessary to cover annual benefits in a PAYG system that had the same incidence of disability and benefit levels. For simplicity, we focus on the cost of insuring total permanent disability, the largest component of disability costs. We calculate the fee, (T_{CH}), as a % of the wage bill, which must be charged to cover the group insurance that finances the “additional payment” for newly disabled workers.³ It depends on the real insurance cost associated with a typical individual in gender-age class i ($Insure_i$), times the number of individuals in that class (n_i), summed over all classes in the contributing labor force, to get the total insurance cost ($TotInsure$), and divided by the AFP's total wage bill to get the break-even fee as a percentage of wages (equation 1).

$$T_{CH} = TotInsure/Wage\ bill = \sum_i n_i * Insure_i / Wage\ bill \quad (1)$$

$Insure_i$ depends on the additional payment (Add_i) that would be needed if the individual became newly disabled times the probability ($Prob_i$) of covered disability for i 's gender-age class (equation 2).

$$Insure_i = Add_i * Prob_i \quad (2)$$

Substituting equation (2) into equation (1) and rearranging terms, T_{CH} can be rewritten as the total inflow of newly disabled workers ($\sum_i n_i * Prob_i$), times the average Add_i per newly disabled worker, divided by the total wage bill (equation 3):

$$T_{CH} = [\sum_i n_i * Prob_i * (\sum_i n_i * Prob_i * Add_i / \sum_i n_i * Prob_i)] / Wage\ bill \quad (3)$$

Add_i , in turn, depends on the necessary capital ($NecC_i$) needed to finance the defined benefit minus the worker's own capital ($OwnC_i$)--that is, the balance in his/her account--that is applied toward these costs (equation 4).

$$Add_i = NecC_i - OwnC_i \quad (4)$$

To calculate T_{CH} we need to show the determinants of $NecC_i$ and $OwnC_i$. $NecC_i$ equals the defined benefit for the newly disabled (DB) times the actuarial factor (a_i) relevant to class i . The actuarial factor tells us by how much the specified annual payout must be multiplied to get the expected present value of the lifetime pension stream, which

equals the total premium necessary to finance that payout. It depends on the interest rate that will be earned on annuity reserves (r), the relevant mortality tables (M), and the individual's age and gender that determine his or her place within these mortality tables.⁴ Since survivors of disabled beneficiaries also receive benefits, for married men and those with children (mar) the actuarial factor is based on a joint pension (equation 5).

$$NecC_i = DB_i * a_i(r, M, age_i, gender_i, mar) \quad (5)$$

$OwnC_i$ depends on the individual's contributions at age t ($Contrib_{it}$), compounded by the interest rate earned until age of disability (N), summed over all t in which work occurs. Contributions are based on wages, so contribution rate (k), initial wage rate (W_i^t) and rate of wage growth (g) determine the total accumulation (equation 6).

$$OwnC_i = \sum_t Contrib_{it}(1+r)^{N-t} = k \sum_t W_i^t (1+g)^{t-t} (1+r)^{N-t} \quad (6)$$

Equations (1)-(6) allow us to calculate the break-even insurance fee in a Chilean-type scheme (T_{CH}) as a function of DB , r , g , k and the age-gender-marital structure and disability incidence of the covered population. They also allow us to calculate the real insurance cost associated with different age-gender-marital groups and compare this with the insurance fee they will have to pay, thereby obtaining the implied pattern of cross-subsidies, profitable and loss-making groups and incentives for selection by AFPs.

By contrast, the break-even tax rate in a PAYG system (T_{PAYG}) equals the annual payouts for the total stock of disabled beneficiaries/covered wage bill--in other words, the average defined benefit for the stock of disabled ($avDB$) times the stock of beneficiaries ($StkDis$), where $StkDis$ is the sum of previous newly disabled who have not yet died (equation 7):

$$T_{PAYG} = avDB * StkDis / Wage \text{ bill} \quad (7)$$

Comparing equations 3 and 7, we see that the relative annual insurance fees in a Chilean-type disability scheme versus a PAYG scheme depends on 1) the size of the expected inflow of newly disabled compared with the stock of total disabled and 2) the average additional payment required to purchase a lifetime annuity for the newly disabled compared with the average annual payout to the stock of disabled. Below, we investigate this relationship between simulated PAYG and Chilean fees in a new and a mature system, under varying assumptions about interest rate, rate of wage growth, disability rates, and population age structure. We expect that:

- In the early years of a new system, when the inflow of new beneficiaries is large relative to $StkDis$ and $OwnC_i$ is small relative to $NecC_i$, $T_{CH} > T_{PAYG}$.
- In long run steady state, however, $T_{CH} > T_{PAYG}$, since $StkDis$ grows relative to the new inflow and $OwnC_i$ grows relative to $NecC_i$.
- The ratio of T_{CH} to T_{PAYG} will vary with the underlying parameters that have different impacts on a funded versus a PAYG system. In particular, PAYG fees should be strongly related to population aging, while interest rates should strongly influence the premium needed to pre-fund the lifetime pension in Chile.

Simulation results under different scenarios

Table 1 simulates T_{CH} under alternative assumptions and compares it with T_{PAYG} . We also observe how much of the total cost of the Chilean disability pension is covered by $OwnC$. This shows the degree to which disability and old age benefits are jointly supplied—the same individual account serves both purposes. Unless otherwise noted, we carry out this simulation for a steady state in which all key parameters, including disability rates and age structure of contributors, are identical for the two systems and remain constant over time at today’s rates in Chile, except for the variables that we are explicitly changing. Only permanent disability incidence and costs are considered. In Chile, contracts between the AFPs and insurance companies usually have two-year terms, or else are written for an indefinite period, which either party can break with a 1 year’s notice. Therefore, the adjustment to these changing variables will occur gradually, as new contracts are written. In these simulations we assume immediate re-contracting.

Base case—start-up vs. steady state. We start with the base case, in which the contribution rate (net of fees) is 10% of wages, $r = 4.5\%$, wage growth = 2%. Workers enter the labor force at age 20 and work steadily until retirement or disability. Expected age of death for men = 80, for women = 84, wives are 3 years younger than husbands and husbands must purchase joint pensions, with 60% to surviving spouse. Then, in year 1 of the new scheme, with only 1 year’s worth of $OwnC$ and $StkDis$, the fee in a Chilean-type scheme would be relatively high—1.35% of wages—while that in a PAYG system would be very low—.08% of wages. A Chilean system costs 17 times as much as a PAYG system in year 1 (row 1). But fees steadily fall in the Chilean scheme and rise in the PAYG scheme, so the PAYG fee almost overtakes the Chilean fee by the end of the

fourteenth year (row 2). After that, $T_{CH} < T_{PAYG}$ (as is the case now, in reality). In steady state, T_{CH} falls to .67%, since accumulated money in the accounts covers half the total cost of the lifetime annuity (row 3). In contrast, T_{PAYG} is 2.73%, 4 times as large as T_{CH} (Figures 1 and 2).

Interest rate variations. If the rate of return rises to 6% (row 6), T_{CH} is cut in half relative to the steady state base case, since the accounts have grown much larger and, further, insurance companies can count on higher investment earnings to help cover their annuity costs. This was roughly the situation in Chile during the 1990's. Conversely, T_{CH} almost doubles if the interest rate falls to 2% at the payout stage (row 4) and more than doubles if interest rates are also 2% during the accumulation stage (row 5). In this case, the accounts stay small and cover only one quarter of total annuity costs. This interest rate sensitivity of D&S fees is much higher than that normally associated with annuities, due in large part to a leverage factor—if the necessary capital rises without a corresponding increase in account balance, the additional payment bears the full brunt of the increase needed.⁵ In contrast, T_{PAYG} is totally insensitive to the falling interest rate. Thus, T_{CH}/T_{PAYG} is higher than in the base case (Figure 3).⁶

Wage growth. A higher rate of wage growth (row 7) means larger accounts but even more so, a higher reference wage. The defined benefit to the newly disabled depends only on the last ten years of wages while the money in the accounts depends on earlier wages as well. Consequently, the gap between necessary capital and own capital increases if wage growth is high, so the additional payment and T_{CH} must rise to cover this gap. T_{PAYG} also increases due to the higher reference wage, but less than in the Chilean scheme. Thus the ratio of T_{CH}/T_{PAYG} rises slightly.

Retirement contribution rate. Suppose the retirement contribution rate rises, to 15% instead of 10% (row 8). The accounts are now much larger, so fewer workers need additional payments. As a result, T_{CH} falls dramatically, to .4%—while an increase in the old age contribution rate has no impact on T_{PAYG} . This underscores the fact that in Chile the retirement account does double duty in covering disability insurance, at no marginal cost, hence results in a large saving relative to a PAYG system.

Disability benefit rate. Suppose the disability defined benefit rate is cut to 50% of reference wage instead of 70% (row 9). This implies a 29% cut in payouts, which would

cut T_{PAYG} by 29% in steady state. But T_{CH} is cut by 58% because of the leverage factor: necessary capital falls while the worker's own account is held constant. Many workers now find that their OwnC is large enough to cover the entire benefit—hence little or no additional payments are needed. The ratio of T_{CH}/T_{PAYG} was 25% in the base case but it falls to 14-15% when old age contribution rates rise or disability benefit rates fall. Thus, the fee in Chile's system is more responsive to policy variables such as changes in benefit rate or retirement contribution rate than is a PAYG system.

Disability probability rates. A doubling of disability probability rates has a powerful impact on insurance costs, doubling them in both systems (row 10). But, as discussed in Part II, the Chilean system may have stronger incentives and more effective procedures for controlling these rates.

Population aging. If the age distribution of the population shifts toward older age groups, insurance costs rise in both systems, because disability probabilities are greater for older workers (row 11). Thus, we can be fairly certain that the D&S insurance premium will rise substantially in the years ahead, as the population ages. But the increase will be smaller in Chile than it would be in a PAYG system, because of the offsetting effect of larger accumulations in the accounts of older workers (Figure 3).⁷

Our main conclusions from these simulations. As expected:

1. In the short run, a new Chilean-type scheme will require higher insurance fees than a PAYG system because the inflow of new beneficiaries is large relative to the stock of disabled and the average balance in the account is small relative to the price of the annuity that covers a lifetime of benefit payouts. It was not adopted in Eastern Europe (which followed the Chilean model for normal retirement) in order to avoid these initial transition costs as well as the difficulties in adjusting assessment rules to private standards (Chlon-Dominczak 2003).

2. But in the long run, Chilean fees are much lower. The funded individual account that is set up for old age retirement finances about half of the disability benefit. Additional pre-funding of the annuity at the point of disability produces investment earnings that reduce annual fees to about a quarter of what they would be in a pure PAYG system.

3. Pre-funding also makes the system less sensitive to demographic shocks. Population aging increases the probability of disability and the cost of disability insurance, whether in a PAYG or pre-funded system. But in a Chilean-type scheme these costs are partially offset by additional money in the accounts of the older workers.

4. However, pre-funding the defined benefit makes the system very sensitive to interest rate shocks. The cost of the insurance policy will vary from year to year depending on interest rates in the economy, and employers and workers will have to adjust to the varying contribution rate.

What does the evidence show?

These simulations imply that insurance fees in Chile would have been relatively high shortly after the new system was introduced in 1982 but would have fallen dramatically over the last 25 years. In contrast, if a new PAYG system had been introduced in 1982 its fees would have been low initially, but would have risen over this period. The cross-over point would have occurred in the mid-1990's. In fact, that is roughly what happened.

Table 2 and Figures 4 and 5 show the annual disability and survivors' (D&S) insurance fee over the period 1990-2004. We compare this with D&S payouts to the stock of beneficiaries (as a percentage of wages), which we use as a proxy for the break-even tax rate that would have covered the same size and incidence of benefits in a PAYG system.⁸ As expected, fees in Chile were much higher than PAYG fees would have been near the start of the new system, before 1990.⁹ But they fell rapidly during the early 1990's, due to growth in account balances in the funded system. At the same time, annual payouts for D&S benefits rose steadily due to the growing stock of disabled and survivor beneficiaries —illustrating the inevitable cost path as a PAYG system matures. Thus the insurance fee in Chile is now only 70-75% that of its PAYG equivalent.

The sharp decline in interest rates over the past 5 years has slowed down this cost decline in Chile and temporarily stabilized the ratio of T_{CH} to T_{PAYG} . If low rates of return on investments prevail, this will reduce accumulations in the accounts and further increase T_{CH} in the long run. But population aging will likely cause PAYG benefit payouts to increase even more and T_{PAYG} to rise even faster than T_{CH} , leading the cost advantage in the Chilean model to grow once again.

II. Cost Controls by Private Companies in the Chilean Scheme

In this section we argue that the incidence of successful disability claims is lower in Chile than it would be in a traditional publicly managed scheme, further cutting costs. In most public disability systems a government agency or body of medical experts must juggle sometimes-conflicting roles as advocate for taxpayers, protector of claimants and impartial judge and jury, in assessing disability claims. Neither civil servants nor medical experts have direct financial incentives to limit successful claims. The high disability costs in many countries have been ascribed to public gatekeepers who are generous at the taxpayers' expense, who allow governments to use disability benefits as a substitute for unemployment insurance or early retirement and in some cases accept bribes in return for applying lax standards.

Chile's disability system, by contrast, attempts to balance public gatekeepers with countervailing incentives from private AFPs to contain costs. AFPs and life insurance companies play a major role in the administration of disability benefits, including participating in claim assessments, bringing appeals, monitoring eligibility conditions and determining disability criteria. For any given total fee the AFP charges, lower disability costs mean more profits for the AFP. Suppose the AFP starts out with a total fee of 2.4% of the worker's wage, and an actual cost of 2%, half of which is the insurance cost, thereby earning the .4% differential as its profit. If it cuts the insurance cost to .8% and continues charging the same market-determined fee, its profits increase by 50% ($(2\% - 1.8\%) / .4\% = 50\%$). AFPs are therefore highly motivated to keep disability probabilities low, and they are given a role in the evaluation procedure that allows them to pursue this goal. We argue that this procedure produces lower age-specific disability claims than would be the case in the old system.

Participation by AFPs and life insurance companies in the assessment procedure

Initial claims are evaluated by 21 Regional Medical Boards, each made up of three doctors hired by the public Superintendencia of AFPs (SAFP), but financed by the AFPs. The member may present his/her own medical tests and invite his/her personal doctor to take part in the discussions (but not the vote). The AFPs and life insurance

companies also have a non-voting representative--their Associations have organized a group of medical observers, who regularly attend Board meetings and monitor its work. About 60% of all claims are approved at the first assessment, for a temporary disability benefit.¹⁰

Three years later (or sooner, if the individual reaches the normal retirement age), the member is re-assessed. AFPs and life insurance companies also participate in this second assessment. Currently 70% of the temporarily disabled come up for a second reassessment; 30% drop out due to death, improvement or because they had learned they were ineligible for insurance and/or had a low benefit (see below). About 94% of these are accepted as permanently disabled (Association of AFPs 2004).¹¹ They receive a lifetime benefit, even if they return to work; hence work by disabled beneficiaries is not penalized, as it is in many countries.¹²

Appeals by AFPs and life insurance companies

Traditional public systems usually do not allow agencies to appeal against approved claims; they only allow workers to appeal denials of disability status. And workers who appeal are, in some countries, allowed to be represented by attorneys. As a result, the appeals process invariably raises successful claims and costs. In the U.S., for example, appeals raise successful claims by 15-20 percentage points.¹³ In Chile, the process is more symmetrical—AFPs, life insurance companies and workers can appeal the decisions of the Regional Boards to a Central Board. The Central Medical Board is also made up of three physicians appointed and paid by the SAFP but financed by the AFPs. Some AFPs hire their own doctors to try to build strong appeals. In 2004 AFPs appealed 26% of provisionally approved claims and 18% of permanent approved claims, and one-third of these appeals were successful (Association of AFPs 2004). In the same year, workers appealed 57% of denied claims and 23% of them were successful. The number of successful appeals by AFPs and insurance companies offset the successful appeals by workers, so the net impact of appeals was 0 (Association of AFPs 2004).

AFP role in shaping criteria for total and partial disability

A Technical Commission meets periodically to determine the medical criteria for granting partial and total disability. Representatives of the AFPs and the insurance companies, as well as three public representatives, sit on this commission, with a vote.

For each handicap presented by the member, the rules allot a certain percentage of disability, which are summed to produce the total degree of disability. The Medical Boards may increase this percentage discretionarily according to specified “complementary factors” in the case of older members with a low level of income, or when the member loses the ability to perform his or her normal job. If the degree of disability exceeds 67% the member is considered totally disabled, whether or not he has continued to work, and is granted a 70% defined benefit. If the degree of disability is 50-67% he is partially disabled and gets a 50% defined benefit. If degree of disability is less than 50%, he is not considered disabled. Among the claims that were approved in 2004, 25% were for partial disability. This proportion has been increasing over time.

Eligibility for insurance: avoiding adverse selection

Adverse selection could potentially be a big problem in an economy like Chile’s, with a high degree of informality and self-employment. A healthy worker could avoid contributing by working in the informal sector, but move to the formal sector if he or she develops a complaint and anticipates filing a disability claim. Self-employed individuals and independent contractors are not required to contribute to the system but may voluntarily do so if they suspect they are becoming disabled. This is more likely as subjective and chronic diagnoses for disability, such as back pain and mental illness, whose intensity and timing are difficult to establish, replace more objective and acute diagnoses such as cardiac problems. Such strategic behavior would enable disabled workers to get relatively large benefits for relatively small lifetime contributions, while healthy workers try to stay out of the system, thereby raising insurance fees for the average worker.

Workers who are approaching old age with small accounts, because they have worked in the informal sector or self-employment for part of their lives, also have a strong incentive to enter the system and apply for disability, because their defined benefit would be greater than the old age benefit based on their own accumulation.¹⁴ This would require a large “additional payment” by the AFP or insurance company. In contrast, workers who have large accounts have less incentive to apply for disability benefits, and may try to withdraw from the contributory system (perhaps by taking early retirement). Thus, adverse selection based on size of contingent top-up as well as probability of

disability may raise the rate of disability applications among contributors and insurance costs for the system as a whole, especially in countries with easy movement in and out of the informal sector.

However, insurance eligibility rules and monitoring by AFPs reduce the likelihood that this will happen. While certification for disability depends purely on medical grounds, eligibility for the defined benefit and the top-up depends on recent work history. In general, an individual must have worked and contributed within the past 12 months in order to be insured and get the additional payment.¹⁵ If this requirement is enforced, it limits strategic behaviour, especially among workers with acute sources of disability. Poor record-keeping by public agencies in many countries, including Latin American countries in the past, has made it difficult to enforce insurance eligibility requirements. In contrast, AFPs keep the contribution records of affiliated workers and thus can ensure that they have contributed long and recently enough to be eligible for insurance. In 2004 only 60% of all successful claims at the first stage and 70% at the second stage were deemed eligible for insurance (Association of AFPs 2004). Most of the growth in disability probabilities in recent years has occurred among the uninsured—AFPs have little incentive to spend resources on questioning or appealing non-insured claims.

Combating strategic behavior by monitoring the reference wage

Another way the Chilean system discourages strategic behavior by workers with irregular contribution histories is by setting a low reference wage for such people. The reference wage used to determine the defined benefit is the simple average of earnings during the prior ten years, expressed in the price-indexed Chilean currency, the UF (Unidad de Fomento), and with a ceiling. Workers who have been in the informal sector, unemployed, or out of the labor force for part of the last ten years will have 0's averaged in and will therefore have a low reference wage and benefit, even if they are insured.¹⁶ For example: The wage replacement rate for a steady worker who becomes disabled is 70%, but a worker who contributed only 60% of the last ten years would receive only 42% of his working wage (60% of 70%).¹⁷ This is important because the density of contributions in Chile—that is, the portion of his working life that an average worker contributes—is about 60% (Berstein, Larrain and Pino 2005; Arenas, Behrman and Bravo

2004; Arenas et al 2007). This downsized reference wage makes it less likely that workers with irregular work histories will try to re-enter the system to become eligible for disability insurance, and it saves money for the system if they do get back in. AFPs use their records to ensure that these rules for defining the reference wage are strictly applied, thereby diminishing adverse selection and disability costs.

Results of the claims assessment procedure and eligibility rules

As a result of the first and second assessments, the appeals procedure, and eligibility rules, only a small percentage of initial claims result in insurance-funded permanent disability benefits. Based on data from 2004-06, out of 100 claimants.¹⁸

- About 60 are approved at the first stage
- 37 of the approved claims were deemed eligible for insurance
- 42 will be reevaluated in 3 years for permanent disability
- 40 of these will be accepted
- 28 of those approved at the second stage will be eligible for insurance
- Successful appeals by workers, AFPs and insurance companies net out to 0

Thus, only 28% of original claimants are projected to end up permanently disabled and insured, a proportion that is quite low by international standards (in the US, for example, acceptance rates are more than double). The rest are not considered disabled or, if disabled, do not get access to the insurance top-up (or may die or improve before reaching the second assessment). Among those disabled and insured, one quarter are only partially disabled and get a 50% benefit. Many have a reference wage that is far less than their full working wage and therefore a benefit that is far less than 70% (or 50%) of their full working wage. A major role in containing these costs is played by the AFPs and life insurance companies, who actively participate in the assessment procedure, help set the rules, have a vested interest in enforcing them, and use their Association to keep careful track of their success.

Disability pension rates in Chile vs. other countries

We expect these procedures to lead to a low inflow of age-specific newly disabled beneficiaries relative to insured population in Chile compared with other countries and, indeed, this is the case. For example, in 1999, for age group 45-54, 2.9 per thousand members were accepted to new disabled status in Chile, compared with 7.8 per thousand

people in that age group in the US and 8.6 in OECD as a whole (OECD 2003 and Table 3).¹⁹ Over all ages, 1 per thousand was accepted to new insured disability status in Chile in 2004, compared with 3 to 5 per thousand in the US over the past two decades (US Social Security Board of Trustees 2005; Social Security Bulletin: Annual Statistical Supplement, various years). These low incidence rates lead to low insurance fees. The disability charge is less than .7% of wages in Chile but 1.8% (covering the disabled only until normal retirement age) in the U.S. and 3-5% in most European countries (US Social Security Advisory Board 2001; Andrews 1999). Of course, many factors besides system incentives enter into these incidence and cost differentials--in particular, the definition of disability, the existence of other programs that cover certain groups of disabled, the generosity and indexation of benefits, and whether they cover the worker until the normal retirement age or death.²⁰ Also, the fact that workers have to finance part of the benefit out of their own accounts may discourage claims, especially for those with large accounts. However, it seems likely that participation of private pension funds in the assessment procedure are important parts of the story.

Testing disability hazards in new vs. old Chilean systems: the sample

To hold other factors constant, it is most useful to compare disability inflow rates in the new and old Chilean systems. In the following sections we summarize an analysis that is presented in greater detail in James, Edwards and Iglesias 2007.

Prior to 1982 Chile's disability system was like traditional publicly managed schemes in other countries. It was run on a pay-as-you-go basis, although with a deficit that was covered by the public treasury. Disability claims were assessed by a public sector Medical Commission. This changed when the new retirement system was introduced in 1982. Workers then in the labor force had a choice between staying in the old system or switching to the new system; most young workers switched while older workers remained. New entrants to the labor force had to join the new system. Thus, after 1982 the two systems co-existed, although the old system is gradually being phased out.

To compare disability hazard and survival rates in the two systems, applying the Kaplan-Meier survival function and Cox proportional hazard model to a recent sample survey of new and old system affiliates (EPS2002). EPS is a large retrospective survey, with about 17,000 observations, that was conducted in 2002 and is representative of the

universe of people who were affiliated with the new or old systems at some point between 1982 and 2001. We know each individual's system affiliation and age in 2002, age of death, disability or old age pension (if relevant), schooling, sex and marital status. We are interested in the propensity of these affiliates to become disabled pensioners under the new and old systems, after controlling for other relevant factors. For the reasons given above, we expect to find lower disability hazards in the new system.

From this large sample we constructed a sub-sample of individuals who were born 1932-1962. We excluded individuals who were born before 1932, because of potential survival bias and memory problems, including a potential underreporting of dead disability pensioners. This under-reporting of the dead may bias downward disability hazard rates, especially for the old system in which these older cohorts are concentrated. Therefore we confine our main analysis to cohorts born after 1932. But we also test sensitivity to enlarging the sub-sample, including all who were born 1922-62.

We focus our analysis on the hazard of disability pensioning between ages 40 and 64, because disability pensions below age 40 are a very low probability occurrence, and eligibility stops at age 65 for men, 60 for women. Effectively, this means that we omit cohorts who were born after 1962, who were under 40 by 2002. It also means that we omit the small number of individuals who had pensioned before age 40. Applying these cohort cut-off criteria, we create a sub-sample consisting of 8324 observations, of whom 70% are in the new system.²¹ Disability pensioners comprise about 2% of the total, or 172 individuals, only 1/3 of them in the new system. The smaller proportion of new system disability pensioners is due, in part, to the age differentials between our new and old system sub-samples and, in part, to differential procedures and incentives; we seek to disentangle these effects.

Kaplan-Meier survival functions for new and old systems

We start by examining Kaplan-Meier survival function, separately for the new and old systems (Figure 6). This shows us the cumulative probability that an individual who is a member of the "at risk group" will remain without a disability pension up to a given age. We define the "at risk" group at a given age as all individuals who reached that age without a disability or old age pension and the hazard of dropping out as a disability pensioner is the proportion of the at-risk group who became a new disabled

pensioner at that age. These are the “failures” and the rest are “survivors” (see Appendix 2 for further explication of the Kaplan-Meier survival function). It is immediately apparent from the K-M curve that new-system affiliates have a significantly higher probability of surviving as non-disability-pensioners than old-system affiliates. For example, by age 55, 5.1 percent of old-system affiliates had become disability pensioners, against just 1.6% of new system affiliates.

Cox proportional hazard model

We proceed to estimate the Cox proportional hazard model, which allows us to control for other factors and to establish whether these differences are statistically significant. The Cox proportional hazard model estimates a baseline hazard function and the impact of co-variables on this hazard. It enables us to estimate age-specific hazards and the statistical significance of differences due to co-variables. In this case, the baseline hazard function applies to the old system, with co-variables having a value of 0. Our main object is to measure the co-variate “*new system*,” which we represent by a dummy variable equal to 1 for those affiliated to the new system. We control for other co-variables such as *unemployment rate* and *years of education*, that may have direct effects on the hazard of disability and may be correlated with new system. In each case, estimated coefficients give the amount by which the baseline hazard must be multiplied to obtain the new hazard that applies when the co-variate is not zero. The Cox proportional hazard model is described in greater details in Appendix 3.

The Cox proportional hazard model is built on the assumption that co-variables have the same proportional effect over all ages in the analysis. Initial estimates of this effect for our data indicated that the proportionality assumption did not hold for the entire baseline. Therefore we split the age range into five sections (ages 40-44, 45-49, 50-54, 55-59 and 60-64), to make the proportionality rule applicable over each section separately. This means that instead of estimating one coefficient for the effect of *new system*, we estimate five coefficients, one for each of 5 different age groups. Since tests further showed that disability hazards vary by sex and marital status, we estimate the Cox model stratified by these two variables. In other words, we allow for differences in the baseline (old-system) hazard between men and women, married and singles, while holding constant the covariate coefficients in all these cases. The estimated baseline

hazards between ages 40-64 are lower for women than men and for married over single individuals (Figure 7).

The new system impact

As expected, the coefficients for the “new system” dummies are far smaller than one and significant at the 1% level or less in all the age ranges between 40 and 59. The coefficient is marginally significant (tested for men only) at ages 60-64 (Table 4 col. 1). What is more surprising is the size of those coefficients: the new system hazard ranges from 49% that of the old system in the 60-64 age range to 21% in the 45-49 age range, with coefficients for the other age ranges in-between. Over most ages, workers in the new system are only 21-35% as likely to start a disability pension as they were in the old system. Figure 8 compares the old system (baseline) hazard and the new system hazard (baseline*estimated coefficients for each age range) for married men.

To obtain the Cox model survival functions as a non-disability pensioner we calculate $(1 - \text{hazard rate})$ cumulatively for the old system and $(1 - \text{baseline hazard} * \text{estimated coefficient})$ for the new system, separately for married and single men and women (holding the other co-variates constant). In each case the estimated new-system survival functions are far above the old system estimates, because the estimated hazards for the new system are one-third to one-fifth those applicable to the old system (Figure 9). These results are consistent with the hypothesis that the assessment procedure in the new system has had a strong negative impact on the rate of successful disability claims, compared with the old public disability insurance system

What else could be causing these differential disability rates?

Old and new system affiliates and pensioners come from different cohorts, span different time periods and many other factors were changing over this time. In general, old system affiliates were concentrated in cohorts born 1932-46 while most new system affiliates were born 1947-62. To what extent do time-specific demand-side factors account for the estimated change in disability hazard rates, rather than the supply-side procedural factors that we emphasize? One such factor, changing unemployment rates, has been much-discussed in the US and international context (see Duggan and Imberman 2006, Autor and Duggan 2006, Autor and Duggan 2003, Rupp and Stapleton 1995 and 1998, Gruber 2000, von Wachter 2007). Changing level of education may be more

important in the Chilean than the US context. We also examine the possible impact of changing eligibility rules and, relatedly, selection bias, as individuals who thought they were likely to file a disability claim stayed in the old system instead of switching into the new system. Finally, we test for sensitivity to survival bias.

In a separate paper we analyze the importance of these other factors and this discussion is summarized in Appendix 4 (see James, Edwards and Iglesias 2007). The most important other factor is unemployment rate. Consistent with findings in other countries, higher unemployment leads to higher disability rates, as workers who lose their jobs and can't find other employment seek to replace their income by claiming disability. However, despite the other control variables and varying specifications, the new-system effect always remains consistently strong and approximately the same size. The estimated proportional differences between the old and new systems in Chile are roughly similar to the observed differences in disability incidence between Chile and other countries with traditional systems. They are also similar to differences in the observed stock of disability pensioners relative to old age pensioners in the new and old systems in Chile.²² These data support our hypothesis that the new assessment procedures, with participation of private AFPs and insurance companies, cut the incidence of disability claims substantially.

Mortality rates in the new and old systems as an indicator of system accuracy

We would also like to know if these cuts are made accurately—that is, if the truly disabled are targeted. We use comparative mortality rates among those who pensioned after 1982 in the new and old systems as a partial test of accuracy (see von Wachter et al 2007 for use of mortality rates as a partial test of accuracy in the US system).²³

If both systems had the same degree of accuracy, we might expect to find lower aggregate mortality rates among new system pensioners. New system members are younger, healthier, their illnesses are more likely to be psychiatric, and if pensioned this was likely to be more recent, therefore with shorter periods of exposure to the disability—all of which would lead to lower mortality rates.²⁴ However, if the new system targets accurately as it cuts approved claims, it has denied the less disabled so this would raise mortality rates among its approved disabled pensioners. Therefore, if mortality rates are the same in the two systems, we take this as evidence that the new

system has targeted benefits to the more disabled, and if mortality rates have increased in the new system this inference is even stronger.

We use probit and proportional hazard models to estimate the probabilities of death of non-disabled affiliates versus disabled pensioners in the old and new systems, controlling for age and gender. We present these results with the caveat that they should be regarded as preliminary since the number of dead disability pensioners is very small. Nevertheless, the effects are statistically significant and consistent, using both approaches.

Not surprisingly, the probits show that the disabled have a (10%) higher probability of death by 2002 than the non-disabled. Every year of age increases the probability of death, women have lower mortality rates than men and more education means lower death rates. We handle survivor bias by confining the analysis to those who pensioned after 1982 and by controlling for years of exposure as a disabled pensioner. Those who pensioned after 1986 are less likely to have died by 2002 than the others because they have fewer years of exposure.²⁵ These effects are significant at the 5% level or less (Table 5).

Most important for our purposes, the dummy variable for new-system disability pensioner has a large (13%) positive coefficient, significant at less than the 1% level, after controlling for all other factors. The new-system coefficient is even larger (18%) when we run the same regression for men only. New-system disability pensioners are more likely to have died by 2002 than old-system disability pensioners.

To investigate this issue further, we develop Kaplan-Meier survival curves by age and Cox proportional hazard regressions of the hazard of dying, by year of exposure to the disability pensioner state. In this case, those “at risk” are all disability pensioners (disabled) or all other affiliates (nondisabled), the “failures” are those who die and the “survivors” are those who live. It turns out that, in the old system, age-specific Kaplan-Meier survival probabilities are practically the same for disability pensioners and other affiliates. Apparently “disability” does not target those with higher expected mortality rates in the old system. In contrast, a wide disparity opens up between survival rates of disabled and other affiliates in the new system. Survival for the non-disabled increases, compared with the old system, as we expected due to health improvements for later

cohorts. However, survival for disabled pensioners drops dramatically (Figure 10). The Cox model shows that the hazard of dying within 3 years of disability pensioning is the same for the two systems, but the hazard of dying within the next 12 years is much greater for the new system, implying far lower survival probabilities (Table 6 and Figures 11 and 12).

Thus, in addition to reducing the incidence of successful disability claims, the new system seems to accurately target those individuals with the most severe medical problems, in the sense that they have much higher mortality rates than disability pensioners in the old system or non-disabled affiliates in the new system.

III. Cost Reduction by Selection and Shifting to the Public Treasury

The measures discussed in Part II reduce costs for the entire system. AFPs, however, also have an incentive to cut their own costs by selecting low risk affiliates, thereby leaving the high risks for other AFPs. Moreover, the system is structured to shift costs to the public treasury for the disabled who are uninsured or those with low pensions, who will be recipients of the minimum pension guarantee. This section presents evidence on these activities.

Differential profitability

Competition in private disability insurance would normally put people into differentiated risk categories, which are charged different prices. When this is limited by asymmetric information or by regulations, differentiated profitability of various workers and cross-subsidies arise. The Chilean requirement of a uniform insurance premium (as % of wages) for all contributors to a given AFP, in the face of differential disability probabilities, is an example of a regulation that makes some types of workers profitable while others are loss-makers. This raises two types of efficiency questions: 1) AFPs may seek out profitable workers and try to avoid serving loss-makers; and 2) workers may try to evade paying into the system if they are being charged more than their true risk. One of the simplest ways to do this is to work in the informal labor market until a disability claim becomes likely. We have no firm evidence on worker behavior but in this section we provide evidence on AFP behavior.

The most obvious source of differentiated profitability is by age (Table 7 and Figure 13). Our simulations show that, even though younger workers have smaller accounts and wages, their lower disability probabilities more than offset this effect and reduce their real insurance cost--but not their fee. Having them as affiliates is therefore profitable to an AFP, while the opposite is true for older workers. The dividing line between profit- and loss-making workers for the disability system is between ages 40-45. Over the lifetime of a given worker this effect may be neutral, as the surplus from the early years compensates the AFP in later years. But workers and AFPs do not make a lifetime commitment to each other. Workers can switch AFPs and, indeed, may try to evade the system altogether when young. AFPs have the converse incentive to attract young and avoid older workers.

A second obvious source of differential profitability is gender (Table 7). On average, age-specific disability rates of men are more than double those of women. Additionally, men have survivors while women usually don't (in Chile widows are automatically considered survivors while husbands are not considered survivors unless they are disabled and financially dependent on their wives). The net result is that female workers pay for components of D&S insurance that they likely will never use, while male workers get more than they pay for. This may discourage women from working in the formal labor market. And conversely, it makes women profitable to AFPs. Chile's President recently proposed that AFPs should rebate part of this fee to women, because of their low incidence of D&S claims. This represents a move toward differentiated disability insurance rates.

Third, single people cross-subsidize married people, because of the inclusion of survivors' insurance in the group policy. This subsidized treatment of survivors' insurance during the working stage is quite different from the treatment during the retirement stage, when husbands pay for a joint pension by accepting a lower benefit themselves. Again, single people (who tend to be young) will have an incentive to evade the formal system and AFPs will have an incentive to attract them. However, our Cox proportional hazard analysis indicates that married people have a lower disability hazard than single people, which partially offsets the inclusion of survivors' benefits.²⁶

Finally, large persistent differences appear across regions, despite the procedures described above to unify criteria. In Regions 6 and 8 disability rates are 40-70% higher than in Region Metropolitana (Greater Santiago), despite similar age distributions. Industry practitioners believe that these disparities are due to lax application of the criteria by the Regional Boards (Table 7).²⁷ The net result is a cross-subsidy to Regions 6 and 8 by the rest of the country, which makes these regions unattractive to AFPs.

We would expect AFPs to attempt to cream the better risks and indeed, we found limited evidence of such attempts. According to our discussions with industry representatives, they use two methods to keep disability costs down: monitoring the assessment procedure (which reduces system costs) and selection (trying to attract and retain workers with low insurance probabilities—which shifts the high cost workers to other AFPs). AFPs are not permitted to exclude workers who wish to affiliate, but they can put forth differential efforts to attract or discourage different kinds of workers. For example, they can and do pay their sales agents different commissions, depending on gender, age and income of the workers they bring into membership. The most aggressive AFPs claim they engage in the following practices: They don't pay any sales commissions on new affiliates from high-risk regions or demographic categories or on those who file for disability benefits within two months of joining; they do pay an above-average commission for new low risk affiliates; they take account of the claims rate in a region when deciding whether to open a branch; consider closing branches in high-risk cities; warn prospective new affiliates that strict criteria will be applied in case of disability claims; have above-average appeals rates; train their staff members to inform workers about other programs such as sickness or accident insurance that cover disability risks; and compete for skilful risk managers who will help them do all of the above. AFPs collect data on disability rates by group, which will eventually enable them to refine these techniques.

Selection reduces costs for the given AFP but does not reduce costs for the system as a whole if it does not change total system membership. However, pro-selection by AFPs may counter adverse selection by some low-cost workers who otherwise would stay out of the system, thereby increasing system coverage and reducing average costs. At the same time, anti-selection of high-cost workers may make it difficult for some

individuals to get into the AFP of their choice. If different AFPs follow different strategies or with differing degrees of success this could result in higher fees at AFPs with a high-risk clientele, thereby re-introducing differentiated pools and fees indirectly. Since older AFPs already have a stock of members who are likely to stay with them through inertia, the new AFPs are best positioned to use these selection methods effectively. Indeed, we find substantial differentiation among AFPs in successful claims ratios and in behaviors that might influence these rates.

In 2004 the ratio of covered accepted claims per thousand contributors varied among AFPs from 1.2 to 1.9, a 50% difference that could translate into a 50% difference in real insurance costs. The AFP that is particularly noted for its selection efforts has been at the bottom end, while the oldest and largest AFP, unable to select, has been near the top end. The former also has the highest rate of successful appeals while the latter has one of the lowest rates (Association of AFPs 2004 and Table 8). Thus cost-cutting by selection seems to go together with cost-cutting by vigorous monitoring of the approval process.

Recent reform proposals by Chile's President include the recommendation of a uniform D&S insurance fee across all AFPs, to eliminate price and profit differences due to selection. This could be accomplished by giving a single insurance company, chosen in a competitive bidding process, the responsibility for providing the additional payment for everyone. Workers would then all be placed in one large risk pool, rather than being divided into 6 separate risk pools, as they are today. Provision of disability insurance would be separated from the management of retirement saving. This proposal would eliminate the problems due to selection—but it might also raise costs by reducing the incentives for AFPs to vigorously counteract adverse selection and carefully monitor the disability assessment procedure.

Transferring costs to the public sector: the minimum pension guarantee

Underpinning these privately financed arrangements is the government's minimum pension guarantee (MPG), which sets a floor—currently 25-29% of the average wage—to disability and old age pensions. Many workers will qualify for the MPG even if they don't qualify for disability insurance, because they weren't working at the time of disability. Twenty years of contributions are needed for MPG eligibility among old age

pensioners, but only ten years (or even less) are needed among disability pensioners.²⁸ Low-earners with 10-19 years of contributions (which many have) therefore have an incentive to seek disability certification and, especially if they are not eligible for D&S insurance, may get it. Many will eventually become candidates for the MPG.

If the pensioner's accumulation (including the additional payment) is not large enough to cover an annuity above the MPG level, he or she must keep the money in the account and withdraw monthly benefits (programmed withdrawals) equal to the MPG. Thus, programmed withdrawals tend to be smaller than annuities—roughly half the size (Table 9). And 60% of the disabled have programmed withdrawal pensions, compared with 35% of old age plus early retirees. When the account balance becomes zero, the government steps in to pay the pension, if the pensioner is eligible for the MPG. Presently, about 80% of all disabled pensioners on programmed withdrawals have benefits at the MPG level and in one third of these cases the benefits are financed by the public treasury. Indeed, the majority of current MPG recipients are disabled and survivor beneficiaries who start out in programmed withdrawals (Table 10).

Several sub-groups of disabled already described are likely to find themselves in this situation: 1) members who are granted disability status but are not eligible for insurance because they are not current contributors; 2) insured individuals who contributed for only a fraction of their working lives and therefore have a small reference wage and pension; 3) insured individuals who choose programmed withdrawals and live longer than the out-dated mortality tables predict; 4) partially disabled workers who get only a 50% defined benefit; and 5) surviving widows of disabled workers. For each of these categories, policy choices reduce the cost of the private insurance but increase the cost of the public contingent liability. These costs will be small if the MPG is price-indexed (as it is, by law) and therefore falls over time relative to the average wage, but they will be large if the MPG rises with wage growth (as it has de facto over the past twenty years). Thus, the MPG serves as a safety valve for a cost-conscious private disability insurance system but its own future costs are uncertain. For further analysis of the MPG see (James, Martinez and Iglesias 2006, Edwards and James 2007).

IV. What Can Other Countries Learn from Chile?

Countries around the world are faced with rising costs of old age security programs. In many countries, disability expenditures are a high proportion of total social security costs and have been rising even faster than old age expenditures.

The Chilean system for disability insurance has two innovative features that help to contain costs: it is pre-funded and it utilizes private pecuniary incentives and procedures to dampen successful claims. Pre-funding in Chile takes place in two stages: first, building the retirement accounts through the worker's career and second, using an "additional payment" when the person becomes disabled to enable the purchase of a lifetime defined benefit. According to our simulations, based on a special data set prepared for us by the Association of AFPs, in the long run the money in the retirement accounts will cover about half of the total disability annuity premium. Further pre-funding through the additional payment initially costs more than an equivalent PAYG system with the same incidence of disability. But it cuts fees dramatically—to about a quarter of PAYG levels--as the funded system matures. Pre-funding increases the sensitivity of fees to volatile interest rates but it reduces the sensitivity to on-going population aging. Currently the system is in the medium-term, with annual fees lower than they would be in an equivalent break-even PAYG system but with gains slowed down temporarily by falling interest rates in recent years.

Finally, Chile's system of pre-funding enables the assessment procedure to include participation by private AFPs and insurance companies, which have a strong interest in controlling costs. Their pressure toward strict application of the rules and their right to appeal initial evaluations have the effect of reducing the incidence of insured disabled cases. Our calculations of hazard and survival rates, using a retrospective data set of new and old system affiliates (EPS 2002) show significantly lower hazards of becoming disability pensioners in the new system. These hazards are cut by 65-80%, compared with the old system. This is consistent with lower observed age-specific incidence of disability and disability insurance fees in Chile as compared with publicly managed systems in other countries. Comparisons of mortality rates among new and old

system disability pensioners suggest that this reduction in disability hazard is achieved while targeting the most severely disabled.

Potential dangers in the system include the sensitivity to interest rate fluctuations noted above; the incentives for each AFP to try to cream the better risks while passing the bad risks on to other AFPs; and the fact that vigorous enforcement of the rules expands the partial and uninsured disability groups who end up being financed by the public treasury.

How can these lessons from Chile be adapted by other countries that are grappling with high disability costs in their traditional systems? We set forth three possible models that capture some of the cost-containment advantages of the Chilean scheme while avoiding some of its problems:

1. *Pre-funding and private insurance with risk-pooling and competitive bidding.* The first model applies to countries that already have or are considering retirement systems with individual accounts and plan to use a Chilean-type disability system. These countries could get the benefits of pre-funding and private participation while reducing the risk of creaming and interest rate sensitivity in their disability systems by placing workers in one large risk pool, as they are in the U.S. and other OECD countries today. In place of the decentralized provision found in Chile, the responsibility for the disability term insurance policy could periodically be auctioned off in a competitive bidding process to one company (or a small number of companies to which workers are randomly assigned). The company winning the auction would make the additional payment which, together with the worker's own account balance, would finance the disability defined benefit.²⁹ Both publicly-appointed experts and insurance company representatives would participate in the assessment process, similar to the procedure in Chile. But, since everyone would be in the same pool, this company would not be able to select workers and, since the contract would be long-term, fee fluctuations tied to the interest rate would be smoothed.

However, insurance companies might charge a high risk premium to compensate for interest-rate smoothing if the contract period is long. Moreover, a monopoly insurance provider might have little incentive to monitor claims and eligibility carefully, hoping to cover higher costs by higher fees in the next round of bidding. Each AFP would also have

little incentive to control costs, since any savings would be shared by the entire pool. In that case, the shift toward a single pool might reduce selection but would also reduce oversight and thereby raise costs over-all. Notably, the Chilean government is currently proposing the adoption of such a system, apparently trading off cost minimization under the current system for other goals such as uniform prices across individuals and through time.

2. *Pre-funding and private insurance, only until normal retirement age.* As a variation on this theme, insurance companies might finance the disability pension only until the normal retirement age (say, age 65 or 67), at which point the old age benefit would take over. This switch at the normal retirement age is roughly consistent with current practice in the US. In this case, the individual's money would remain in his or her account, collecting returns, until normal retirement age. At that point, the disability annuity would cease and the individual would be treated similarly to a normal retirement pensioner. This variation would imply less uncertainty for the insurance company and less incentive for older workers to apply for disability benefits, because the disability annuity would cover a shorter time period and have a specified termination date. Both of these would reduce disability costs. But some workers would see their benefits fall substantially when they reach normal retirement age, if the old age pension is lower than the disability pension. If part of the normal retirement pension is PAYG, this variation would imply a smaller shift to pre-funding (i.e. the premium to be paid up-front would only cover a short-term disability annuity), therefore lower fees in the short run. However, in the long run fees for the system as a whole would be higher.

3. *Public provision, mimic private participation.* The third option is to use a government agency, rather than private companies, to provide disability benefits. In a country with individual accounts, the agency would take the balance in the accounts of disabled workers and pay the defined benefit. This system would be partially pre-funded by the money in the accounts, but the rest of the benefit would be financed on a PAYG basis. (In a traditional system with no individual accounts, finance would be completely PAYG). Because of the smaller amount of pre-funding, short run fees would be lower and long run fees higher than in a Chilean-type scheme. Costs would be less sensitive to interest rate variations, but more sensitive to population aging, than in a funded scheme.

Among countries with individual account systems, this method was used in Hungary and Croatia--to avoid transition costs. Latvia, Estonia and Sweden use this method only until normal retirement age, at which point disabled workers are treated like normal retirees.

The reliance on public management rules out cost controls due to private participation in the assessment procedure. Nevertheless, it might be possible to adapt some elements of the Chilean process by introducing countervailing force, even without the profit motive. For example, the public agency responsible for the program could be given the right to appeal approved cases, or to oppose claimants' appeals, represented by lawyers who have an incentive to win their cases. This would increase the probability that both sides would be forcefully presented, which might save money and lead to greater accuracy at the same time. (See similar recommendations by the US Social Security Advisory Board (2001) and Autor and Duggan (2006)).

Finally, a caveat: By using private participation, Chile has cut costs, apparently in a reasonably accurate way, but we don't know whether it has picked the "right" mix of benefits versus costs, false positives versus false negatives, and pension size versus incidence. Disability is hard to define and probably consists of a continuum rather than an on-off switch. Value judgments are involved in where to draw the line and with which trade-offs. Chile's very low hazard rates suggest it has chosen to minimize type 1 errors (false positives) at the possible expense of more type 2 errors (false negatives). Its low private costs may eventually spill over into higher public costs via the MPG, which sets a pension floor using looser criteria. Some societies might wish to grant disability benefits more liberally, even though this will cost more and may involve more false positives. Or, for a given outlay, they might wish to pay lower benefits to a higher proportion of claimants.

Other countries, however, already consider their current disability hazard rates and costs excessive, in the sense that they impose heavy burdens on non-disabled workers and employers. The experience of Chile suggests that these costs can be contained, while targeting the most disabled more accurately, by prefunding, by private participation in the assessment procedure, and/or by adopting processes and incentives that mimic private participation.

Appendix 1: Contracts that share risks between AFPs and insurance companies

The pools of workers in each AFP (ranging from 150,000 to 1.5 million) are large enough to enable them to bear the risk stemming from differences in individual characteristics. The AFP is well placed to keep this risk low—it monitors the assessment procedure, handles the initial application by workers, can steer them toward other programs (such as accident insurance) when feasible, and can direct its marketing efforts toward low risk workers. If the main risks in the disability program stemmed from differences across individuals, AFPs could cover the top-up to finance the defined benefit without the involvement of insurance companies.

However, AFPs are not well structured to bear the risk of extreme outcomes, which usually stem from systemic variables that are non-diversifiable and are correlated across individuals as well as AFPs. For example, the successful claims rate for the system as a whole rose sharply between 1997 and 1999, raising the total additional payment for most pension funds. As a second example, between January 2002 and October 2005 the interest rate fell from 5.6% to 3.1%, a 2.5 percentage point drop. Holding the account balance constant, this would have raised the necessary capital by over 40% and the required top-up by much more, due to the leverage factor described previously.³⁰

In these cases, costs can rise sharply. To make credible promises in the face of this uncertainty, AFPs would have to meet capital and reserve requirements set by the insurance regulator; i.e. they would have to become or to contract with insurance companies. Insurance companies can and do hedge part of the interest rate risk by investing their reserves in long term bonds that will rise in value if interest rates fall. They can cross-subsidize temporary losses from other insurance products whose profits are negatively correlated with disability insurance profits. Finally, they can reinsure or use the owner's equity capital in the reserves.

Therefore, to ensure that disability obligations will be financed, since 1987 AFPs have been required to take out a group policy with a life insurance company that guarantees the additional payment and temporary pension. This contract varies among AFPs but basically it embodies risk-sharing such that the AFP covers all costs up to a ceiling while the insurance policy manages most payments and finances the tail of the

distribution. The expected cost is passed back to worker as part of the AFP's administrative charge, but large unexpected increases in fees are avoided in the short run.

Specifically: a typical contract includes a *provisional rate*, which determines the proportion of the wage bill that is transferred to the insurance company each month. This money is used by the insurance company to pay the temporary pension after the first assessment and make the additional payment after the second assessment. If actual claims exceed this provisional rate, the AFP transfers more money to the insurance company, up to a *maximum rate* that is specified in the contract. The insurance company pays for anything above the maximum. The ceiling for disability plus survivors' insurance was less than .9% of wages for most contracts until the late 1990's, but as claims ratios rose and interest rates fell the maximum rate increased, and it now ranges between 1-1.25% of wages. A *participation rate*, generally between 90% and 100%, specifies the proportion of savings that are kept by the AFP if actual claims are lower than the maximum; the insurance company keeps the rest. The maximum rate and participation rate determine the degree of risk-sharing between the two organizations. The insurance company is compensated for its risk by participating in good claims experience, by keeping most of the investment return on the provisional premiums before they are spent (the rest is shared with the AFP), and by a flat monthly fee paid to it by the AFP. Of course, if costs rise above the ceiling and this is expected to continue, the insurance company will demand a higher provisional and maximum rate and a lower participation rate when the contract comes up for rebidding. But in a competitive market the company cannot recapture its loss on the previous contract and AFPs have an opportunity to plan for the higher costs that are coming.

Since 1987 regulations have been in place to make the annuity market transparent and avoid agency problems that might arise when the AFP chooses the insurance company, passing the costs on to workers.³¹ A public competitive bidding process must be used to choose the insurance company that makes the additional payment. The AFP must send to the regulator (the SAFR) a comparative analysis of the cost of each bid and any other factors that led to its final choice. Regulations specify the interest rate and mortality tables that must be used in calculating the additional payment for each disabled worker.³² Once the additional payment is placed in the account, workers are given a

choice among all annuity or PW providers. However, the insurance company that made the additional payment must stand ready to provide a simple immediate life annuity at the 70% (or 50%) defined benefit level, in exchange for the money in the account.³³ Our analysis of contracts indicates that since 1987 AFPs have changed insurance companies frequently, less than half of the contracts written have involved an ownership relationship between the AFP and the insurance company, there is no apparent difference in the contract terms between those with and without such a relationship, and the fee charged for D&S insurance has been relatively low, as already demonstrated.

AFPs usually give insurance companies information about the gender, age, and regional distributions of their members, family groupings, account balances and historical claims rate. They are likely to get a lower maximum rate if these factors indicate a lower incidence of disability. This may lead to attempts to cream the good risks, as discussed above. The bottom line in this risk-sharing arrangement—while extreme outcomes are insured, AFPs still have the major responsibility for financing disability benefits and a big incentive to control costs.

Appendix 2: Kaplan-Meier Survival Function

The Kaplan-Meier survival function shows us the cumulative probability ($CumS_{age_t}$) that an individual who is a member of the “at risk group” will remain without a disability pension to a given age, t. It is obtained by multiplying the single-year survival rates for all preceding ages, up to and including age t. We define the “at risk” group at a given age as all individuals who reached that age without a disability or old age pension and the hazard of dropping out as a disability pensioner is the proportion of the at-risk group who became a new disabled pensioner at that age. These are the “failures” and the rest are “survivors.”

$$CumS_{age_t} = CumS_{age_{t-1}} * S_{age_t} \text{ where:}$$

$$Atrisk_{40} = \text{All non-pensioner affiliates at start of age 40}$$

$$failures_{40} = \text{number of newly disabled at age 40}$$

$$S_{40} = \text{Survives at age 40} = 1 - \frac{failures_{40}}{Atrisk_{40}}$$

$$Atrisk_{41} = Atrisk_{40} - failures_{40} - dropouts_{41} + newentrants_{41}$$

$$dropouts_{41} = \text{number at risk age 40 who become old age or early retirement pensioners between 40 and 41}$$

$$newentrants_{41} = \text{number of new entrants to system between age 40 and 41}$$

$$S_{41} = 1 - \frac{failures_{41}}{Atrisk_{41}}$$

The initial “at risk” group at the start of age 40 is the total number of individuals who were in the system at 40 and had not yet pensioned. Individuals who take a new disability pension during age 40 are considered a “failure” and the survival probability for age 40 = $1 - \frac{failures_{40}}{Atrisk_{40}}$. The “at risk” group at the start of age 41 is the total number

of individuals who were in the system at 41 and had not yet pensioned. This equals the number at risk at 40 - failures at 40 - dropouts for an old age pension or death during age 40 + new labor market entrants during age 40. The survival rate at 41 = $1 - \left(\frac{failures_{41}}{Atrisk_{41}}\right)$

and the cumulative survival rate at 41 = $CumS_{40} * S_{41}$. And so on.

Appendix 3: The Cox proportional hazard model

The Cox proportional hazard model is based on the assumption that the hazard, $h(t)$ (defined as the proportion of the population at risk that becomes a newly disabled pensioner at age t), is:

$$h(t) = e^{X_i\beta}h_0(t) \quad (1)$$

where:

$h(t)$ is the hazard, given the values of co-variables

$h_0(t)$ is the baseline hazard, setting co-variables to zero

X_i is a vector of covariates

β is a vector of parameters to be estimated.

Dividing both sides of the equation by $h_0(t)$ we obtain

$$h(t)/h_0(t) = e^{X_i\beta}. \quad (2)$$

That is, the model assumes that the effect of $X_i\beta$ is proportional over all ages covered by the baseline hazard, hence the term proportional hazard function. Our main object is to measure the impact of the co-variate “*new system*,” which we represent by a dummy variable equal to 1 for those affiliated to the new system. In other words, we want to test the null hypothesis that individuals of the same age have the same disability hazard in the two systems. A β different from zero (or an exponentiated β different from 1) would lead us to reject this hypothesis. We control for other co-variables such as *unemployment rate* that may have direct effects on the hazard of disability and may be correlated with new system. In each case, estimated coefficients give the amount by which the baseline hazard must be multiplied to obtain the new-system hazard.

A proportional effect over all ages would imply that the ratio of hazards with and without co-variables is constant for all ages. Initial estimates indicated that the proportionality assumption does not hold for all ages for our data. Therefore, we changed the model specification, splitting the hazard into five sections (40-44, 45-49, 50-54, 55-59 and 60-64) to make the proportionality rule applicable over pre-established sections. Instead of estimating one coefficient for the effect of *new system* we estimate five coefficients, one for each section. Tests further showed that disability hazards vary by sex and marital status, so we estimate the model stratified by these two variables. In other words, we allow for differences in the baseline (old-system) hazard between men and women, married and singles, while holding constant the covariate coefficients. The estimated baseline hazards are lower for women and for married individuals.

Appendix 4: Alternative explanations for lower disability hazards

Changing unemployment rates. It is often observed that disability claims rise during periods of unemployment, as individuals lose their jobs, can't find new ones and may try to avail themselves of disability benefits. Then, if unemployment rates were higher during earlier periods, this could help explain the higher disability rates observed for the old system.

We were able to disentangle the effects of new system and unemployment for two reasons: First, there is a fair degree of overlap in the years at risk and years of pensioning of old and new system affiliates, albeit at differing ages. Most time occurred in the 1980's and 1990's and most pensioning took place in the 1990's, for both systems. Additionally, the Chilean economy went through cyclical upturns and downturns both before and after the reform. Unemployment was low through the 1960's, reaching 3% in 1973, then rose sharply to 23% by 1982, during a period of economic chaos and hyperinflation. Post-reform, the economy went through a period of prolonged growth during which unemployment fell to 6% by 1995 but then rose during a cyclical downturn, reaching 14% by 2002. The existence of a complete business cycle during the 1980's and 1990's is important because it reduces the correlation between the reform and unemployment rates.

In earlier work on old age pension probabilities, we found that age-specific probabilities of pensioning rose during periods of high unemployment—but this did not change the reform effect. That is exactly what we found here, for disability pensioning. Individuals at risk in periods of higher unemployment have a larger hazard of becoming a disability pensioner. Specifically, in our main specification (col. 1, Table 4) this probability rises 5-9 percentage points for each one percentage point increase in the unemployment rate for individuals in their 50's. (But in another specification, which includes older cohorts who worked in earlier years, the unemployment rate becomes insignificant; apparently this variable is highly sensitive to choice of cohorts and time period.) However, the new system effect barely changes when unemployment is in the equation--in fact, it become stronger for some ages (compare columns 1 and 2 in Table 4).

Level of education. Individuals with more education might be less likely to file for disability, as their income from work is higher, their accounts larger so gains from disability insurance smaller in the new system and their jobs might be more amenable to avoiding disability. Average education levels rose rapidly over the past three decades in Chile, as the modal schooling level increased from primary to completed secondary and many Chileans acquired some higher education. Yet, when we entered person's years of education or secondary degree into the hazard model, it was never significant and did not change the reform effect. Our regressions in Table 4 therefore do not show level of education as a co-variate.

Job safety and general health conditions. On average, jobs for new-system affiliates may be safer than jobs for old-system affiliates and general health conditions may have improved, as a result of broader economic growth and its allocation to health and safety. This might reduce disability inflow rates in the new system. While job accidents are covered under a separate program from the general disability program under discussion in this paper, no such distinction was made in the EPS data, so this potential explanation remains. Moving in the opposite direction, the definition of disability has evolved to include mental as well as physical health, and the former constitute an increasing proportion of the total, which might increase the disability hazard in the new system. We do not have a variable that captures these changes on a year-to-year basis in our regressions. However, if improved job safety and health is the explanation, we might expect the new-system advantage to increase when we shift our sample to include cohorts further back in time--born after 1922 rather than 1932—but we find that the opposite happens (see col. 4, Table 4).

New eligibility rules and selection bias. In the new system, to be covered by D&S insurance a must have contributed during the last 12 months and also paid at least 6 contributions in the year immediately preceding the last registered contribution. In the old system, prerequisites are different. For example, in the SSS (the largest program), workers need to have at least 50 weeks of contributions and a density of contributions over the entire membership period of 50% or more. In the Caja de Empleados Particulares (the second largest program), eligible workers must have contributed for at least 3 years, including at least one contribution during the last 24 months. In the Caja de

Empleados Públicos, the requisite is to have at least 10 years of contributions. In other words, in the new system younger workers with fewer years of contributions can qualify disability pensions more easily than in the old system, while workers who fulfilled the requirements for the old system in the distant past, but have worked less in the immediate past, could qualify more readily in the old system. However, we found disability rates to be lower for all age groups, 40-59 and even beyond, so new differential eligibility conditions do not appear to account for our results.³⁴

Perhaps more important, asserted employment from the distant past would be harder for officials to contradict in the old system. The new system placed a greater emphasis on the recent past, which was more readily verifiable. Also, temporarily, selection bias might have been at work. In 1982, older workers who thought that they were at high risk of applying for disability might have stayed in the old system, because they were uncertain how disability determinations would be made in the new system and whether they would meet the new eligibility requirements. This would have produced a relatively higher incidence of disability in the old system in the mid 1980's because workers with a higher propensities selected the old system, not because of declines in propensities in the new system. In fact, all the disability pensioning that took place prior to 1987 was in the old system. Therefore, we reran the Cox model, excluding all observations at risk and disability pensions that began between 1982-87, the period when selection based on disability propensities would have taken place. The new system impact remained significantly strong, except for ages 40-44 (col. 3, Table 4).³⁵

Survival bias. Given the retrospective nature of the EPS survey, we faced a potentially serious problem of survival bias. The survey is supposed to be representative of the universe of affiliates in the new and old systems between 1982 and 2001. Even affiliates who were dead by 2001 are included. However, our comparisons of reported versus expected deaths lead us to conclude that the problem of survival bias is potentially large, and the number of missing dead people may be especially large if we include cohorts born close to 1922, for whom deaths were more likely. This bias would understate the hazard of becoming disabled, especially in the old system, whose members tend to be older, therefore more likely to have died. It would understate the gain from the new system (see James, Edwards and Iglesias 2007).

To minimize survival bias we cut off the cohorts included in the main analysis at birth year 1932, but we also show results including birth years 1922-31 (Table 4, col. 4). If survival bias is very great for older cohorts, inclusion of the 1922-31 cohorts might reduce reported disability rates for the old system and eliminate the reform effect. As expected, the baseline (old system) hazard becomes smaller and the new-system effect weaker when we extend our sample to the birth year 1922. However, the impact of the reform remains large and highly significant--a cut of about 60-70% at the 1% significance level or better for ages 45-59 and marginally significant for ages 40-44 (col. 4, Table 5). On balance, it does not seem that any of these alternative explanations could account for the consistently large estimated difference between the hazard of disability in the old and new systems.

Table 1: Simulation of Chilean disability insurance fee compared with PAYG fee, as % of wage, under various scenarios

	T_{CH}	T_{CH} if OwnC=0	% annuity covered by OwnC	T_{PAYG}	T_{CH}/T_{PAYG}
Base case: r=4.5%, g=2%					
1. end of yr 1	1.35%	1.36%	1%	0.08%	1688%
2. yr 14	1.15%	1.36%	15%	1.12%	103%
3. steady state	0.67%	1.36%	51%	2.73%	25%
Sensitivity analysis					
4. r=2% in payout stage	1.20%	1.91%	37%	2.73%	44%
5. r=2%--accum+payout stage	1.47%	1.91%	23%	2.73%	54%
6. r=6%	0.32%	1.14%	72%	2.73%	12%
7. r=4.5,g=3%	0.81%	1.47%	45%	2.92%	28%
8. contribution rate => 15%	0.40%	1.36%	71%	2.73%	15%
9. benefit rate => 50%	0.28%	.97%	71%	1.95%	14%
10. disability prob. doubles	1.34%	2.72%	51%	5.46%	25%
11. % old increases	0.96%	2.63%	63%	4.93%	19%

Source: simulation by author

Notes: This is simulated group insurance fee as % of wages for permanent disability in Chilean-style system, compared with insurance fee as % of wages for same benefit payouts in hypothetical PAYG system. Simulations use Chilean incidence rates (new accepted permanent disability claims/total contributors) and demographic structure of contributors, which are assumed to remain constant. Contribution rate is 10% and defined benefit for total disability is 70% of reference wage, with 60% of primary benefit to surviving widow of disabled worker. In 2004 only 60% of disabled workers were eligible for insurance, which reduces probability of insured accepted claims. Expected age of death = 80 for men, 84 for women, and wives are 3 years younger than husbands; calculations are for joint annuity purchased by husband, covering wife.

In base case rate of return on accounts and annuities is 4.5%, wage growth is 2% annually.

Row 1: results for end of year 1 of AFP system; eligibility within one year of joining is assumed but account accumulations and stock of disabled pensioners are small as system is new.

Row 2: results for year 14 of AFP system.

Row 3 and subsequent rows assume steady state.

In subsequent rows, base assumptions apply except for specified variable that is changed.

Row 4: r falls to 2% during annuity stage; accumulation value does not change.

Row 5: r falls to 2% during accumulation and payout stage.

Row 6: r increases to 6% during accumulation and payout stage..

Row 7: rate of wage growth increases to 3%.

Row 8: contribution rate is increased to 15%.

Row 9: defined benefit rate is cut to 50%.

Row 10: ratio of accepted disability claims/total contributors doubles.

Row 11: population aging: proportion of total contributors at each age under 43 is cut by 1% per year and raised by 1% per year for each age over 43, due to reduced fertility.

Col. 1: break-even insurance fee for additional payment to finance defined benefit, as % of wage.

Col. 2: insurance fee if retirement accounts = 0 (additional payment = necessary capital)

Col. 3: proportion of defined benefit financed by retirement account ((col. 2-col. 1)/col. 2)

Col. 4: fee as % of wage if same defined benefit were financed on PAYG basis for stock of disabled; stock equals sum of past inflow until age 80 for men+7 years at 60% for surviving wife.

Col. 5: ratio of insurance fee in Chilean-type scheme to PAYG insurance fee.

Table 2: D&S insurance premiums and D&S payouts as % of wage bill

Year	D&S premium/ wage bill	D&S benefits/ wage bill	D&S premium/ D&S benefits
1990	1.35%	0.84%	161%
1991	.98%	0.84%	117%
1992	.83%	0.79%	105%
1993	.76%	0.74%	103%
1994	.70%	0.77%	91%
1995	.58%	0.79%	74%
1996	.56%	0.72%	78%
1997	.56%	0.76%	73%
1998	.56%	0.80%	70%
1999	.67%	0.91%	74%
2000	.78%	0.99%	79%
2001	.74%	1.04%	71%
2002	.77%	1.11%	69%
2003	.95%	1.11%	86%
2004	.95%	1.29%	74%

Source: data from PrimAmerica, based on data from SAFP and SVS.

Notes: Col. 1 gives insurance premiums, as % of wages, by year, for Chilean group disability and survivors' (D&S) insurance policy that covers additional payment, provisional benefits and other expenses. This is an approximation, based on financial statements of AFPs regarding their payments to insurance companies.

Col. 2 gives annual D&S benefits paid to individuals who, in the past, filed successful claims under D&S insurance. See text and endnotes for derivation of these numbers.

Col. 3 gives ratio between the two.

Table 3: Inflow to disability benefit status, Chile vs. US and OECD, 1999
(new inflow, per thousand in insured population)

Age group	20-34	35-44	45-54	55-59	60-64
Chile	.2	.9	2.9	7.2	12.3
US	2.7	4.5	7.8	13.9	12.8
OECD	2.3	4.2	8.6	14.9	14.1

Source: OECD data from OECD (2003), p. 81

Chilean data calculated by authors from claims and assessment data supplied by Association of AFPs, contributor and member data supplied by SAFP. Only disabled who are insured are included here—in 1999 this was about 70% of those who were granted disabled status in Chile. Inflow to temporary disability status is given; inflow to permanent disability status would be about 3/4 as large, depending on age. Ratios are given as % of [(members + contributors)/2] since insured population includes some affiliates who are not currently contributing.

OECD numbers are newly disabled beneficiaries as % of population in the relevant age group, minus the stock of people in that age group who are already on disability benefits. The denominator includes some people who are not eligible for insurance. If this definition were used for Chile, Chile's disability inflow rate would be much lower.

Table 4: Estimates of Determinants of Hazard of Disability Pension

(Cox Proportional Hazard Stratified by Sex and Marital Status; numbers given are hazard ratios relative to baseline)

Covariate: Segment of the hazard over which effect applies	1932-62 cohorts	1932-62 cohorts	Exclude 1982-87	1922-62 cohorts
New System: Age 40 to 44	.355 (-2.71)*	.337 (-2.88)*	.579 (-1.24)	.497 (-1.83)***
Age 45 to 49	.21 (-4.12)*	.213 (-4.1)*	.145 (-4.41)*	.300 (-3.24)*
Age 50 to 54	.325 (-3.5)*	.307 (-3.71)*	.368 (-2.64)*	.383 (-3.14)*
Age 55 to 59	.296 (-3.23)*	.317 (-3.25)*	.299 (-3.18)*	.397 (-2.87)*
<i>Males</i> -Age 60 to 64	.493 (-1.63)***	.553 (-1.33)	.493 (-1.63)***	.638 (-1.24)
Unemployment: Age 50-54	1.054 (1.84)***		1.111 (1.99)**	1.010 (0.42)
Age 55-59	1.093 (1.98)**		1.094 (1.98)**	0.980 (-0.87)
#obs	8324	8324	8217	9623

* significant at 1% level or less

** significant at greater than 1% but less than 5% level

*** marginally significant at less than 10% level

Notes: Baseline differs by sex and marital status, but impact of co-variates relative to baseline is same for all. Numbers in parentheses are z-statistics.

**Table 5: Mortality of Disability Pensioners in New vs. Old Systems
(change in probability of dying by 2002 in percentage points)**

Probit regression, reporting marginal effects in percentage points

	Men + women		Men only	
	dF/dx	z	dF/dx	z
Age-2002	.06	2.65*	0.06	1.58
Yrs ed	-.14	-3.38*	-0.27	-4.01*
female	-2.22	-6.06*		
Disability	9.02	2.08**	16.56	2.4**
Dis86-9	-2.65	-2.03**	-3.81	-2.09**
Dis90-3	7.6	1.15	13.43	1.33
Dis94-7	-2.1	-1.24	-3.26	-1.48
Dis98-2	6.11	1.5	5.06	1.03
New sys	-.3.73	-7.08*	-5.10	-6.07*
Dis*newsys	12.78	3.15*	17.79	3.06*
# obs	7674		4429	
Pseudo R2	.085		.078	
Prob>chi2	0.00		.00	
Obs P	3.47		4.54	
Pred P (at x-bar)	2.58		3.63	

dF/dx is for discrete change of dummy variable from 0 to 1

z and $P > |z|$ correspond to the test of the underlying coefficient being 0

* = significance level < 1%

** = significance level > 1% and < 5%

Dis86-9 = started disability pension 1986-89 or after, relative to 1982-85

Dis90-3 = incremental effect of starting disability pension 1990-93 or after; this is added to Dis86-9 to get total effect for 1990-93. And so on.

New sys = new system affiliate

Dis*newsys = disability pensioner in new system

Table 6: Estimates of Determinants of Hazard of Death after Disability Pension
(Cox Proportional Hazard Model; hazard ratios relative to old-system baseline)

Covariate: Segment of the hazard over which effect applies	1932-62 cohorts Full Sample Baseline Differs by Sex	1932-62 cohorts Men Only
New System: 1-3 years after pension	.72 (-0.40)	1.04 (0.04)
4-7 years after pension	10.21 (2.07)**	7.82 (1.78)***
8-15 years after pension	6.75 (1.90)***	6.75 (1.90)***
#obs	172	120

* significant at 1% level or less

** significant at greater than 1% but less than 5% level

*** marginally significant at less than 10% level

Notes: Numbers in parentheses are z-statistics.

Table 7: Variation in Incidence of Disability, by Age and Other Characteristics, 2004

Age		Region and gender	
30	.05%	Greater Santiago	.15%
40	.12%	Region 6	.21%
45	.21%	Region 8	.26%
50	.41%	Women	.11%
60	2.2%	Men	.24%

Source: calculations by authors based on data provided by Association of AFPs, 2004.
Rates are for newly accepted permanently disabled claims/contributors in relevant group.

Table 8: Variation among AFPs—claims, approvals and appeals, 2004*

AFP	First (temporary) assessment				Second (permanent) assessment		
	Claims (& approval) rate per000	Appeals rate(%)	Success rate(%)	Over-turned rate(%)	Appeals rate (%)	Success rate(%)	Over-turned rate (%)
Cuprum	2.6 (1.2)	28.9	38.6	11.2	22.5	30.3	6.8
Habitat	4.0 (1.5)	25.8	34.5	8.8	15.5	27.9	4.3
Provida	4.9 (1.6)	25.8	35.9	9.3	16.9	24.4	4.1
Santa Maria	3.7 (1.4)	26.0	39.1	10.2	18.0	19.1	3.4
Planvital	5.5 (1.9)	26.0	38.8	10.1	19.7	28.0	5.5
Summabans.	3.3 (1.3)	30.1	29.9	9.0	21.7	26.2	5.7
Total	4.2 (1.5)	26.4	35.8	9.5	17.9	25.5	4.6

Source: calculations by authors based on data from Association of AFPs 2004.
Notes: Claims rate is number of applicants for disability per 000 contributors.
Approved rate is number of approved insured cases per 000 contributors.
Appeals rate is number of appeals by AFPs as % of approved covered claims.
Success rate is successful appeals by AFPs as % of all appeals.
Overturned rate is successful appeals by AFPs as % of approved covered claims.

Table 9. Numbers and size of disability policies in AFP system (stock of annuities and programmed withdrawals (PW))—selected years

	Total disability pensioners	% annuitants	Average monthly annuity (UF)	Average monthly PW (UF)
1988	3,294	26.4%	7.8	4.5
1990	6,785	39.6%	10.5	4.4
1992	7,196	41.7%	10.5	5.3
1994	8,295	40.7%	9.9	5.9
1996	11,931	36.4%	10.2	5.7
1998	15,875	35.9%	10.5	5.6
2000	20,281	40.6%	10.5	6.2
2002	26,809	40.7%	10.8	5.9
2003	29,826	40.4%	10.8	5.8

Source: data from PrimAmerica, based on data from SAFP and SVS.

Notes: About 85% of disability pensions are for total disability (proportion has been declining incrementally through time). Average size given is for pensioners on total disability. These numbers do not include disabled beneficiaries covered directly by their AFPs pre-1987 under an arrangement called “cubiertas por seguro.” UF is Unidad de Fomento—the price indexed unit of account commonly used in Chile. In 2002 1UF=about US\$25 so average monthly annuity was about US\$270 and average monthly programmed withdrawal pension was about US\$150. The MPG has been 4.46UF at age 60/65, 4.86UF at age 70 and 5.1UF at 75.

Table 10: Percentage of programmed withdrawal pensioners at MPG level, 2003

	% receiving MPG (1)	% increasing PW to MPG floor (2)	Following PW formula or voluntary reduction (3)	% at MPG level (1+2)	Total number (5)	Number on MPG from govt. (6)
Total disability	25%	53%	22%	78%	13,719	3,412
Partial disability	19%	64%	17%	83%	2,800	532
Survivors	19%	53%	28%	72%	65,551	12,517
All PW pensioners	15%	55%	30%	70%	173,278	25,528

Source: data provided by Superintendencia de AFP (SAFP) and calculations by authors.

Notes: This table shows the proportion of pensioners who already receive the full MPG from the government (col. 1); those who are still drawing down their own accumulations but at an accelerated rate in order to stay above the MPG floor (col. 2); and those who are following the PW formula above the MPG level or have voluntarily reduced their payouts, perhaps for tax reasons, while remaining above the MPG (col. 3). Survivors include 1) survivors of D&S insurance (that is, widows and dependent children of workers and disabled beneficiaries) and 2) recipients of joint annuities purchased by retired workers. More than half are from D&S insurance. This table applies only to programmed withdrawal pensioners. About 60% of all disabled beneficiaries are on PW. Annuitants are much less likely to be at the MPG level.

Figure 1: Simulated Disability Insurance Fee in a Chilean-type Scheme vs. a PAYG Scheme, by System Maturity

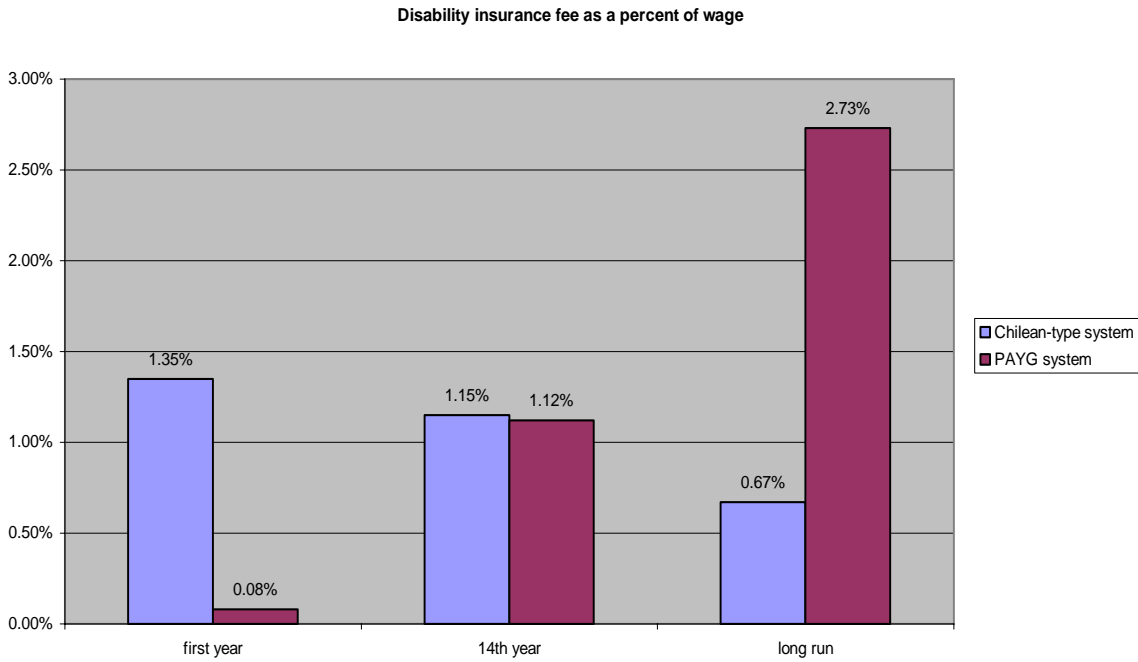


Figure 2: Simulated Percentage of System Annuity Premiums Covered by Retirement Accounts of Newly Disabled, by System Maturity

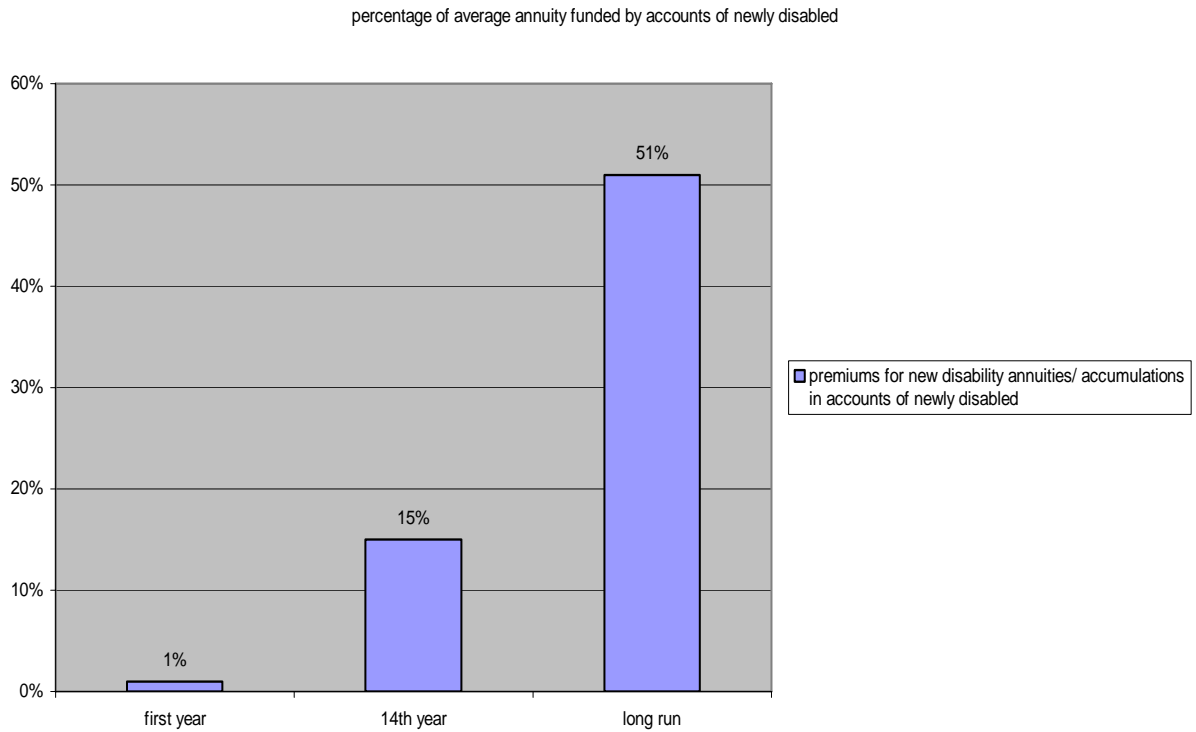


Figure 3: Simulated insurance fee as % of wages in Chilean-type and PAYG Systems: Sensitivity to interest rate changes and population aging

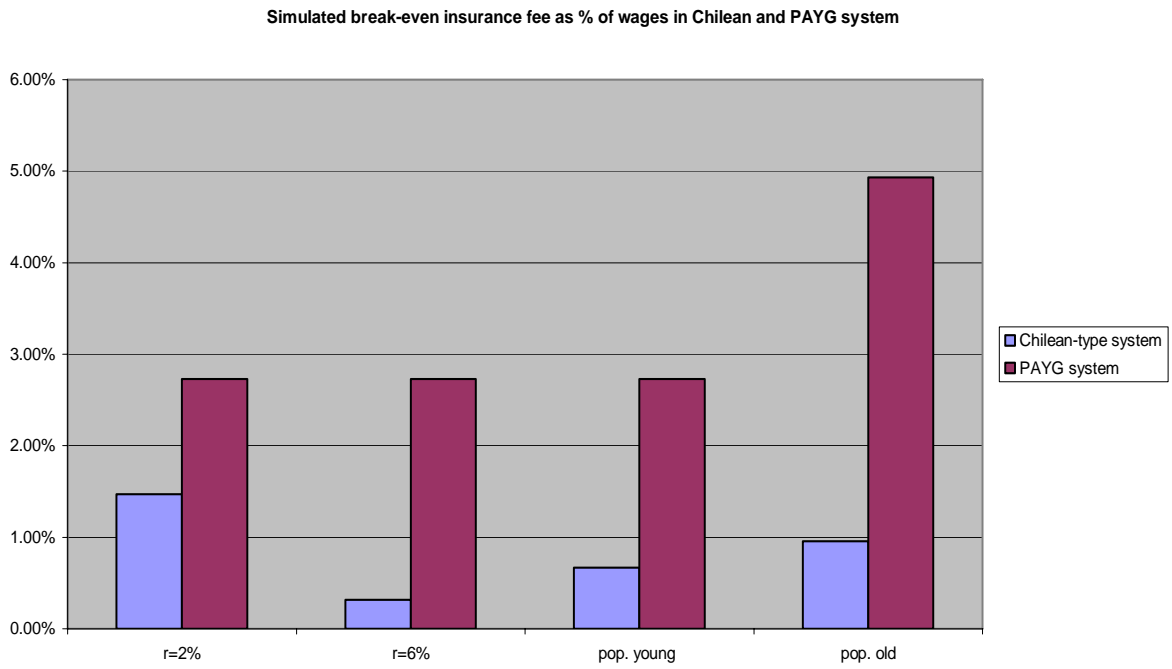


Figure 4: D&S Insurance Fee and Payouts as % of Total Wage Bill, 1990-2004
 (See Table 2 and text for derivation of numbers).

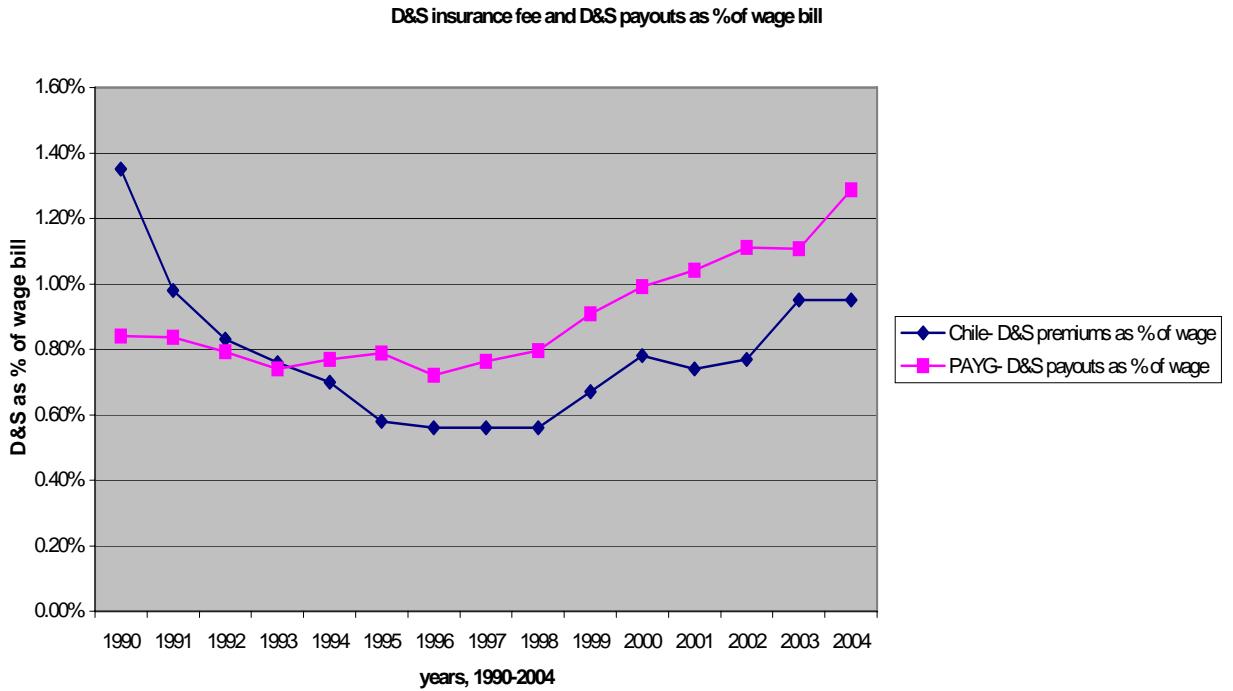


Figure 5: Annual D&S Fees: Ratio of Chilean/PAYG Models, 1990-2004

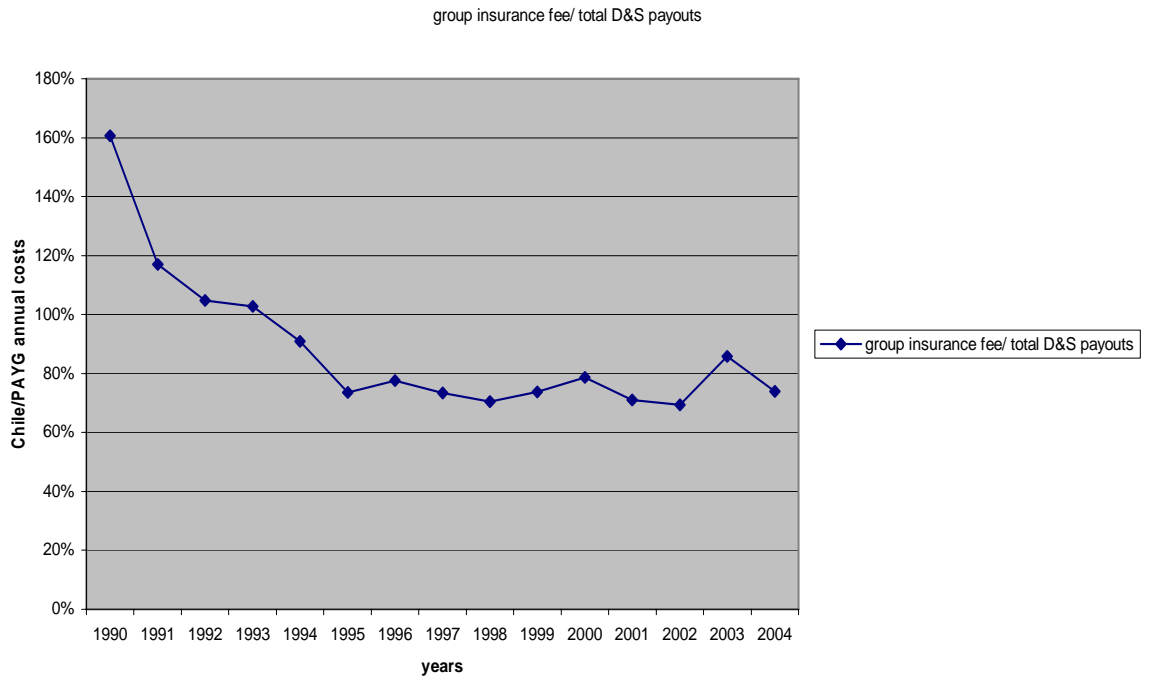


Figure 6: Kaplan-Meier Survival Rate as Non-Disability Pensioner, Old vs. New System

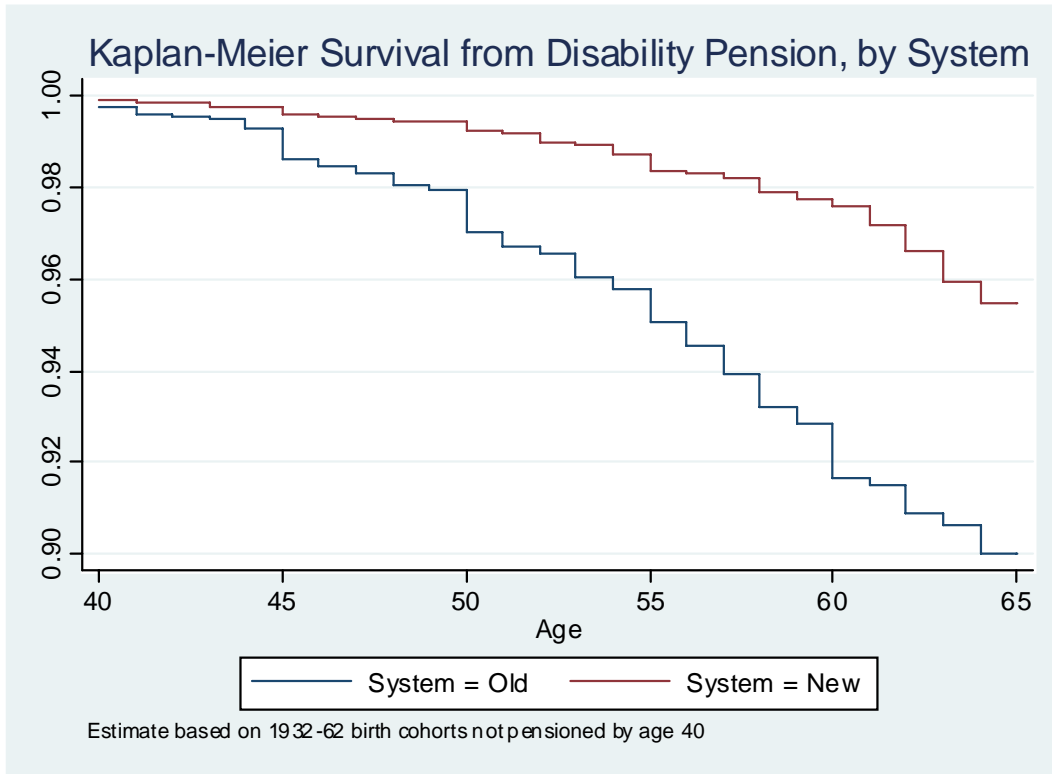


Figure 7: Baseline disability hazards by gender and marital status

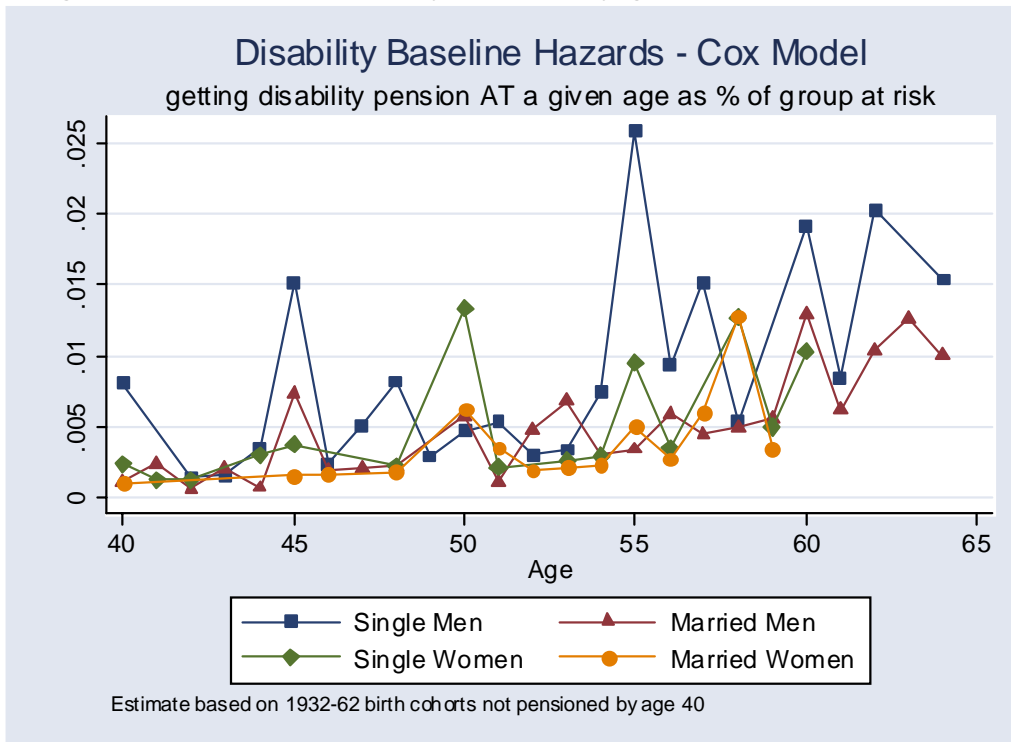


Figure 8: New vs. old system disability hazards for married men

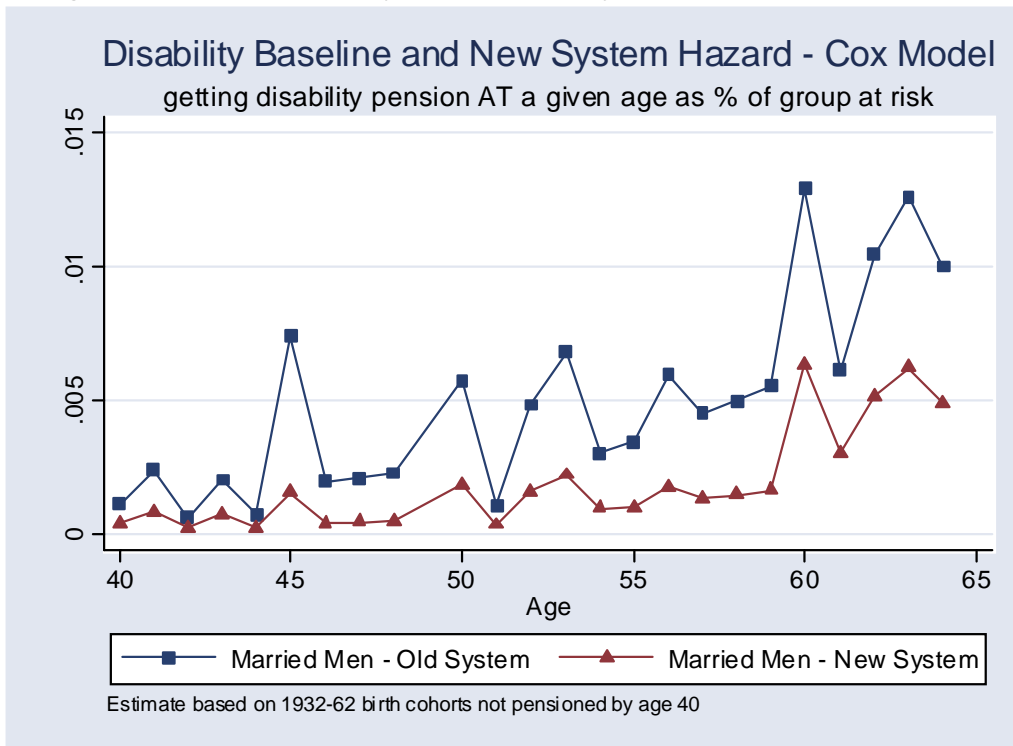


Figure 9: Survival as non-disability pensioner, married men—Cox model

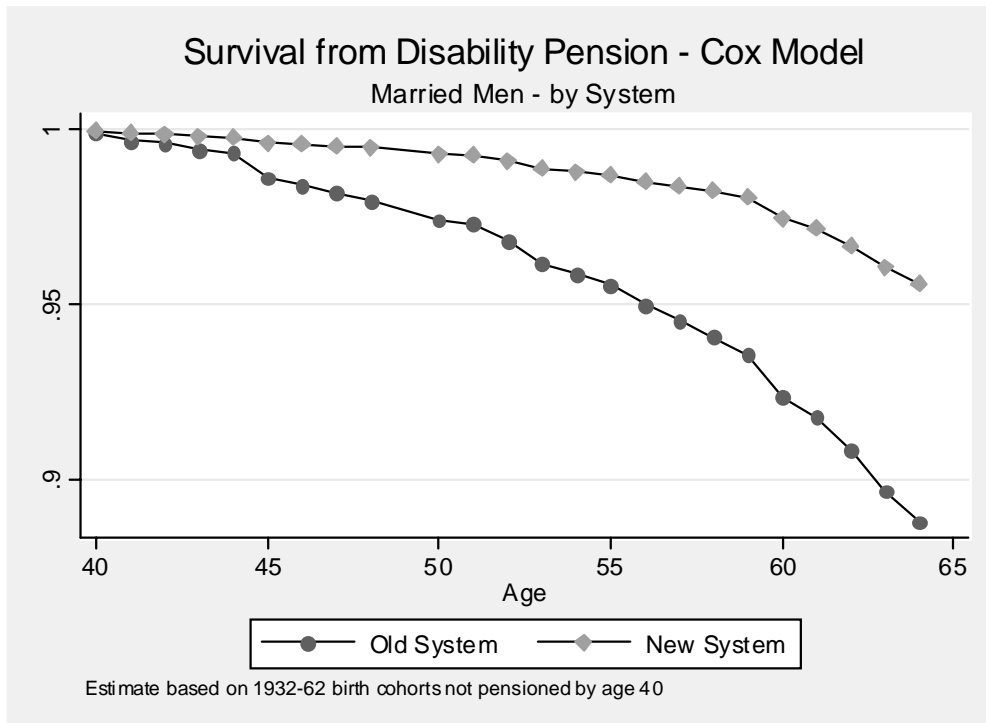


Figure 10: Kaplan-Meier: Survival rates (not dying) by disability status and system

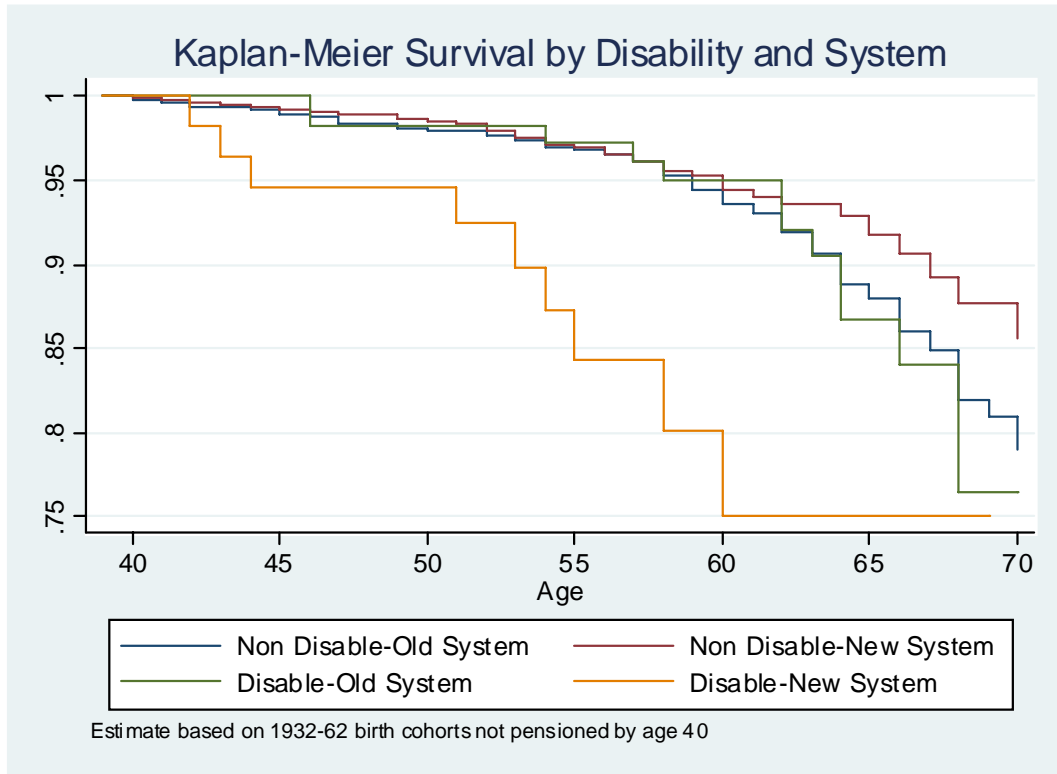


Figure 11: Death hazard among disability pensioners, by system

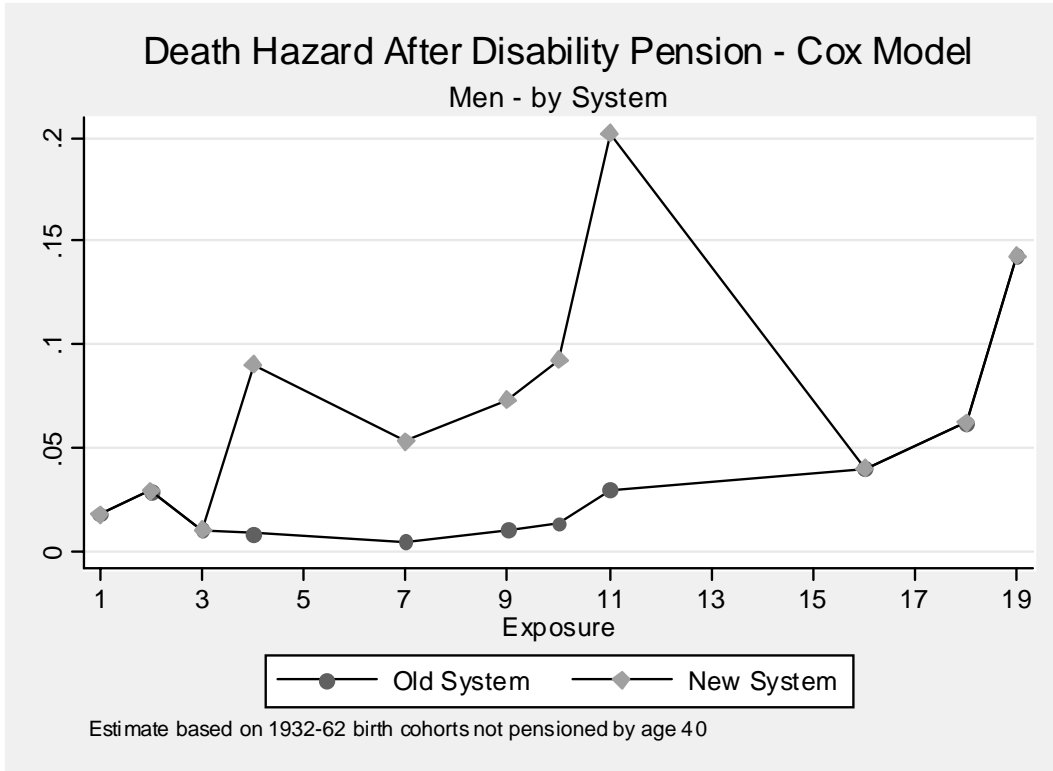


Figure 12: Survival rates among disability pensioners, by system

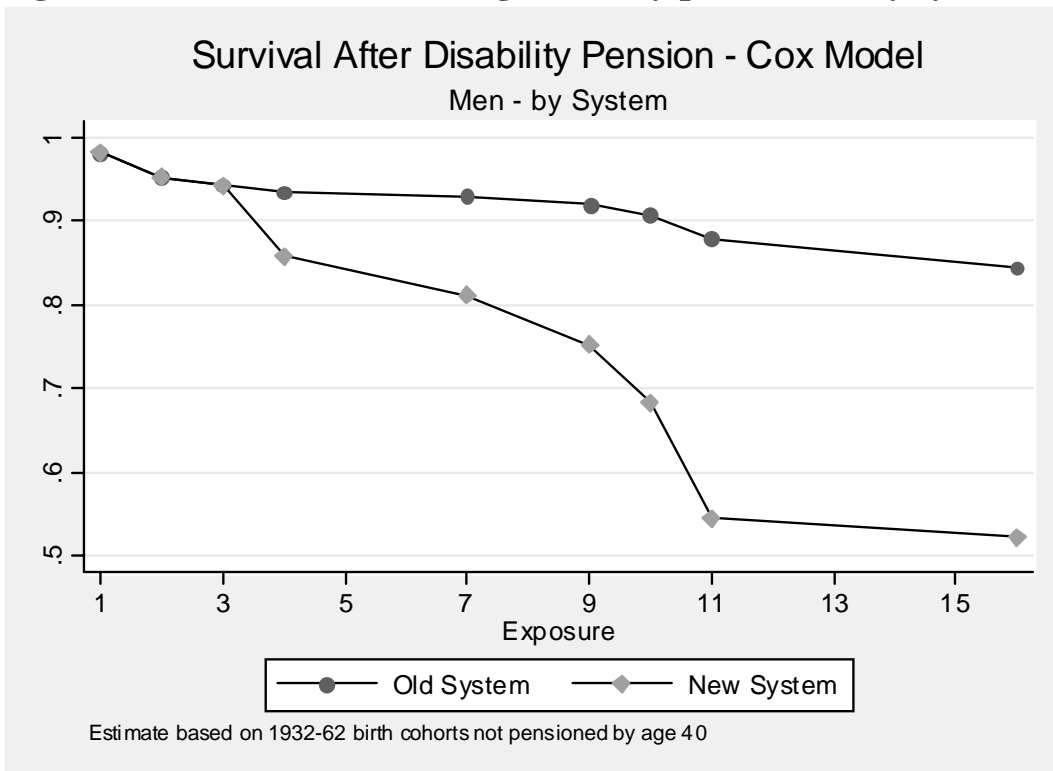
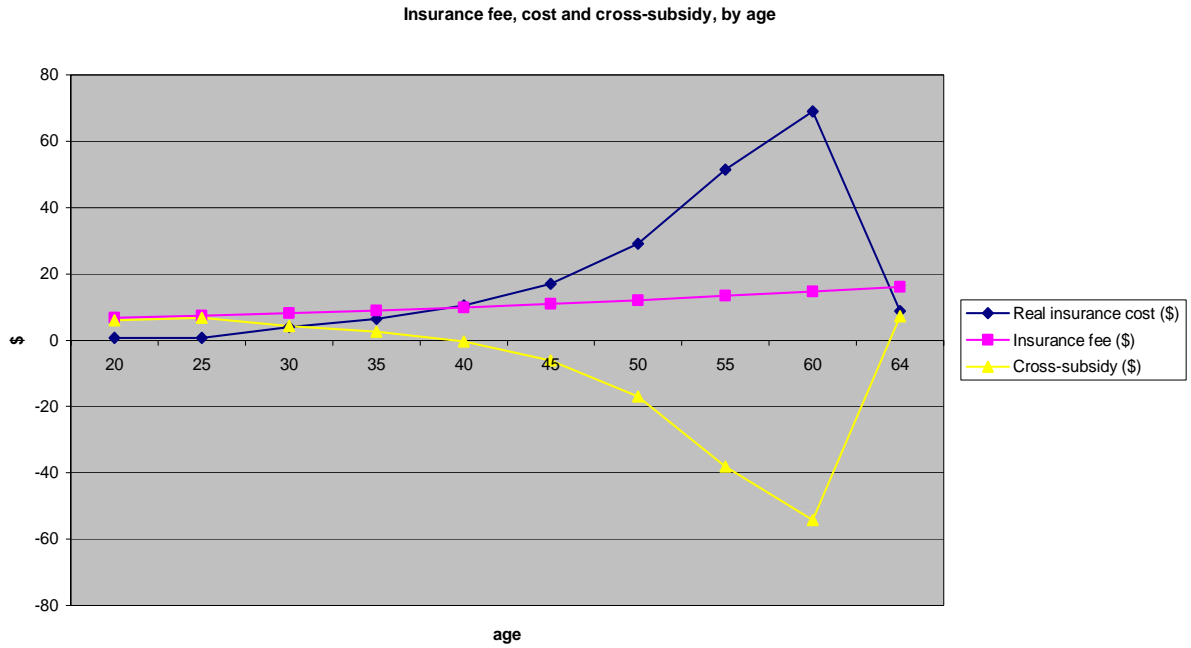


Figure 13: Simulated Difference between Real Insurance Cost and Fee, by Age*
 (wage at 20 = \$1000; see text and Table 1 for assumptions)



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Endnotes

¹ For previous discussions of disability insurance in Chile and other countries with individual accounts see Grushka and Demarco 2003, Castro 2004, Wiese 2005, Valdes and Navarro 1992.

² Annuities last the entire lifetime, thereby providing longevity insurance. Programmed withdrawals have the same expected present value as annuities but their monthly payouts are more front-loaded. They do not provide longevity insurance (that is, the money in the accounts may be exhausted before death) but do give the worker bequest rights over any money left in the account if he should die. Currently, 40% of disabled pensioners have annuitized, a much smaller percentage than for the system as a whole. For more details on payout modes see James, Martinez and Iglesias 2006.

³ For expositional simplicity, we abstract from differences across AFPs in this section. We focus in the cost of insuring permanent disability and abstract from (1) other insurance costs such as provisional pensions, (2) contributions paid back to workers who are not declared permanently disabled and (3) recognition bonds that the Chilean government paid into the accounts of new pensioners, in exchange for their service in the old pension system.

⁴ Other characteristics, such as income, education, occupation and DNA may also enter into the correct mortality schedule. However, the only characteristics now specified by the SAFP in setting the allowable mortality tables are gender and age. For simplicity, we assume that the same interest rate is earned during the accumulation and payout stages and this is constant for all workers, insurance companies, AFPs and time periods.

⁵ For example, suppose the interest rate for annuities suddenly falls from 4.5% to 2%, while everything else remains constant. Then, our simulations show that the necessary capital per unit of wage for a 50-year old worker rises by \$4.6 (from \$11.1 to \$15.7), an increase of 41%. The additional payment also rises by \$4.6 (from \$6.5 to \$11.2)—but this is an increase of 72%. In reality, everything else won't remain constant; the balance in the worker's account will increase in the short run, due to rising bond prices as interest rates fall, and this covers part of the higher necessary capital. But in long run steady state, after the temporary capital gains period has passed, the additional payment must rise even more, since worker's own-capital will be smaller due to the lower rate of return during the accumulation stage.

⁶ An offsetting factor, not included in these calculations, is the cost of temporary disability, which is not pre-funded and which therefore reduces the interest-rate sensitivity of the system over-all. Interest-rate sensitivity might be further smoothed over time by longer-term contracts between AFPs and insurance companies, but at the expense of a higher risk premium that the companies are likely to demand. It is also possible that AFPs will absorb some of the temporary cost changes if they believe that affiliates will react to price volatility or that political criticism will be stimulated by increases in fees—the latter is likely to be the case currently. However, ultimately the high interest rate sensitivity of the cost of insuring a funded defined benefit will be difficult to avoid.

We may contrast this Chilean arrangement with funded defined benefit employer-sponsored retirement plans in the US and other OECD countries, which try to smooth fluctuations in required contribution rates by basing charges on assumptions about very long run rates of return. Experience has shown that these assumptions are often wrong, and may leave the pension system seriously under-funded. Chile avoids this problem in its D&S system by requiring the cost of the DB to change frequently, as interest rates change. The term contract between the AFP and insurance company sets a ceiling to the share of these costs that is borne by the AFP and its members and thereby partially smooths, over a limited period of time (typically 2-3 years); but the revised expected cost is passed back to workers when the contract is renegotiated.

⁷ As an example of the sensitivity of PAYG systems to population aging: in the U.S. the cash surplus of the disability insurance program has been decreasing for several years and will turn negative by 2014, several years earlier than the cash surplus of the old age program, according to the Intermediate assumptions of the social security trustees. This is mainly due to the fact that the baby boom generation has entered the age group 50-65, at which point the incidence of disability increases sharply. Thus, population aging affects disability costs sooner than it affects normal retirement costs in a PAYG system. (U.S. Social Security Board of Trustees 2005).

⁸ Table 2 does not compare disability costs alone, since reported insurance premiums combine disability and survivors' (D&S) costs. To compare the D&S insurance premium in Chile with that which would be charged if all D&S benefits were paid on a PAYG basis, we need data on total annual D&S benefits paid to individuals as a result of their coverage by the D&S insurance. However, the available data on D&S payouts in Chile include payments to survivors of old age and early retirement pensioners, financed by joint pensions purchased upon retirement. These benefits are not financed by D&S insurance so we exclude them from the comparison. We estimate that 36% of all D&S payouts were for disability and 64% were for survivors, of whom 54% were financed by D&S insurance. This means that 70% ($=36\%+54\%*64\%$) of the reported D&S payouts stem originally from D&S insurance.

The reported numbers on D&S payouts also include some disability beneficiaries who were not eligible for insurance (i.e. for the additional payment), although they were permitted to draw down their own accounts after being certified as disabled. These constitute about 30% of the stock of disabled individuals (40% of the new inflow in 2004) but only 20% of all payouts to the disabled. (We estimate the average benefit for the uninsured disabled is the same as the average PW benefit, which is about 2/3 of the average benefit including annuities). These payouts, too, should be excluded from D&S payouts, a reduction of $36\%*20\%=7\%$. Operating in the opposite direction, the temporary disabled are paid directly by their AFPs for 3 years and are not reported as recipients of D&S pensions. This group needs to be added back into the group that would have to be paid, in a PAYG system. This would add about 43% to disability costs or $36\%*43\%=15\%$ to total D&S payouts. The net impact of these three adjustments brings us to $70\%-7\%+15\%=78\%$ of reported D&S payouts as the implicit amount that would have to be charged if the same benefits that are paid today on a funded basis were instead financed on a PAYG basis. We report these adjusted numbers in Table 2 col. 2.

⁹ Fees in the early years would have been higher still were it not for the existence of recognition bonds—government payments into the accounts of new retirees to compensate them for their previous contributions to the old system—which were not included in these simulations. This reduced the additional payment and therefore the insurance fees that were passed on to workers.

¹⁰ Applications are rejected because individuals have lost less than 50% of their working capacity or are disabled by a labor accident or professional illness, in which case the disability is covered by a different program.

¹¹ The additional payment to cover the cost of the life annuity is made at the point when the disability is certified as permanent. In the few cases where the permanent claim is rejected, the AFP must place in the worker's account an approximation of the contributions he would have made during the 3 years of temporary disability, to maintain the size of his eventual old age pension.

¹² A common problem in disability systems is how to rehabilitate and provide work incentives for disabled workers. This poses a contradiction, because disability benefits are presumably paid to individuals who cannot work, if they work they may become ineligible for benefits and thereby become worse off, yet the economy is better off if they are encouraged and enabled to work.

Chile's system, like all others, reflects these contradictions. Members who receive provisional pensions may continue working while receiving the pension. If employed they must pay social security contributions. However, members who receive provisional disability pensions have little incentive to work and contribute, because if eventually granted permanent total disability status, as most are, the greater balance accumulated in the personal accounts during the transitional period will merely reduce the additional payment without improving the total pension. The Medical Board does not have to receive information about whether or not the worker has worked in the transitional period, but the AFP usually sends them this information in cases where work has continued. Thus, work is not necessarily held against the individual in the re-assessment procedure, but it may be, and at any rate the entire contribution rate will be a pure tax to him, in contrast to other workers who derive a direct benefit from these contributions. There are no deliberate rehabilitation facilities. All these factors will discourage work during the temporary period or encourage work in the informal sector where contributions are not paid.

Once the worker gets permanent disability status, he keeps it regardless of whether or not he works. This contrasts with many other countries where, eventually, individuals who work are taken off the disability rolls. (This was true, for example, in parts of Chile's old system). In this sense, the new Chilean disability system rewards work, as does the Chilean old age pension system (see Edwards and James 2006). However, workers who have withdrawn from the labor force during their provisional period may find it difficult to re-enter later on.

¹³ In the U.S., appeals can only be brought by workers whose initial claims have been denied, so appeals inevitably increase approved cases. This is exacerbated by the growing tendency of attorneys, who specialize in disability cases, to represent applicants in appeals. In 2000, only 38% of claims were approved initially, but the majority of those denied benefits appealed and more than half of all appeals eventually won. Therefore, 55% of all claims were eventually accepted. (Social Security Advisory Board 2001, pp. 8, 18, 19; Autor and Duggan 2006).

¹⁴ For example, a worker approaching age 65 who contributed for only the last ten years and earned a 5% rate of return would get a replacement rate of only 10% from his old age pension, but he would get 70% if he can qualify for a disability benefit.

¹⁵ The individual must 1) be working and contributing at the time of the claim, or 2) have contributed during the last 12 months and also paid at least 6 contributions in the year immediately preceding the last registered contribution. 3) Self-employed workers must have paid at least one contribution in the calendar month before the date of the claim. 4) In addition, he must not be a pensioner or be over the normal retirement age (65M/60W). Workers who are certified as permanently disabled based on medical criteria can withdraw their own money as an annuity or programmed withdrawal. But if they do not meet the criteria for insurance based on employment history they do not get the additional payment that would cover a 70% replacement rate—which would raise costs for others. These conditions are lighter than those in other countries with contributory schemes. For example, 3 years of contributions are typically required in Latin America, 5 years in OECD countries (OECD 2003, Grushka and Demarco 2003, Andrews 1999). In the US the applicant must have worked in 5 of the last 10 years and cannot be working currently.

¹⁶ For workers who have not been in the social security system for ten years, only their membership period is included, with a minimum of 24 months.

¹⁷ This de facto 42% average replacement rate is comparable with the disability replacement rate in many OECD countries, although lower than in the Netherlands or Sweden and higher than the US or UK. See Andrews 1999 and U.S. Social Security Advisory Board 2001 for numbers in other countries. The 70% replacement rate given to steady workers is unusually high. The definition of the reference wage creates disparities among individuals that may be regarded as questionable. For example, an individual who worked steadily for twenty years, then intermittently for ten years, has a larger own-account but gets a lower disability pension than one who worked intermittently for twenty years, then steadily for ten years, assuming that they both have the same age and wage when working.

¹⁸ Calculations by authors based on Association of AFPs, 2004-6. We assume that the future disposition at the second stage of claims that originated in 2004-06 will follow the same pattern as the disposition in 2004-06 of second stage claims. That is, the proportion of second stage claims rejected or deemed ineligible for insurance in 2004-06 is assumed to predict the eventual rejection and eligibility at the second stage of claims that originated at the first stage in 2004-06; and the ratio of second stage claims in 2004-06 to

approved first stage claims in 2001-03 is assumed to predict the proportion of approved first stage claims in 2004-06 that will eventually be considered at the second stage. About 30% of approved first stage claims from 2001-03 were lost due to death, improvement, reaching retirement age before 2004-06, or drop-outs as applicants learned they were ineligible for insurance and/or had small pensions.

¹⁹ We approximate the insured population in Chile as consisting of an average of contributors and affiliates, since all contributors plus some non-contributing affiliates are insured. The OECD numbers use all individuals in the age group as the denominator. If this term were used for Chile its disability inflow rate would be much lower than that given above, because of the wide disparity between number of residents and insured persons.

²⁰ For example, disability may be concentrated in groups that tend to be ineligible for insurance in Chile, while other countries have more inclusive coverage. Some countries pay disability benefits with less than 50% impairment and do not have separate programs for occupational accidents and illness, which would increase their incidence rates. Mature PAYG systems have a large stock of disabled pensioners remaining from past systems, who must be paid, even if the current system has been reformed. These factors would all reduce relative incidence and/or costs in Chile.

However, differences also work in the opposite direction—for example, Chile does not apply a work test while many other countries do; this should increase Chile's relative disability rate. Chile pays disability benefits until death while in some other countries, such as the US, disability benefits are paid only until normal retirement age, at which point old age benefits take over; this should greatly increase Chile's relative cost. In Chile disability benefits are price-indexed, while in some countries only a nominal benefit is specified (less expensive) and, conversely, in other countries benefits are indexed to wages (more expensive).

Chile also has separate programs that provide benefits for workers who are disabled due to work-related accidents or illness, as well as cash payments for individuals on sickness leave due to non-occupational illness. These programs interact with disability insurance and affect its cost. For example, AFPs may advise disabled workers to apply for benefits under an alternative program, financed by other sources. We do not discuss them further in this paper.

²¹ This sample includes 606 people who started out in old system but switched to the new system in 1982 when they were over age 40. For further discussion of the switchers and how we handled them see James, Edwards and Iglesias 2007.

²² The ratio of stock of disabled pensioners to old age pensioners was 30% in 2005 in the old system but only one-third of that--10%--in the new system (in 2003) (INP 2006 and SAFP 2003). Since maturity is reached among disability pensioners sooner than among old age pensioners, this ratio will probably fall further for the new system in the future; this is especially the case since new system affiliates have been postponing their age of retirement (Edwards and James 2005). The steady-state stock of disabled relative to old

age pensioners in the new system will probably be about one-quarter that in the old system, consistent with our estimated hazard rates.

²³ We only include individuals who pensioned after 1982 in this analysis, because if they pensioned and died before 1982 they would not be included in the ESP sample frame.

²⁴ Between 1995 and 2004, the percentage of permanent disabilities accounted for by psychiatric disorders increased from 12 to 20% of the total in Chile, while cardiac disorders moved in the opposite direction by the same magnitude—from 19% to 12%. Data provided by Association of AFP's. A similar change occurred in the US and other countries. In 1985 the 4-year mortality rate in the US for disability pensioners as a whole was 22%, but for mental disorders it was only 5% (Duggan and Imberman 2005).

²⁵ To proxy years of exposure, we include 4 dummy variables interacted with disability pensioner status, indicating the years when the disability pension started: 1986-89, 1990-93, 1994-97 and 1998-2002, with 1982-85 as the omitted period. We expect a negative sign (fewer deaths) for later periods because they indicate fewer years of exposure to disability status. These dummy interactions measure marginal effects. (That is, the first dummy measures the reduced mortality for all years after 1985 relative to omitted years 1982-85, and the second dummy measures the incremental impact for all years after 1989, etc.) The first term turns out to be negative and highly significant; those who pensioned after 1986 are less likely to have died by 2002. However, the coefficients on the subsequent dummies are insignificant—no further incremental distinctions after 1986. This suggests an offset by survival bias—dead people are less likely to be lost for later periods—or by the increasing share of new-system disability pensioners in later years.

²⁶ Another group that may be profitable are those with higher education, who are likely to work in occupations that have lower disability probabilities and to get better medical care, therefore not remain disabled. Higher educated people may work more regularly, therefore accumulate more and require a smaller additional payment if they should become disabled. Operating in the opposite direction, they tend to have steeper age-earnings profiles, which means they have a higher reference wage relative to their accumulation, hence require a larger additional payment. These counteracting effects may be the reasons why a previous analysis of the disability system based on limited data from 1987-89 does not find evidence of differential profitability and cross-subsidies across income groups from D&S insurance (Valdes and Navarro 1992). However high earners are profitable to AFPs for another reason—they pay a higher administrative fee, because of their higher wages and contributions, while their administrative costs are not higher. As a result, AFPs try to attract high earners.

²⁷ Death and disability because of labor accidents or employment-related illness are covered under a different program, so differences in the structure of employment among regions can not explain differences in AFP system disability rates.

²⁸ To be eligible for the MPG, the disabled worker must have: 1) at least 10 years' contributions in the social security system, or 2) at least two years' contributions in the

last 5 years prior to the disability claim, or 3) 16 months contributions if he has joined the labor force within the last 2 years, or 4) been contributing at the date of disability, if this was caused by an accident. If the individual has other sources of income, such as wages or pension from the old system, this may invalidate his eligibility for the MPG. However, we don't know if this means-test is effectively enforced. See James, Martinez and Iglesias 2006.

²⁹ In Mexico a centralized public agency, IMSS, is supposed to make the additional payment while insurance companies offer the annuities. However, so far IMSS has been making benefit payments rather than pre-funding annuities through the private market. Interestingly, the new unemployment insurance system in Chile, which also uses a combination of individual accounts and insurance, puts all workers into a single pool and auctions off the rights to handle the insurance to a single provider—perhaps to avoid selection and related problems. The bidder that won—a consortium of AFPs.

³⁰ Systemic stock market risk is also involved, since the individual retains control over investing his account during the 3-year temporary disability period. If the stock market should fall the additional payment that is the obligation of the AFP and insurance company will rise. (However, the transitory disabled are not allowed to invest in the riskiest portfolios).

³¹ A potential conflict of interest might arise if the AFP contracts with an insurance company in its own financial conglomerate. The AFP might then have an incentive to increase the insurance fee, because it becomes a non-transparent profit to its affiliated insurance company, with the high cost passed along to workers. This arrangement may be used when workers are not price-sensitive but transparent profits are subject to political disapprobrium. Also, if a sub-group of AFP shareholders has a large participation in a particular life insurance company, they may try to get the contract awarded to that company. Indeed, these things might have happened in Chile prior to 1987. In Argentina, where AFPs contract directly with insurance companies to pay the benefits, without giving workers any choice of payout mode or provider, 11 of the 12 pension funds belonged to the same ownership group as their insurance company in 2002—an arrangement that has resulted in high insurance fees (Grushka and Demarco 2003). These problems have been mitigated in Chile by regulations described in the Appendix.

³² The interest rate that must be used in the calculation of the additional payment is the average internal rate of return on annuities granted in the 3 months prior to that in which permanent disability was granted. The mortality tables that must be used are out-dated and probably overstate mortality rates. They have been in force since 1985, in contrast with mortality tables for normal old age and early retirement, which were up-dated in 2004. Mortality tables for the disabled are especially complex because they depend on causes of disability (which have been changing) and on years of exposure. True mortality rates of disabled due to psychiatric causes may be lower than those due to cardiac causes, and the latter themselves have been falling over time. (See James, Martinez and Iglesias 2006 for a discussion of overstated mortality and interest rates in the Chilean payout stage).

³³ Since mortality rates are probably overstated, this could lead to an understatement of the additional payment and a loss by the company on disability annuity sales. This is not a big risk since 60% of disabled workers choose PW, the majority of those who annuitize choose a guaranteed period annuity for which a discretionary market price may be charged, and some purchase an annuity on market terms from a different insurance company.

³⁴ The old-system benefit formula also favored older workers or those who had contributed in the distant past, while the new-system benefit favored younger workers who contributed in the recent past. According to the benefit formula in the largest old system, the SSS, disability benefits were “equal to the retirement pension”. The retirement pension, in turn, was based on number of working years—50% for first ten years + 1% for every year after ten up to 70%. This old system formula is more generous for workers who have 30 years of service but have not contributed regularly during the past ten years, while the new system formula is more generous for workers who have less than 30 years of contributions but have contributed regularly during the past ten years. Neither system had a clear-cut advantage here.

In our sample, observed disability pensions in 2002 were 70% of non-disability pensions, both for the new and old systems. For men, the ratio was 65% in the new system, 62% in the old system. Again, no clear-cut difference. Over-all, there is little reason to believe that changes in relative size of disability pension could account for the observed difference in hazard rates.

³⁵ We checked for the possibility of differences in new-system effects between switchers and non-switchers, and found no significant difference.

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Summary Findings

The disability insurance system in Chile is much less well-known than the pension part, but it is equally innovative. It differs from traditional public disability insurance in two important ways: 1) it is largely pre-funded—through the accumulation in the retirement account and later through an additional payment made when the person becomes permanently disabled, sufficient to cover a lifetime defined benefit annuity; and 2) the disability assessment procedure includes participation by private pension funds (AFPs) and insurance companies, who finance the benefit and have a direct pecuniary interest in controlling costs. Survivors' insurance is handled in the same way, through a combined D&S fee. We argue that pre-funding will raise disability fees in the early years of a new system as funds are built up but reduce them in the long run as benefits are covered out of accumulated funds. We further hypothesize that the participation of private pension funds in the assessment procedure will keep system costs low, by cutting the incidence of successful disability claims. Finally, we expect that these incentives will also lead to cost-shifting—to other AFP's by selection and to the public treasury via the minimum pension guarantee (MPG). Using simulations based on a special data set that was provided to us by the Association of AFPs and applying the Cox proportional hazard model to a retrospective sample of new and old system affiliates (ESP 2002), we conclude that these hypotheses are broadly consistent with observed behavior.

HUMAN DEVELOPMENT NETWORK

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