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COMO INTEGRAR BENEFICIOS DE INVALIDEZ EN UN SISTEMA DE CUENTAS INDIVIDUALES: EL MODELO CHILENO

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Diciembre 2006

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How to Integrate Disability Benefits into an Individual Account System:

The Chilean Model

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November 2006

Abstract

The disability insurance system in Chile is much less well-known than the pension system, but it is equally innovative. It differs from traditional public disability insurance in two important ways: (1) the disability benefit is largely pre-funded--through the accumulation in the retirement account and later through an additional payment made when the person becomes permanently disabled; and (2) the disability assessment procedure includes participation of private pension funds and insurance companies, which finance the additional payment and have a direct pecuniary interest in controlling costs.

If a worker is certified as permanently disabled, his account is topped up so as to finance an annuity that pays 70% of the reference wage for full disability and 50% for partial disability. Each pension fund must purchase a group term insurance policy that covers this additional payment. This paper describes the active participation in the assessment process of private pension funds and insurance companies that provide the additional payment and have an incentive to constrain the probability of successful insured disability claims.

The paper also simulates the impact on costs of pre-funding the lifetime defined benefit. We find that pre-funding increases annual cost in the short run but decreases it in the long run. In long run steady state the accumulation in the worker's retirement account covers about half the total annual cost, and the additional payment reduces it further, to about a quarter of what it would be in a pure PAYG system. Pre-funding makes disability insurance costs less sensitive to population aging but more sensitive to interest rate volatility. Non-differentiated pricing of the insurance fee creates cross-subsidies and, in a competitive market, incentives for creaming. Some of the cost reductions to the private insurance may imply a larger future public obligation, due to the minimum pension guarantee.

How to Integrate Disability Benefits into an Individual Account System:

The Chilean Model

Many countries have adopted old age systems that include individual accounts—funded, privately managed defined contribution plans. The President's Commission to Strengthen Social Security recommended such a system for the US. It is difficult to figure out how to incorporate disability benefits into a social security system with a defined contribution component, since disabled people may not work long enough to accumulate large balances. A defined contribution system might generate reasonable replacement rates for workers who retire after contributing 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) defined benefit system, this will take an increasing percentage of total social security taxes in the future. Moreover, it may encourage workers with small accumulations to try to qualify for disability rather than normal retirement, which will raise taxpayer costs still further. Beyond these problems of integration, disability is a more subjective condition than old age, and disability programs are therefore prone to errors of over-inclusion or over-exclusion granting disability status too generously or too stingily or to the wrong recipients. Because of the complexity of the issues, disability insurance has been largely ignored in the various individual account proposals.

Chile offers an interesting public-private solution to this problem, private provision with government regulating and guaranteeing. This part of the Chilean system is much less well-known than the old age 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 and insurance companies, who finance the benefit and have a direct pecuniary interest in controlling costs.

Our simulations show that pre-funding makes disability costs lower in the long run but higher in the early years of a new system. We estimate that in long run steady state the worker's own retirement account covers about half the total cost, and additional pre-funding of the lifetime pension reduces annual costs to about a quarter of what they would be in a pure PAYG system. Pre-funding makes disability insurance costs less sensitive to population aging but more sensitive to interest rate volatility. Furthermore, the incentives facing private pension funds and insurance companies and their active participation in the assessment process exert a downward pressure on the probability of successful insured disability claims.

Disability insurance in Chile starts with the mandatory retirement accounts, to which each individual must contribute 10% of wages. The money is invested by several pension funds managers (AFPs), among which workers can choose. Workers can also choose between different investment portfolios offered by the AFPs. If a worker becomes disabled before retiring, the retirement savings account covers part of his disability pension —which helps keep marginal costs low— but he receives a defined benefit regardless of the amount he has accumulated. This is accomplished through the private insurance market. Specifically, each insured worker is guaranteed a lifetime benefit that is 70% of his average wage if he is *totally* disabled and 50% if he is *partially* disabled. Afterwards, at the time the benefit is purchased, the account is topped up if the balance is insufficient to cover the specified annuity.

Each AFP is required to purchase a term group insurance policy to cover the cost of this top-up 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. Survivors' insurance for workers is covered in the same way.

The insurance premium is included in the general administrative charge that each worker pays to the AFP. Apart from a small flat component, the total administrative charge is a uniform percentage of wages —currently 2.4%— regardless of age, occupation or account size. This fee includes the cost of the group disability plus survivors' (D&S) insurance, which is slightly less than 1% of wages currently, with lifetime disability amounting to about 2/3 of the total. D&S insurance costs are .9%-1.7% of wages in other

Latin American countries that adopted the Chilean model (AIOS 2005). By comparison, the D&S charge is 1.8% of wages in the US (covering payouts to the disabled only until they reach normal retirement age) and 2-6% in most OECD countries (U.S. Social Security Advisory Board 2001; Andrews 1999). Table 1 and Figure 1 give the historical evolution of the D&S insurance fee and compare it with the annual payouts for pensions that insured beneficiaries receive.

On the public side of the ledger, the government provides a minimum pension guarantee for the disabled, just as it does to old age pensioners and survivors —about 25% of the average wage in the economy. This may exceed the defined benefit for low earners, those with irregular contribution histories and the partially disabled. If the individual's defined benefit is less than the minimum pension the government subsidizes it, providing the individual meets the eligibility conditions for the guarantee. For individuals who buy an annuity, the government also guarantees 75% of the annuity over the minimum (with a maximum of UF 45), in case the insurance company defaults. Finally, the government closely regulates the assessment procedure and the financing of the private insurance.

The Chilean disability scheme was adopted in many Latin American countries. It was not adopted in Eastern Europe, which followed the Chilean model for normal retirement, in order to avoid the initial transition costs associated with pre-funding as well as the difficulties in adjusting assessment rules to the standards of private provision (Chlon-Dominczak 2003). The object of this study is to examine how this mixed public-private system has worked and whether it provides a useful model for other countries to consider. We use publicly available aggregate data as well as a special data set on incidence that was put together for this project by the Association of AFPs. While the absence of data from the old system makes it impossible for us to isolate the quantitative effects of the new system, our institutional analysis and simulations strongly suggest that the Chilean model will produce lower rates of successful claims and costs, and the available data are consistent with this prediction. However, we do not know whether this is optimal, or whether Chile has substituted under-inclusion for the potential over-inclusion that may exist in other countries.[1]

Part I describes the Chilean procedures in greater detail, focusing on the incentives and opportunities for private AFPs to contain successful claims ratios and the resulting

implications for the government's contingent liability. Part II analyzes the consequences of pre-funding the defined benefit for a given set of approved claims ratios. We simulate the insurance premium that will cover the group disability policy under different scenarios, compare this with the tax rate that would be necessary under PAYG, and examine cross-subsidization and incentives for selection. Part III discusses how the US and other countries might adapt the Chilean disability scheme in the context of a reformed system with smaller individual accounts and a larger public benefit than exists in Chile.

I. How the Chilean Disability System Works—incentives to control costs

While pre-funding is the most obvious characteristic of the Chilean disability scheme, a second, more subtle, characteristic is the new incentive system. AFPs and insurance companies that provide disability insurance have a strong pecuniary incentive to keep costs down, and have a place in the assessment process that gives them an opportunity to do so. This contrasts with public systems, where such pecuniary incentives are weaker and principal-agent problems potentially greater. The Chilean system therefore contains stronger safeguards against errors of over-inclusion. The challenge is to balance this with safeguards against over-exclusion.

Group disability insurance and the incentives for cost control

Pension funds managers (AFPs) are required to provide disability and survivors insurance for their working members. While these two types of pensions are financed in the same manner, this paper concentrates on disability pensions. The individual's retirement savings cover a large part of these pensions. However, the individual is promised a defined benefit, which is 70% of his reference wage for total disability, 50% for partial disability, and 30-60% of the primary pension for various categories of survivors of disabled beneficiaries.

To turn the defined contribution into a defined benefit, the AFP must put an additional payment into the account if the worker's own accumulation is insufficient to finance an annuity of the specified type and amount. This additional payment is made at the point when the disability is certified as permanent—3 years after the claim has been filed and temporary disability status has been granted, or age 65, whichever comes first. During

4

that 3-year period the AFP pays the defined benefit directly to the individual as a *provisional pension*. In both the temporary and permanent stage, the pension is expressed in UF's (Unidad de Fomento), the inflation-indexed unit of account that is commonly used for long-term transactions in Chile, so it is effectively inflation-indexed.

With the money in his account, including any additional payment, the disabled worker purchases an annuity or programmed withdrawal pension at the specified level or higher. The annuity lasts the entire lifetime, thereby providing longevity insurance. The programmed withdrawal does not provide longevity insurance but does give the worker bequest rights over any money left in the account if case of dead. In any event, the total future pension of the disabled individual is pre-funded at that point—partly out of his own retirement saving and partly out of the additional payment from the AFP.

The cost of this disability insurance is passed on by the AFP to all contributing workers as part of its administrative fee. This fee is charged as a uniform percentage of taxable wage; distinctions by age, gender, occupation or other individual characteristics are not allowed. The combined fee is about 2.4% of wages, with the D&S insurance share slightly less than 1% and the disability component representing about 2/3 of total D&S.[2]

Most important, for any given total fee that the AFP charges, lower D&S costs mean that more is left over for the AFP's owners. Suppose the AFP starts out with a total fee of 2.5% of the worker's wage, and actual costs of 2%, half of which is the insurance cost, thereby earning a .5% profit. If it cuts the insurance cost to .75% and continues charging the same fee (because demand is viewed as price-inelastic), its profits increase by ((2%-1.75%)/.5%)=50%. The AFP can accomplish this by monitoring the assessment procedure to reduce disability probabilities —which saves money for the system as a whole— or by selection —trying to attract members with lower probabilities while leaving the high risks for other AFPs.

Assessment of claims—the role of private oversight

In most public systems the evaluation of the disability is made by a public body or medical experts and benefits are paid by the social security system. No party has a direct financial incentive to limit successful claims. In some countries program gatekeepers may avoid conflicts by being generous, at the taxpayer's expense, disability benefits may be used by the government as a substitute for unemployment insurance or early retirement, and

financial incentives such as bribes may lead public officers to accept questionable claims. All these practices increase costs, without a countervailing force.

In Chile, the evaluation is also made by medical experts and overseen by a public regulatory body, the Superintendencia of AFPs (SAFP), but the private pension fund managers (AFPs) participate in the process and have strong financial incentives to keep costs low. Their presence ensures that any doubts about the claim will be raised, just as the adversarial process in a trial ensures that both sides are presented. Therefore we would expect a lower ratio of successful claims, relative to insured population, in a Chilean-type system than in a public PAYG system.

Temporary and permanent certification. Claims are evaluated by 21 Regional Medical Boards operating in 12 administrative regions plus Greater Santiago. Each Medical Board is made up of three doctors hired and paid by the 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 insurance companies may also nominate a "medical observer," with the right to speak but not vote. Since 1998 this has become systematized: the AFP Association has organized a group of medical observers, who regularly attend Board meetings and monitor its work.

A positive first assessment by the Regional Medical Board entitles the individual to a provisional (temporary) disability benefit. About 60% of all claims are approved at this stage.[3] Three years later (or sooner, if the individual reaches the normal retirement age) the member is re-assessed, and AFPs participate at this stage also. This second assessment is considered permanent and, if positive, entitles the person to the additional payment that will cover his lifetime defined benefit. Currently about 75% of temporary disabled individuals are accepted as permanent three years later. This amounts to 93% of all individual who come up for the second assessment; most of the attrition is due to deaths that have occurred in the meantime (Association of AFPs 2004). This permanency of disability status is quite common in other countries too, either on a formal or de facto basis —a movement out of disability status is rare (OECD 2003). In Chile, unlike many other countries, the individual keeps his permanent disability pension even if he returns to work —in this sense, work is not discouraged, although it is not actively encouraged through rehabilitation efforts either.[4] 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.

Appeals. A Central Medical Board hears appeals from both sides and tries to keep uniformity across regions. 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, 26% of all temporary approved claims and 18% of all permanent approved claims were appealed by AFPs, rates that have been growing over time, and one-third of these appeals were successful (Association of AFPs 2004). This reduces the rate of approved claims by 5-9%. A traditional public system has no place for such appeals, so costs would be 5-9% higher, ceteris paribus.[5] The Central Board's decision is final as far as the AFP's are concerned; but members may appeal in the legal courts. The courts have reversed a small number of Board decisions.

Partial versus total disability. A Technical Disability Commission sets and updates the rules for assessing the degree of 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, uniformly regardless of the individual's occupation. However, 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 he is granted a 70% defined benefit. If the degree of disability is between 50-67% he is partially disabled and is entitled to a 50% defined benefit.[6] 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, a proportion that has been increasing over time.

If a person is deemed disabled but does not meet the eligibility conditions for insurance described below, he is entitled to withdraw the money in his account as a life annuity or programmed withdrawal, but he does not get the additional payment that would give him a 70% or 50% replacement rate. Our analysis focuses on those who qualify for the insurance and therefore affect its cost.

Most of the costs of this assessment procedure are borne by the AFPs. On the one hand, this cost-shifting may lead to excessive appeals by members and higher disability rates than would be optimal. But on the other hand, AFPs have much greater experience with the system, which may enable them to limit successful claims. Their representative sits on the Regional Medical Boards (although without a vote) and the Technical Disability Panel, giving them regular on-going inputs into these decisions. The Association of AFPs keeps track of claims, acceptances and appeals and how these ratios have been changing through time and vary across regions and AFPs. The results of this procedure are:

1. *Consistent with our hypothesis about the importance of private pecuniary incentives, new disability beneficiary inflow rates are far lower in Chile than in the US or other OECD countries, holding age constant.* Taking age 45-59 as an example: In 1999 in the U.S., 7.8 individuals per thousand members of that age group were accepted to disability status and this number was 8.6 for OECD as a whole (OECD 2003 and Table 2). In contrast, in Chile only 2.9 per thousand insured members were accepted to disabled status. (We approximate the insured population in Chile as consisting of an average of contributors and members, since all contributors plus some non-contributing affiliates are insured. If we used the entire age group in the denominator, as in the OECD countries, Chile's numbers would be much lower yet). Over all ages, 1 per thousand was accepted to new insured disability status in Chile in 2004, compared with 4 to 6 per thousand insured members in the US over the past two decades (US Social Security Board of Trustees 2005). Disability incidence rates are roughly similar to those in Chile in the other Latin American countries that adopted its model (AIOS 2005) (Of course, many other factors help account for this pattern).[7]

2. *Claims rates have been rising in Chile—doubling between 1995 and 2004 (data provided by Association of AFPs).* We decomposed the change in claims/contributor ratios into parts due to changes in age composition (AgeComp) versus changes in age-specific claims propensities (ClmProp), using the accounting identity:

$$\Delta claims = \Delta AgeComp \cdot 1995 Clm\text{Prop} + \Delta Clm\text{Prop} \cdot 1995 AgeComp + \Delta AgeComp \cdot \Delta Clm\text{Prop}$$

Our decomposition shows that both factors contribute to the doubling in claims/contributor ratios, but changing age-specific claims propensies play the larger role (Table 3). Since acceptance rates have remained roughly constant over this period, the probability of becoming disabled has risen substantially (Figures 2 and 3). However, in recent years most of this growth has occurred among the uninsured —AFPs have little incentive to question or appeal claims that will not, in any event, cost them money (see below).[8]

3. The assessment procedure in Chile has been only partially successful in achieving uniform treatment across regions. For example, disability rates are 40% higher in Region 6 and 75% higher in Region 8 than in the rest of the country, while their population age distributions are virtually identical (National Institute of Statistics). These inter-regional disparities stem in large part from differences in age-specific claims ratios. Acceptance rates are lower than average in these regions, but not enough to bring their ratios of accepted claims back to the national average (Figure 4).

Eligibility rules

Eligible versus ineligible claims. In Chile, eligibility for disability status, which gives the individual early access to the money in his account, depends purely on medical grounds. But eligibility for insurance and the 70% or 50% defined benefit depends on his recent work history. He must 1) not have reached retirement age (65M/60W); 2) not be a pensioner; 3) be working and contributing at the time of the claim, or 4) become disabled within 12 months since the last contribution was made, having paid at least 6 contributions in the year immediately preceding the last registered contribution, and 5) for self-employed workers, they must have paid at least one contribution in the calendar month before the date of the claim. These eligibility conditions are lighter than those in other countries with contributory schemes, where 3 years (Latin America) or 5 years (OECD) of contributions are commonly required for entitlement (OECD 2003, Grushka and Demarco 2003, Andrews 1999).

Poor record-keeping by public agencies in many Latin American countries have lead to high rates of successful insured disability rates in the past. In contrast, in Chile these rates are constrained by the fact that AFPs keep the contribution records of their affiliates and have strong incentives to ensure that the eligibility conditions are strictly observed. In 2004, 40% of all successful claims were deemed ineligible for insurance, an increase from

the 30% reported 4 years earlier. Thus only 36% (0.6 * (1-0.4)) of all claims were both insured and approved in 2004. Over this same 4-year period, all growth in incidence of disability occurred among the uninsured.

Adverse selection. Strong possibilities exist for adverse selection of workers with a high propensity for disability into the insured labor market in countries with large informal and self-employed sectors. This could raise disability insurance costs for everyone. In Chile, the density of contributions —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). The remainder of the time the worker is out of the labor force, self-employed or in the informal sector. A healthy worker can avoid contributing by working in the informal sector, but move to the formal sector if he anticipates filing a disability claim. This becomes more likely as subjective diagnoses for disability, such as back pain and mental illness, whose intensity and timing are difficult to establish, replace more objective diagnoses such as cardiac problems. 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. Workers who can't meet the pre-conditions for early withdrawal of their funds may move back into covered employment and apply for disability benefits. If the rate of return on accounts is less than 5%, most workers will have an old age replacement rate less than 70% as they approach their 60's (Table 4); they will fare better if they become eligible and apply for disability.[9] Adverse selection is mitigated in Chile by AFPs, who actively discourage sales agents from bringing them new clients who are likely to apply for disability benefits in the near future, by refusing to pay them sales commissions in these cases (see Part II).

Reference wage. Incentives for and costs of adverse selection are further reduced by calculations of the reference wage, which give many disabled workers a very low pension. The reference wage used to determine the defined benefit is the simple average of earnings and other income during the prior ten years, expressed in UF (therefore indexed for inflation) and with a ceiling (60UF). 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, so young members have a lower averaging period. But older members (more likely women) who have been unemployed, in the informal sector or out of the labor force

for part of the last ten years have 0's averaged in and therefore have a lower "reference wage" and "reference benefit," even if they are eligible. If totally disabled, a steady worker gets a 70% replacement rate but a worker with a contribution density of 60% during his last ten years gets a benefit that is only 60%*70%=42% of the wage he got when working.[10] This makes it less likely that a worker with a low density of contributions will find it advantageous to get back into the system to become eligible for insurance, and it saves money if he does get back in. Widows of these average disabled beneficiaries get 60% of his reference benefit, in other words 60%*60%*70%=25% of the wage he got when working. AFPs help to assure that these rules are strictly applied. Both the low-benefit worker and his widow, however, are protected by the government's minimum pension guarantee, so long as they meet the eligibility conditions.

Contracts between AFPs and insurance companies

In order to ensure that they will be able to finance their disability obligations, since 1987 AFPs have been required to take out a group policy with a life insurance company that guarantees the additional payment and provisional pension.[11] 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 covers the tail of the distribution.

Regulations. The 1987 law and subsequent regulations constrain many aspects of this contracting process. A public competitive bidding process must be used to choose the insurance company. The AFP must send to the regulator (the SAFP) a comparative analysis of the cost of each bid and any other factors that led to its final choice. 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 insurance company 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, including the additional payment. The individual worker can buy the annuity from this company or some other company, if he prefers. The mortality tables that must be used are out-dated and probably overstate mortality rates.[12]   If mortality rates are overstated, this could lead to an understatement of the necessary capital and to a loss by the company on tied disability annuity sales.[13] (It could also lead to a larger obligation for the public treasury for the minimum pension guarantee—see below).

Risk-sharing. The typical contract shares the risk between the AFP and insurance company, with the insurance company making actual payments but the AFP paying most of the cost, except for extreme outcomes. It 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 make the additional payment and pay the temporary pension. If actual claims exceed this provisional rate, the AFP transfers more money to the insurance company, up to a maximum rate that sets a ceiling to the AFP's obligations. 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 is 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 ceiling and participation rate determine the degree of risk-sharing between the two organizations. Additionally, the AFP usually pays the insurance company a monthly flat fee for management expenses and the insurance company refunds to the AFP part of the investment returns earned on the provisional premiums, before they are spent.

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 ceiling if these factors indicate a lower disability rate. This may lead to attempts to cream the good risks. We return to this point in Part II.

Extreme outcomes. AFPs save money by partial self-insuring. 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, it handles the initial application by workers and can steer them toward other programs (such as accident insurance) when feasible, and it can direct its marketing efforts toward low risk workers. If the main savings come from monitoring the assessment procedure, this locus of risk-bearing also minimizes costs for the system as a whole, but if it comes from steering or selection, the gain for one AFP implies a loss elsewhere in the system.

But AFPs are not well structured to fully insure, which would entail capital and reserve requirements set by the insurance regulator. Insurance companies are better able to bear the risk of extreme outcomes, which usually stem from systemic variables. For example, the successful claims rate for the system as a whole rose sharply between 1997 and 1999 and many insurance companies made losses. (When contracts were renegotiated, the maximum rate went up substantially in every case).

As another example, between January 2002 and October 2005 the interest rate used for determining the additional payment fell from 5.56% 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 additional payment by much more, due to a leverage factor described below. Yet, insurance contracts in place during 2002 still governed all claims originating in 2002, including the permanent disability assessments requiring additional payments three years later in 2005. Insurance companies can and do hedge part of this interest rate risk by investing the reserves backing these obligations in long term bonds that will rise in value if interest rates fall. Also, the assets in the account have risen for similar reasons, somewhat reducing the increase in additional payment. Nevertheless, companies are now making larger additional payments than they expected, pushing them above the ceilings prevailing in 2002, and we can expect maximum rates to rise further when contracts are renegotiated.[14]

Since these systemic risks are largely non-diversifiable, when losses are made in one year, they must be covered by equity capital from reserves, profits made in other years or from other insurance products. This works, in part, because disability is only a small portion of the insurance companies' portfolios (retirement annuities constitute the largest portion). The bottom line in this risk-sharing arrangement—while extreme outcomes are insured, AFPs still have a big incentive to control costs that stem from individual claims.[15]

Responsibility of the state—the minimum pension guarantee (MPG)

When the disability pension turns out to be lower than the minimum pension guarantee (MPG), the state makes up the shortfall, providing that the disabled member has: 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. This contrasts with 20 years of contributions required for MPG eligibility for non-disabled workers. Low earners with 10-19 years of contributions (which many have) will not qualify for the MPG normally, but will qualify if they are disabled—and therefore have a special incentive to become certified as disabled. Eligibility conditions for the MPG are also easier than eligibility for disability insurance, since workers who contributed in the past but not the present will qualify for the former but not the latter. However, eligibility for the MPG is partially mean-tested, a conditions that may be applied more strongly in the future than the past.[16] The minimum pension is about 25% of the average wage, and this rises to 27% at age 70 and 29% at age 75.

Once they meet the eligibility criterion, several sub-groups of disabled are especially likely to have an own-pension that falls below the MPG level: 1) those with low density of contributions who have a small reference wage and pension because many 0 years have been averaged in; 2) insured disabled individuals who choose programmed withdrawals and live longer than the out-dated mortality tables would predict; 3) partially disabled workers who get only a 50% defined benefit; 4) members who are granted disability status but are not eligible for disability insurance because they are not current contributors (this group constitutes 30-40% of all the disabled); and 5) surviving widows of disabled workers who were originally entitled to the MPG at the 60% level but this has been implemented at the 100% level. Note that each of these categories is due to policy choices that reduce the cost of the private insurance but may increase the cost of the public contingent liability.[17]

The private pecuniary incentives that may limit the success rate of claims of insured workers may not operate to limit successful claims of non-insured workers. AFP representatives know whether a worker has been contributing at the time of his claim and is therefore likely to be insured. They have no reason to spend resources on questioning or appealing non-insured claims. The Medical Boards may have less desire to deny a claim of a non-insured worker who, it appears, will simply be getting early access to his own savings. These factors may be contributing to the rise over time in the proportion of non-insured disabled. However, if the worker is certified as disabled he gets much easier access to the taxpayer-financed minimum pension guarantee than the non-disabled. Moreover, by taking his money out early he fails to accumulate as large an account and own-pension as

he would by keeping it in longer; his account has fewer years in which to accumulate interest and more years for which an annuity must be financed.

Previous studies have shown that old age retirees with large accumulations tend to annuitize in order to get longevity insurance, while those with small accumulations tend to choose programmed withdrawals and rely on the MPG to provide longevity insurance (James, Martinez and Iglesias 2006). This is true for disabled pensioners as well. The average size programmed withdrawal is about half the size of the average annuity and only 25% more than the MPG (Table 5). As of 2003, 60% of all disabled workers were on programmed withdrawal.[18] More than half of these were drawing down their accounts at the minimum pension level. When they use up their own funds the state will take over, providing they meet the eligibility conditions. Another quarter had already exhausted their accounts and was receiving pensions from the state. Indeed, the majority of current MPG recipients are disabled and survivor beneficiaries (Table 6).

The minimum pension guarantee has been rising at 2% annually, in real terms, since the new system started. When it rises, the increase applies to the stock of existing retirees, as well as the new flow (see James, Martinez and Iglesias 2006). This increase in MPG can add up to a particularly large amount for disability pensioners and their survivors, who may be young and live many years after retiring. As the MPG rises, allowable programmed withdrawals rise, the accounts are used up faster, and the government must step in sooner. Also, when the MPG rises above existing annuity values, the government tops up the annuity. Based on these data, it seems likely that a high proportion of disabled programmed withdrawal pensioners and their surviving spouses, and even some disabled annuitants, will eventually receive the public subsidy, as they age. The exact proportion depends on how many meet the eligibility conditions, information which we do not have.

This paper does not address the issue of how to prevent the growth of expenditures on the minimum pension guarantee and whether or not this would be desirable. To some extent, the MPG permits and serves as a safety net for a cost-conscious private disability insurance system. It does appear that careful long run simulations of fiscal liabilities should be carried out, including scenarios with an increasing incidence of insured partial and non-insured disability and disability with a low reference wage.

II. Costs and cross-subsidies in the Chilean system

In this section, we compare costs and cost-drivers in a pre-funded Chilean-type disability insurance scheme, under alternative scenarios, with those in a public PAYG system. In this analysis we abstract from the incentive effects described in Part I. That is, we assume that the probability of disability is the same in the two systems, in order to isolate the impact of pre-funding. An analysis of cross-subsidies and incentives for selection by AFPs also follows from this analysis.

A simple model for determining the group insurance premium

For simplicity, we focus on the cost of insuring total permanent disability, the largest component of disability costs. Broadly speaking, real insurance costs for an individual in Chile depend on the probability of becoming permanently disabled, the capital that is necessary to finance an annuity equal to the 70% defined benefit and the accumulation in the individual's account. Real insurance costs for the system depend also on the age structure of the covered population, which weights and sums the individual costs.

We calculate the premium, T, as a % of the wage bill that must be charged to cover the group insurance that finances the lifetime pension for the inflow of newly disabled workers for the system as a whole. By law, this premium is levied as a uniform percentage of the wage for all contributing workers in a given AFP. It depends on the real insurance cost associated with individuals in gender-age class i ($Insure_i$), summed over all classes, weighted by the proportion of each class in the contributing labor force (w_i) to get the total insurance cost ($TotInsure$), and divided by the AFP's total wage bill (equation 1).

$$T = TotInsure/Wage\ bill = \sum w_i\ Insure_i/Wage\ bill \tag{1}$$

The insurance cost of individual i depends on the additional payment (Add_i) that would be needed if he became disabled times the probability of covered disability for i's gender-age class ($Prob_i$) (equation 2).[19]

$$Insure_i = Add_i * Prob_i \tag{2}$$

Add_i, in turn, depends on the necessary capital ($NecC_i$) needed to cover the defined benefit (70% of his average wage for the last ten years) minus the worker's own capital ($OwnC_i$)-- that is, the balance in his account —that helps to cover these costs (equation 3).

$$Add_i = NecC_i - OwnC_i \tag{3}$$

$NecC_i$ equals the defined benefit times the annuity factor (a_i) for the newly disabled worker. The DB depends on the individual's average wage over the last ten years, which in turn depends on his density of contributions. The annuity factor tells us by how much the specified annual payout must be multiplied to get the expected present value of the lifetime pension stream. It depends on the interest rate decreed by regulations (rr), the relevant mortality tables (M), and the individual's age and gender that determine his or her place within these mortality tables.[20] Since survivors of disabled beneficiaries also receive benefits, for married men the annuity factor is based on a joint pension (equation 4).

$$NecC_i = DB_i* a_i(rr, M, age_i, gender_i) \tag{4}$$

The balance in the account depends on the individual's contributions at age t ($Contrib_{it}$), compounded by the market interest rate earned (r) until age of disability (N), summed over all t in which contributory work occurs. (For simplicity, r and rr are assumed to be the same for all workers, insurance companies and AFPs, and constant over time). Contributions are based on wages, so contribution rate (k), initial wage rate (W_i^t) and rate of wage growth over contributing years (g) determine the total accumulation (equation 5).[21]

$$OwnC_i = \sum Contrib_{it}(1+r)^{N-t} = \sum kW_i^t(1+g)^{t-t}(1+r)^{N-t} \tag{5}$$

In contrast, the required contribution rate in a PAYG system equals the annual payouts for total stock of disabled beneficiaries/covered wage bill.

The relative cost of a Chilean-type disability insurance scheme versus a PAYG scheme therefore depends on 1) the size of the new inflow of disabled compared with the stock of existing 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 existing disabled. In the early years of a new system, when the stock of existing beneficiaries is not much larger than the inflow of new beneficiaries and account accumulations are small, the contribution rate needed to finance PAYG payouts will be lower than that in a Chilean-type scheme. Pre-funding for lifetime pensions generally requires more money initially than PAYG for annual pensions. In long run steady state, however, PAYG contribution costs should be higher, since the stock of disabled becomes large relative to the new inflow, and the cost of the lifetime annuity is covered partially by

the account accumulation and investment earnings. We will investigate this relationship between simulated PAYG and Chilean costs in a new and a mature system.

We will also investigate which variables determine relative costs. We expect that PAYG costs will be more strongly related to population aging, which increases the stock relative to the flow and also increases the probability of disability, while a Chilean-type scheme has the offsetting advantage of greater account accumulation with age. But interest rates should be irrelevant to PAYG contribution requirements, while strongly influencing the premium needed to pre-fund the lifetime pension in Chile.

Simulations—how costs rise with age and population aging

Table 7 and Figure 5 simulate equations (3)-(5) —the own capital, necessary capital and additional payment needed for a worker, per dollar of his wage, if he should become disabled, focusing on how these vary as the worker ages. We assume in this base simulation that the contribution rate, net of fees, is 10% of wages, as in Chile. The net rate of return on accumulations and discount rate for annuity are assumed to be 4.5%. The worker enters the labor force at age 20 and works steadily thereafter until retirement or disability. His wage rises 2% per year over his lifetime, from age-earnings or economy-wide growth. Expected age of death for men is 80, for women is 83, and wives are 4 years younger than husbands. Otherwise, we do not distinguish between men and women at this point.

Given these assumptions, the worker's own capital rises steadily as he ages, due to the growing accumulation in his account from contributions and investment earnings. At the same time, necessary capital per dollar of wage falls more modestly as the pension has to be paid for fewer years.[22] As a result, the worker's own capital covers an increasing proportion of the necessary capital. The additional payment required, should a worker become disabled, starts at 99% of necessary capital at age 20 but falls to 3% just before age 65.

Columns 1 through 4 in Table 8 simulates equations (1) and (2) under the same set of assumptions, taking into account data on approved disability rates and insurance eligibility rates. Even though the additional payment (contingent upon disability) falls sharply with age, the probability of disability rises even faster. Thus, the real insurance cost associated with individual i rises dramatically as the individual ages. The real insurance cost (additional payment per unit of wage*probability of disability) is 100 times greater for

18

a 60-year old than for a 20-year old! This also means that aggregate insurance costs will rise as the population ages.[23]

Given the current age structure of contributors in Chile and the assumptions used for our simulations, the insurance premium will be .67% of the aggregate wage bill.[24] This allows us to calculate the actual dollar amount of the insurance fee that workers in different age-wage categories pay. Under the assumed 2% rate of wage growth, worker close to retirement age will pay more than double the amount paid by a starting worker. But this differential amount paid is much less than the differential in real insurance costs. As a result, younger workers are "profitable" to the system while older workers are loss-makers (Table 8, col. 4-6 and Figure 6). The cross-over point occurs in the early 40's.

Sensitivity analysis—Chile vs. PAYG

Next, we test the sensitivity of the disability insurance premium (as a % of wages) to alternative assumptions and compare with pay-as-you-go costs, defined as total payouts to the stock of disabled pensioners/total wage bill (Table 9). We also observe how much of the total cost of the disability pension is covered by money accumulated in the worker's account. Unless otherwise noted, we carry out this simulation mainly 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, except for the variables that we are explicitly changing. In Chile contracts between the AFPs and insurance companies usually are signed for a two-year term, or else are written for an indefinite period, in which case either party can terminate the contract with a 1 year's notice. Therefore, the adjustment to these changing variables will occur slowly, 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 $r = 4.5\%$ and age-wage growth = 2%. Then, in year 1 of the scheme, with only 1 year's worth of account accumulation and stock of disabled pensioners, but assuming the same probability distribution for the inflow of new beneficiaries that exists today, the cost in a Chilean-type scheme would be relatively high —1.35%— while that in a PAYG system would be very low —.08%. A Chilean system costs 17 times as much as a PAYG system in year 1 (row 1). But costs steadily fall in the Chilean scheme as account balances grow, and rise in the PAYG scheme as the stock of disabled pensioners increases, so the PAYG cost almost

overtakes the Chilean premium by the end of the fourteenth year (row 2). In steady state, the insurance premium in a Chilean-type system falls to .67%, since money in the accounts —accumulated but no longer needed for old age retirement— covers half the total cost of the lifetime annuity (row 3). In contrast, in the PAYG system, with no accounts or investment earnings but a large stock of pensioners, the required contribution rate to cover the identical disability payouts would be 2.73%, 4 times as large as in Chile.

Interest rate variations. The required insurance premium in the Chilean scheme 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 are small and cover only about one quarter of total insurance costs. But if the rate of return rises to 6% (row 6), the insurance premium 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. Over the past 3 years we have observed a 2.5% decline in interest rates, which, our simulations show, are likely to more than double the premium needed to purchase the defined benefit annuity. In contrast, the required contribution rate in a PAYG system is totally insensitive to the interest rate.

The high responsiveness of the Chilean scheme to changes in interest rates is due in part to a leverage factor built into the system —if the necessary capital rises without a corresponding increase in account balance, the additional payment bears the full brunt of the increase needed. For example, suppose the interest rate suddenly falls from 4.5% to 2%, and in the very short run this only affects the annuity discount rate. Then, 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%, which produces a corresponding increase in insurance premium (Table 7, compare next-to-last row with base case for age 50).

In the medium term the balance in the worker's account will increase, due to rising bond prices as the interest rate falls, and this offsets part of the higher additional payment. But in long run steady state, when workers are buying in at the new higher bond prices, the additional payment must rise even more, since the worker's own-accumulation falls due to the lower rate of return (Table 7, last row).

Wage growth. A higher rate of age-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. The gap between necessary capital and own capital increases if wage growth is high, and the additional payment and insurance premium must rise to cover this gap. The required contribution rate in a PAYG system also increases, but less than in the Chilean scheme. Thus the ratio of Chile/PAYG cost 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, the insurance premium falls dramatically, to .4% —while in a PAYG system an increase in the old age contribution rate has no impact on the cost of disability insurance. 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 PAYG disability taxes by 29%. But the insurance premium in Chile falls by much more than 29% because of the leverage factor: necessary capital falls while the worker's own account is held constant. Many workers now find that their own-accounts are large enough to cover the entire benefit —hence little or no additional payments are needed. The insurance premium falls to .28% —less than half the steady state base premium. Thus, Chile's system is much more amenable to manipulation by policy variables such changes in benefit rate or retirement contribution rate than is a PAYG system. The ratio of insurance cost in Chile's system versus a PAYG system was 25% in the base case but it falls to 14-15% when old age contribution rates rise or disability benefit rates fall. (Of course, the converse is also true).

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 I, 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.[25]

Density rates. Both systems are left unchanged by a decrease in density of contributions that is evenly spread through the person's lifetime, since the wage bill, reference wage and account accumulation are cut in the same proportion. Therefore we do not show the impact of this change. But if density becomes low early in life and high later on, in the age range that is more subject to becoming disabled, this will raise the average reference wage and pension but reduce the average account balance (since it has accumulated interest for fewer years), and will lead to a relatively large additional payment and insurance cost relative to the neutral case. PAYG costs will also rise, but by a smaller amount since there is no account balance effect.

Our main conclusions from these simulations:

1. Once the steady state is reached, annual insurance costs in a Chilean-type scheme are much lower than that which would be required if the same benefits were covered on a PAYG basis. This is mainly because, in Chile, funds in the retirement accounts plus expected interest earned on the pension premiums during the payout stage cover much of the disability costs for the new inflow and pensions purchased in the past cover the benefits of the large stock, while in a PAYG system the current payroll tax would have to cover the latter cost. These factors, plus the incentives discussed in Part I, may help explain why disability insurance premiums in Chile and other Latin American countries that follow its approach have been less than 1% of wages, while in most OECD countries that use a PAYG approach without private participation in the assessment process, the implicit cost exceeds 3% wages (AIOS 2005, Andrews 1999).

2. However, during the early years of the new scheme, when the accounts and the stock of disabled pensioners are relatively small, the insurance cost needed for PAYG is lower than that needed for a Chilean-type scheme, due to the up-front costs of pre-funding.

3. The underlying role played by account accumulations and pension premiums makes a Chilean-type scheme very sensitive to the interest rate, while PAYG plans are much more sensitive to the age structure of the work force. Pre-funding partially protects the Chilean disability system from the impact of population aging.

4. Chile's disability insurance cost is much more responsive than a PAYG system would be to changing old age contribution rates and disability benefit rates, thereby lending itself to easier policy manipulation.

5. Our simulations are roughly consistent with changes in actual D&S insurance premiums and annual payouts for D&S benefits--the latter a proxy for costs that would apply if the same benefit were paid on a PAYG basis (Table 1, Figures 1 and 7).[26] Costs in Chile were higher than PAYG costs would have been near the start of the new disability system, in 1990. But they fell rapidly during the early 1990's, due to growth in account balances in a funded system. At the same time, annual payouts for D&S benefits rose steadily as the stock of disabled beneficiaries grew relative to the new flow—illustrating the inevitable cost path as a PAYG system matures. Thus the insurance cost in Chile is now only 74% that of its PAYG equivalent. However, Chile's absolute cost has increased and its relative position has temporarily ceased to improve due to recent rapidly falling interest rates that adversely affect funded systems but do not affect PAYG systems.

6. We reran our simulations using, alternatively, the 1995 and 2004 age structures, disability probabilities and interest rates, in an attempt to determine how much of the increasing premium over time was due to aging of the contributory labor force, rising age-specific insured disability/contributor ratios and an estimated 1% decline in the annuity interest rate (Table 10). We found that the total simulated insurance premium rose .39% over this period. Of this amount, 15% was due to aging of the contributory labor force and another 23% to declining interest rates.[27] But the largest cause was the rising age-specific rate of successful claims, discussed in Part I, which accounts for 38% of the total increase.

This precise decomposition of effects would probably change if we used a different starting and ending date. For example, most of the increase in disability/contributor ratios occurred in the late 1990's. Most of the decrease in interest rates occurred after 2000. Nevertheless, all these results confirm that the Chilean system is relatively low cost but highly sensitive to interest rate changes, is not immune to population aging, and, despite the

incentives and procedures discussed in Part I, has not consistently prevented the growth of successful disability claims (Figure 8).

Cross-subsidies

Private disability insurance would normally put people into highly differentiated risk categories, which are charged different prices. When this is limited by asymmetric information or by regulations, cross-subsidies arise. The Chilean requirement of a uniform insurance premium (as % of wages) in the face of differential disability probabilities is an example of a regulation that creates cross-subsidies. This raises equity questions about whether the redistribution is going in the right direction. It also raises two types of efficiency questions: 1) AFPs may seek out profitable workers and try to avoid serving loss-makers, as discussed in the next section; and 2) If group change is feasible, workers may try to place themselves into the group that receives subsidies rather than giving them, which may raise the incidence of disability among contributors and the over-all cost of the system. One of the most likely ways to avoid paying a cross-subsidy is to evade contributions by working in the informal labor market.

The most obvious cross-subsidy is by age. We have already seen (Table 8 and Figure 6) that young workers, who have low disability probability rates, pay more than their true insurance cost, while the opposite is true for older workers. Even though younger workers have smaller accounts, their lower successful claims rate more than offsets this effect and reduces their expected insurance cost, but it doesn't reduce their fee. The dividing line between profit and loss-making workers for the disability system is between ages 40-45. From an equity viewpoint this cross-subsidy may be neutral, as we can think of a given worker redistributing to himself over his lifetime. But from an efficiency viewpoint it may distort behavior. Young workers may avoid the formal system (have a low density of contributions) because the fee they will have to pay contains a large tax, while older workers try to re-enter to gain the subsidy—both of which will increase the required insurance rate and may imply an inefficient allocation of labor.

A second obvious source of cross-subsidy is gender. On average, disability rates of men are 3 to 4 times as high as those of women (Table 11 and Figure 9). Additionally, men have survivors while women usually don't (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 D&S insurance that they likely never will use, while male workers get more than they pay for. This may discourage women from working in the formal labor market.[28]

Third, single people cross-subsidize married people. 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.

Fourth, cross-subsidies go to workers with steep age-earning profiles, since they have small accumulations relative to their reference wage. This means that subsidies go to high earners, who got that way by having steep age-earnings profiles. Low earners may then be induced to work informally, for at least part of their careers. Operating in the opposite direction, high earners may cross-subsidize low earners because they are less likely to become disabled. But if disabled, high earners may get better medical care and live longer, thereby costing the system more. These counteracting effects may be the reasons why a previous analysis based on limited data from 1987-89 does not find evidence of cross—subsidies across income groups (Valdes and Navarro 1992).

Finally, large persistent differences appear across regions, despite the procedures described above to unify criteria (Table 11). In regions 6 and 8 disability rates are about 40% and 75% higher than in the Greater Santiago, respectively. All three regions have similar age distributions and interest rates, so this is not the cause of the disparity. Industry practitioners believe that these disparities are due to lax application of the criteria by the Regional Boards in the face of a heavier incidence of claims in these regions (Figure 4). The net result is a cross-subsidy to Regions 6 and 8 from the rest of the country.

Selection by AFPs

How do AFPs react to these cross-subsidies? According to our discussions with industry representatives, they use two methods to keep disability costs down: monitoring the assessment procedure —which is efficient— and selection —trying to attract and retain workers with low insurance probabilities while trying to avoid the others. Selection reduces costs for the given AFP, but does not reduce costs for the system as a whole —it simply shifts costs from one AFP to another. It may not be efficient, as it may make it difficult for

some workers to get into the AFP of their choice for their old age retirement accounts. It may result in different fees for affiliates of different AFP's or for higher profit rates of AFPs with a low risk clientele.

AFPs cannot 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 (besides the direct effect, this reputation may induce affiliates who are contemplating filing a claim to switch to another AFP); train their staff members at branch offices to inform workers who inquire about disability insurance about risks that are covered by other disability programs such as sickness or accident insurance; and compete for skilful risk managers who will help them do all of the above.

If these strategies are effective, it would mean that high-risk workers pay a higher cost, but part of this cost may take the form of lower service and fewer choices for their retirement accounts. If some AFPs follow these strategies more effectively than others, high-risk workers may end up pooled with other high-risk workers, in AFPs with high fees, low service or low profits. AFPs collect data on disability rates by group, which will eventually enable them to refine these techniques. 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. The older AFPs also have a larger legacy of non-contributing affiliates, some of whom will apply for disability status.

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 these efforts has been at the bottom in terms of accepted covered claims per contributor, 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 Tables 12A and B). Thus cost-cutting by selection seems to go together with cost-cutting by vigorous monitoring of the approval process.

The selection problem could be completely eliminated if a single insurance company, chosen in a competitive bidding process, were given 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. However, a monopoly provider might believe it could pass higher costs back to the worker in the next round of bidding, so it would have less incentive to monitor claims carefully. In that case, the reduction in positive selection by AFPs would be accompanied by higher costs due to a reduction in oversight and appeals and an increase in adverse selection.[29]

III. Conclusion and Lessons for Other Countries

The Chilean system for disability insurance has two innovative features: it is pre-funded and it utilizes private pecuniary incentives and procedures to contain successful claims and costs. 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 life annuity or programmed withdrawal pension. We estimate that in the long run, the money in the retirement accounts will cover about half of total disability costs. Further pre-funding through the additional payment costs more than PAYG initially, but it cuts costs dramatically as the system matures. Pre-funding also reduces the sensitivity of costs to population aging.

Unlike disability assessment procedures in pure public systems, the Chilean scheme features a prominent role for private companies that have a direct incentive to keep costs low. Although the public Supervisor of AFPs chooses the members of the Regional Medical Commissions that assess claims, a medical observer representing the private AFPs sits as a non-voting member on a regular basis. About 60% of all claims are approved at

this stage. AFPs can and do bring appeals before the Central Medical Commission, which ends up reversing 9% of these successful claims (this possibility does not exist in a pure public system). They check the employment records and demand strict enforcement of the eligibility conditions for insurance. With a few exceptions, an individual must be actively working and contributing in order to qualify for the defined benefit. This excludes a large and increasing proportion—now 40%--of approved claims. As a result, only about one-third all claims are ultimately approved as both temporarily disabled and eligible for insurance, a number which is relatively low by international standards. Three years later a second assessment is carried out, which determines if the person is permanently disabled and cuts this proportion further, to 27% of the original claims.

The employment records also enable AFPs to verify the reference wage, with 0's averaged in for non-contributing years. For a worker with an average density of contributions of 60%, this reduces the defined benefit for full disability to 42% instead of 70% of the wage he earned while working (for partial disability 30% instead of 50%). A Technical Commission, which includes representatives of the AFPs and insurance companies, meets periodically to determine the medical criteria for granting partial and total disability. An increasing proportion of approved claims (now 25% of the total) have been deemed partial. Thus, less than a quarter of claims are finally deemed fully permanently disabled and insured and many of these individuals get a defined benefit that is only 40-45% of their wage when working. A major role in containing these costs is played by the AFPs, who actively participate in the assessment procedure and enforce the rules.

Consistent with what one would expect from this procedure: the inflow of new disability beneficiaries is much lower in Chile than in the US or other OECD countries, even when age structure and coverage are controlled. For age group 45-54, 2.9 per thousand insured members were accepted to disabled status in Chile in 1999, compared with 7.8 per thousand in the age group in the US and 8.6 in OECD as a whole. Insurance costs are much lower in Chile than in other countries that do not have these features—less than 1% of wages in Chile, compared with 3-5% in most OECD countries. However, incidence rates and costs are similar to Chile in the other Latin American countries that have adopted its system. While many other factors undoubtedly help explain these patterns, they are consistent with what one would expect from the incentives and pre-funding

described above. Underpinning all these private insurance arrangements is a public minimum pension guarantee, which sets a floor on disability income for workers who meet the MPG eligibility condition even if they don't qualify for disability insurance or receive only a low defined benefit.

These system features are designed to protect workers against loss of earnings due to disability, at relatively low cost. However, they also have other effects, not very evident at first, which may create problems in the future:

1. In a funded system that guarantees a defined benefit, the term group insurance premium will be very sensitive to the interest rate. The total cost of the system will vary from year to year depending on interest rates in the economy, and employers and workers have to adjust to the varying contribution rate. According to our simulations, a 1% decrease in interest rates used for annuitization will increase the premium by over 20%. Encouraging long-term contracts between AFP and insurance company might permit partial smoothing over time, but at the expense of a higher risk premium that the company is likely to demand; and costs might jump by a large amount when the contract finally changes. It is also possible that AFPs will absorb some of the cost changes and smooth fees over time, 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.[30]

2. Cross-subsidies that stem from uniform community pricing in the face of differential risk may pose problems in a competitive environment and in economies where the informal sector is large. Workers with low disability and survivor probabilities and negative cross-subsidies (when young and single) may try to stay out of the formal contributory system. They may re-enter the formal system when they have higher probabilities and positive cross-subsidies (when older and married), thereby increasing total cost while diminishing insurance coverage. AFPs may try to select good risks and avoid bad risks, making it difficult for bad risks to affiliate with the AFP of their choice. We already have (limited) evidence of selection by AFPs. While exclusion of workers is prohibited, it may be more difficult for high-risk groups (by region, age, socio-economic class) to affiliate with the AFP of their choice for their retirement saving. This does not

appear to be a huge problem currently, but it could grow. It could be eliminated by placing all workers into one large disability risk pool that is auctioned off to a single insurance company in a competitive bidding procedure. This would avoid selection problems but it might also avoid some of the incentives to control costs that exist currently.

3. A potentially high cost of the minimum pension guarantee looms, for disabled beneficiaries whose benefit is relatively low--because of low earnings or contribution densities, partial rather than full disability status or ineligibility for disability insurance. In recent years insurance costs have been contained by dampening the incidence of successful claims for full and insured disability, while the partial and uninsured disability groups have expanded. Our data indicate that the majority of disabled individuals fall into these low-benefit categories and are likely to eventually receive some subsidy as they age--providing they meet the eligibility conditions for the MPG. The long-term fiscal burden should be carefully calculated, with sensitivity analysis, to determine whether this is likely to become a problem for the public treasury.

4. If the shift to a system of funded retirement accounts is financed by a diversion of existing contributions (a carve-out) this poses a transition cost problem, which is exacerbated when disability benefits are also fully funded. Disability occurs at an earlier age than retirement and therefore pre-funded disability benefits would be disproportionately represented in the early stages of the new system. Countries that want pre-funding of disability benefits with low transition costs should consider financing disability insurance through an add-on rather than a carve-out.

What are the lessons for the US or other countries that have or are considering starting an individual account system? Should they adopt the Chilean scheme for disability insurance, to gain the advantages of pre-funding and private incentives to contain costs? In this discussion it is important to bear in mind that in the US and many other countries the account size under consideration is smaller than that in Chile, and a larger public benefit is likely to be retained. Precise replication of the Chilean disability scheme is neither feasible nor desirable under these circumstances. However, certain elements could be adapted. For example, using the money in the accounts as a partial pre-funding of the disability benefit and continuing to grant a defined benefit to disabled workers, are almost inevitable. Beyond that, some countries are very concerned about escalating disability costs while others feel

they have these costs under control. The Chilean model is probably more relevant to the former. We outline several alternatives approaches to disability insurance that might be considered, in conjunction with a social security reform that combines a modest retirement account with a downsized PAYG benefit.

1. The first alternative would use private insurance companies to pre-fund a lifetime disability benefit. Workers would be placed in one large risk pool, as they are in the U.S. today, but this risk would be financed through the private insurance market, as in Chile. In place of the decentralized provision of disability insurance in Chile, this responsibility would periodically be auctioned off in a competitive bidding process to one company (or a small number of companies to which workers were randomly assigned), to avoid creaming problems. The premium would be paid by the social security system, carved out from the tax that currently finances disability insurance, or it could be an add-on to the payroll tax, to avoid transition costs. The companies would make the additional payments which, together with the workers' own account balances, would finance the specified lifetime annuity for disabled individuals. The assessment process would continue to be run by the social security system, but with participation by the insurance companies. Costs would be kept low by pre-funding, competitive bidding and private monitoring of the assessment process. However, the insurance companies might charge a high risk premium because of their limited control over the evaluation procedure and the long uncertain time period for the lifetime annuity. Moreover, if the defined benefit for disability were high relative to the reformed old age benefit, workers would be encouraged to seek disabled status, also raising costs.

2. A variation on this theme would have the insurance companies pre-fund the disability annuity only until the normal retirement age (say, age 67), at which point the reformed 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 account, collecting interest, until age 67. Indeed, as part of their obligations, the insurance companies would pay into the account each year a contribution based on an imputed wage. When the individual reached age 67 the disability annuity would cease and he would be treated similarly to normal retirement pensioners--receiving a reformed PAYG old age benefit from the traditional system plus a pension financed by his

individual account. This variation would imply some pre-funding but less than the previous option, less uncertainty for the insurance company and a smaller incentive for older workers to apply for disability benefits. But it would continue to include private participation in the assessment process.

3. The third option would use a government agency, rather than private companies, to provide disability benefits. The agency would take the money in the accounts and provide the defined benefit directly to disabled individuals. This system would be partially pre-funded by the money in the account, but there would be no additional up-front payment, since the rest of the benefit would be financed on a PAYG basis. Because of the smaller amount of pre-funding, short run costs would be lower and long run costs higher than in a Chilean-type scheme. Costs would be much less sensitive to interest rate variations, but more sensitive to population aging, than in a funded scheme. This method is being used in Hungary, Croatia and, de facto, in Mexico.[31] A variation in Sweden, Latvia and Estonia replaces the disability benefit with the old age benefit plus a pension from the account, at the normal retirement age (see Wiese 2006 for further discussion of Hungary and Sweden). This would be most comparable to the method used in the US today.

Cost controls due to private participation in the assessment procedure would be absent in this arrangement. However, it might be possible to adapt some elements of the Chilean process, in a weaker form. For example, if the initial assessment is made by an expert body that is independent of the government agency, an agency representative could be permitted to participate in the process as a non-voting member. The agency representative could also be allowed to appeal approved cases to the next level of the assessment process, with a cost-containment and accuracy objective. This should increase the probability that both sides—the argument for paying the benefit and, in questionable cases, the argument for denial--would be presented. This would be in the spirit of recommendations made by the Social Security Advisory Board (2001).

This paper has focused on the impact of pre-funding, private incentives and other variables on disability insurance costs in the Chilean scheme. We have no evidence on the important questions of whether more accurate evaluations are made by this procedure, and whether Chile has chosen the right trade-off between benefits and costs.

Table 1: 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 note 21 for derivation of these numbers.

Col. 3 gives ratio between the two.

Table 2: Inflow to disability benefit status, Chile compared with US and OECD
Per 1000, 1999—new inflow

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

Notes: 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 disabled beneficiaries as % of population in that 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 3: Claims ratios over time—change due to aging composition effects vs. age-specific claims propensity effects

Observed	1995 age composition and age-specific claims propensities	2004 age composition and age-specific claims propensities	Change, 2004-1995
Claims/contributors	.23%	.42%	.19%
Decomposition--change in claims/contributors from 1995 to 2004	**2004 age composition,** with 1995 age-specific claims propensities constant	**2004 age-specific claims propensities,** with 1995 age composition constant	**interaction term**
Claims/contributors	.3%	.32%	
Increase from observed claims/contributors, 1995	.07%	.09%	
% of total observed change	37%	49%	14%

Source: data on claims supplied to us by Association of AFPs and calculations by authors

Notes: Panel 1 presents observed ratios of aggregate claims/contributors for 1995 and 2004, and change in claims ratios between these two years.

Panel 2 decomposes observed change in aggregate claims/contributors into two parts: one part due to change in age composition of contributors, holding 1995 age-specific claims propensities constant (as weights), and the other part due to change in age-specific propensities to file claims, holding 1995 age composition constant (as weights).

Table 4: Real rates of return needed for 70% old age replacement rate of last ten years' average wage, for worker age 60 with different number of contributing years

Years worked	r needed if contributions made at end of career
10	23%
20	11%
30	7%
40	5%

Source: author's calculations

Assumptions: 10% contribution rate, 2% rate of real wage growth, expected age of death 80. These numbers give rate of return needed for 70% replacement rate of wages earned during last ten years worked, if the person retires with an early or normal old age pension at 60. These individuals will get a higher replacement rate under disability insurance than under their retirement pension, unless their rate of return on investments exceeds the rate given in each cell.

Table 5: Numbers and size of disability policies in AFP system (stock of annuities and programmed withdrawals (PW))

	Total disability pensioners	% annuitants	Average size monthly annuity (UF)	Average size monthly PW (UF)
1988	3,294	26.4%	7.8	4.5
1989	5,181	32.7%	9.8	5.2
1990	6,785	39.6%	10.5	4.4
1991	6,942	42.8%	10.5	4.9
1992	7,196	41.7%	10.5	5.3
1993	7,301	41.7%	10.0	5.1
1994	8,295	40.7%	9.9	5.9
1995	10,409	34.3%	10.3	6.5
1996	11,931	36.4%	10.2	5.7
1997	13,413	36.8%	10.1	5.7
1998	15,875	35.9%	10.5	5.6
1999	19,069	37.9%	10.6	5.7
2000	20,281	40.6%	10.5	6.2
2001	23,388	39.6%	10.7	6.1
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 85-90% of disability pensions are for total disability. 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." The system described in the text was adopted in 1987.

UF is Unidad de Fomento—the price indexed unit of account in Chile. Its exchange rate with the dollar has varied over time. In 2002 1UF=about $25 so average monthly annuity was about $270 and average monthly programmed withdrawal pension was about $150.

The MPG has been 4.46UF, rising to 4.86UF at age 70 and 5.1UF at 75.

Table 6: Percentage of programmed withdrawal pensioners at MPG level

	% 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 number 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 voluntary 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. The proportion of annuitants receiving the MPG is much less.

Table 7: Simulation of necessary capital, own capital and additional payments, to worker, if disabled, selected ages, per $ of own-wage

	Necessary capital/ own wage	Own capital/ own wage	Additional payment/ own wage	Own capital/necessary capital
20	14.6	0.1	14.5	0.01
25	13.7	0.6	13.1	0.05
30	12.9	1.2	11.7	0.10
35	12.6	1.9	10.7	0.15
40	12.2	2.7	9.5	0.22
45	11.7	3.6	8.1	0.31
50	11.1	4.6	6.5	0.41
55	10.3	5.7	4.6	0.55
60	9.3	6.9	2.4	0.75
64	8.3	8.1	0.3	0.97
wtd av.	12.4	2.4	10.0	0.21
50, ann. r=2%	15.7	4.6	11.2	.29
50, all r=2%	15.7	3.1	12.6	.20

Source: simulation by author

Assumptions: workers remains in contributing employment through age 64 or until disabled, annual wage growth equals 2%, rate of return on account and discount rate used for calculation of necessary capital for annuity equals 4.5%, age of death is 80 for husband, 83 for wife, she is 4 years younger than he, and he must purchase a joint pension (no children as beneficiaries).

Numbers give $ of necessary capital, own capital and additional payment per $ of wage, contingent on individual becoming disabled.

Weighted average sums over all ages, with weights equal to actual age distribution of contributors in Chile.

Last two rows show how necessary capital, own capital and additional payment change for a 50-year old disabled individual when the interest rate drops to 2% at the annuity stage only and at the annuity + accumulation stage.

Table 8: Annual insurance cost, premium and cross-subsidy for permanent disability, selected ages

Age	Age distribution of contributors	Incidence of disability	Real insurance cost ($)	Insurance fee ($)	Cross-subsidy ($)	Cross-subsidy/ own wage (%)
20	.029	.0001	0.7	6.7	6.0	0.60%
25	.029	.0001	0.7	7.4	6.7	0.61%
30	.032	.0005	3.9	8.1	4.3	0.35%
35	.032	.0007	6.4	9.0	2.6	0.19%
40	.030	.0012	10.4	9.9	-0.4	-0.03%
43	.030	.0012	10.1	10.5	0.5	0.03%
45	.022	.0021	17.0	11.0	-6.1	-0.37%
50	.015	.0041	29.1	12.1	-17.0	-0.94%
55	.008	.0093	51.4	13.3	-38.1	-1.90%
60	.003	.0221	69.0	14.7	-54.3	-2.45%
64	.03	.0221	8.8	16.0	7.2	30%
Wtd av. insurance cost/wtd av. wage		.67%				

Source: simulations by author.

Assumptions: worker has an initial wage of $1000 yearly, annual wage growth of 2%, remains in labor force until age 64 or disabled, rate of return on account and discount rate used for calculation of necessary capital for annuity equals 4.5%, age of death is 80 for male worker and 83 or his wife, who is 3 years younger; he purchases a joint annuity (no children as beneficiaries).

Col. 1: actual age distribution of contributors in Chile, which is assumed to remain constant over time. This is used to weight average insurance cost and average wage.

Col. 2: incidence of newly accepted permanent disability claims/contributors from data supplied by Association of AFP's, Chile

Col. 3: insurance cost per worker = probability*additional payment as % of wage (from Table 6)*60% (In 2004 60% of accepted claims were eligible for insurance).

Weighted average insurance cost/weighted average wage (of $1420 annually) gives insurance cost as % of wage that must be charged to break even (.67% in this case). Weights are proportion of each age group in total set of contributors.

Col. 4: individual's insurance cost = worker's own-wage*break-even insurance cost as % of wage for the system (using .67% cost calculated above).

Col. 5: cross-subsidy in $ = insurance cost minus real insurance cost for individual

Col. 6: cross-subsidy as % of worker's own-wage = cross-subsidy in $/worker's own wage

Table 9: AFP disability insurance cost as % of wage under various scenarios, compared with PAYG

	Cost--Chile	Cost if no own-account	% cost from own-account	Cost if PAYG	Chile/PAYG (col. 1/col. 4)
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	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 cost as % of wages for permanent disability in Chilean-style system, compared with insurance cost 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 so this reduces the probability of insured accepted claims (the remaining 40% can draw benefits from their own accounts but do not collect the additional payment or defined benefit). 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; past service counts toward eligibility 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.

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

Row 6: r increases to 6%.

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 cost in absence of retirement accounts (additional payment = necessary capital)

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

Col. 4: cost 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 cost in Chilean scheme to PAYG insurance cost.

Table 10: Causes of increased simulated disability insurance cost, 1995-2004

Total effect	1995 age structure and disability probabilities, r=5%	2004 age structure and disability prob., ann. r=4%		Total change, 2004-1995
Simulated insurance premium as % of wage	.29%	.68%		.39%
Decomposition-- change in simulated insurance premium	**2004 age structure & 1995 disability probabilities, r=5%**	**2004 disability prob. & 1995 age structure, r=5%**	1995 age structure & disability prob., ann. r=4%	**Sum of separate effects**
Simulated insurance premium as % of wage	.35%	.44%	.38%	
Increase from simulated 1995 premium as % of wage	.06%	.15%	.09%	.3%
% of total simulated change (increase/total change)	15%	38%	23%	76%

Source: simulations by authors, based on assumptions given in Table 8 except as noted below. Data on age structure of contributors and probability of permanent disability for 1995 and 2004 supplied by Association of AFPs.

Notes: 60% of approved claims in 2004 and 70% in 1995 were assumed to be eligible for insurance; total disability probabilities were reduced by these proportions. Assumed real interest rate for accumulation stage in both years is 5%. Assumed annuity interest rate is 5% for 1995, 4% during 2004, which roughly corresponds to average annuity rates prevailing in these years.

Table 11: Variation in permanent disability rates, insured + non-insured (as % of contributors) by year, gender and region

	Chile	Region 6	Region 8	Region Metropolitana	Women	Men
1995	0.08%	0.10%	0.13%	0.07%	0.02%	0.08%
1996	0.08%	0.07%	0.12%	0.06%	0.02%	0.08%
1997	0.08%	0.09%	0.12%	0.07%	0.02%	0.09%
1998	0.10%	0.09%	0.17%	0.08%	0.03%	0.10%
1999	0.11%	0.11%	0.21%	0.09%	0.03%	0.12%
2000	0.12%	0.12%	0.21%	0.10%	0.04%	0.13%
2001	0.15%	0.19%	0.26%	0.12%	0.04%	0.16%
2002	0.18%	0.22%	0.29%	0.15%	0.05%	0.18%
2003	0.17%	0.24%	0.30%	0.14%	0.05%	0.17%
2004	0.17%	0.21%	0.26%	0.15%	0.05%	0.14%

Source: data provided to authors by Association of AFP's

Table 12A: Variation by AFPs—claims, approvals and insured, 2004

AFP	Claims/ affiliates (per 000)	Claims/ contributors (per 000)	Approval rate (%)	Insured among approved (%)	Approved insured/ contributors (per 000)
Cuprum	1.71	2.61	65	73	1.24
Habitat	2.05	4.0	61	60	1.45
Provida	2.29	4.94	56	59	1.64
SantaMaria	1.52	3.65	62	62	1.41
Planvital	1.92	5.48	62	55	1.88
Summabans.	1.78	3.27	65	62	1.33
Total	2.02	4.21	59	60	1.51

Table 12B: Variation by AFPs—successful appeals, 2004*

	First (temporary) assessment			Second (permanent) assessment		
AFP	Appeals rate(%)	Success rate(%)	Overturned rate (%)	Appeals rate(%)	Success rate(%)	Overturned rate (%)
Cuprum	28.9	38.6	11.2	22.5	30.3	6.8
Habitat	25.8	34.5	8.8	15.5	27.9	4.3
Provida	25.8	35.9	9.3	16.9	24.4	4.1
Santa Maria	26.0	39.1	10.2	18.0	19.1	3.4
Planvital	26.0	38.8	10.1	19.7	28.0	5.5
Summabans.	30.1	29.9	9.0	21.7	26.2	5.7
Total	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: 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.

Figure 1: D&S insurance costs and payouts as % of total wage bill*
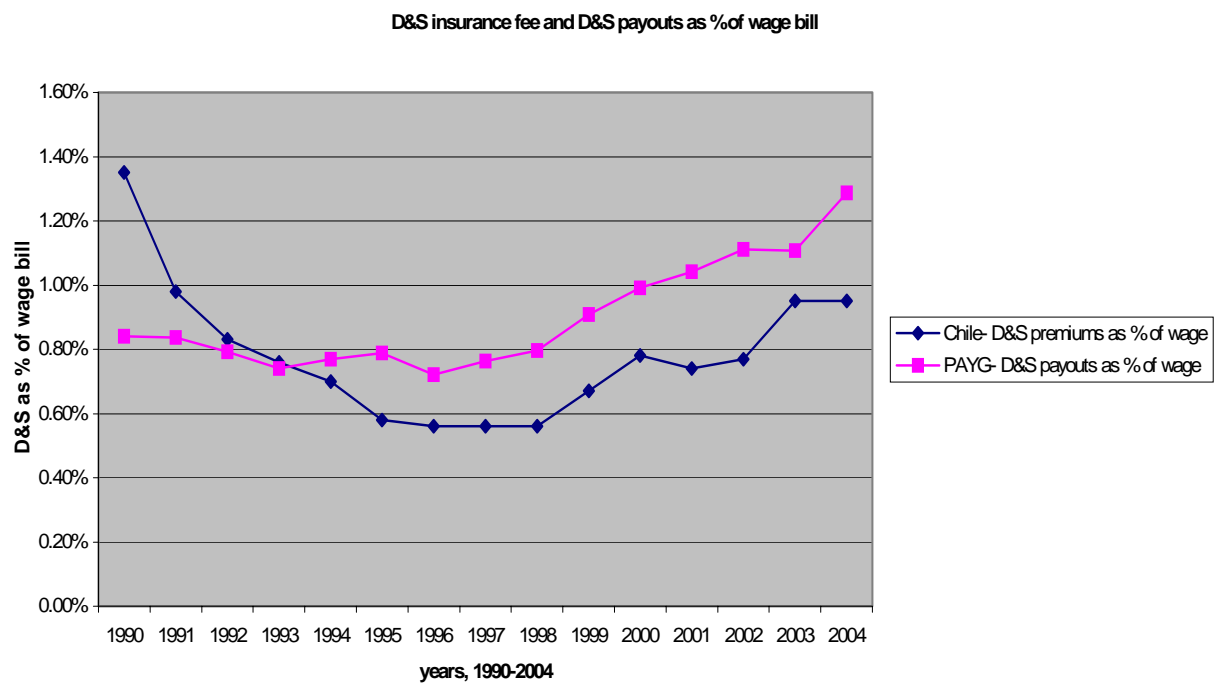(based on Table 1)

D&S insurance fee and D&S payouts as % of wage bill

Figure 2: Rising disability claims and accepted claims over time

Claims, temporary and permanent disability as % of contributors, over time
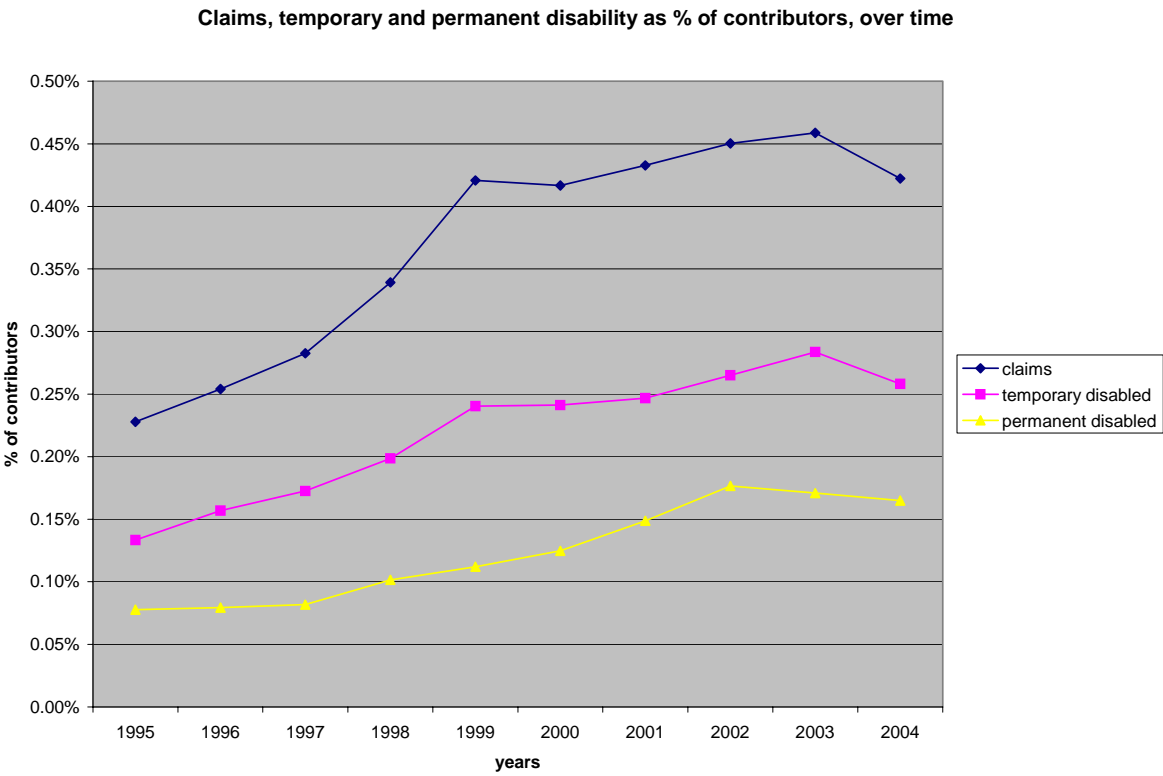
Figure 3: Disability acceptance rates over time

accepted disability rates, over time
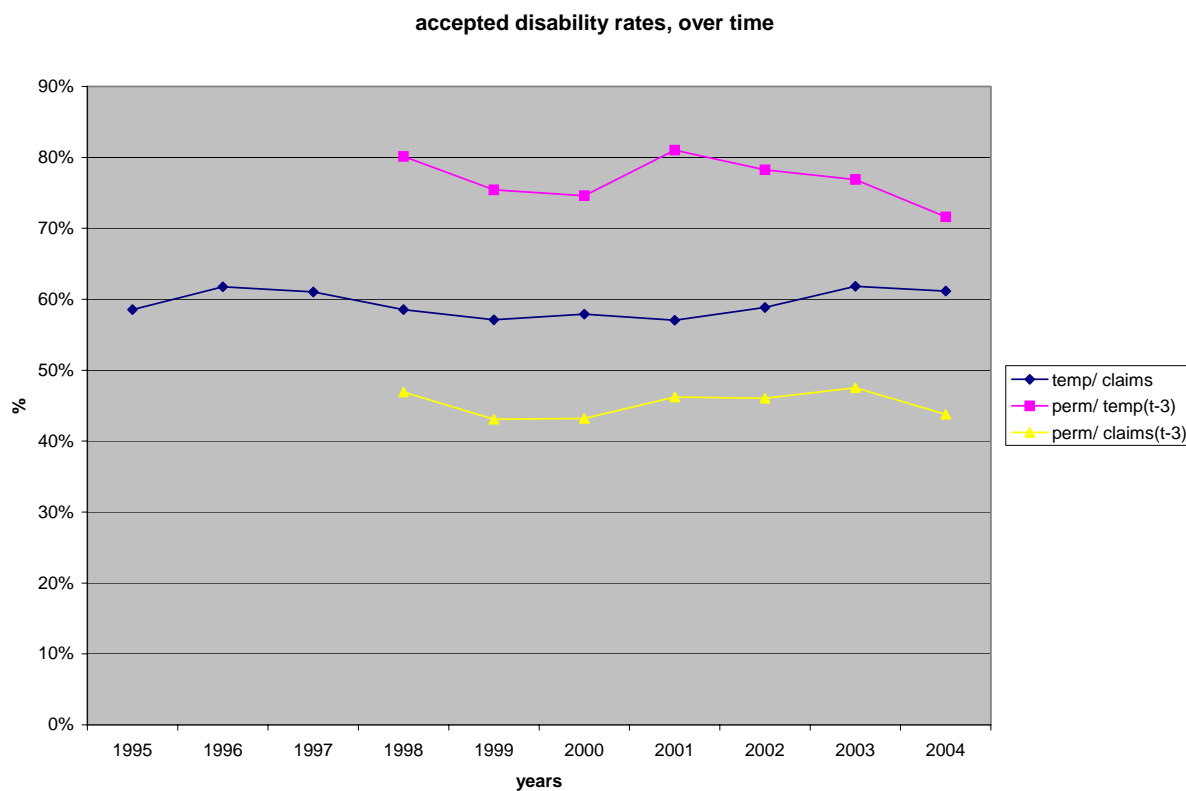
Figure 4: Claims/contributors and accepted claims/contributors, ratios of Regions 6 and 8/all-Chile

claims/contributors and temporary acceptances/contributors, ratios of regions 6 and 8 to all-Chile
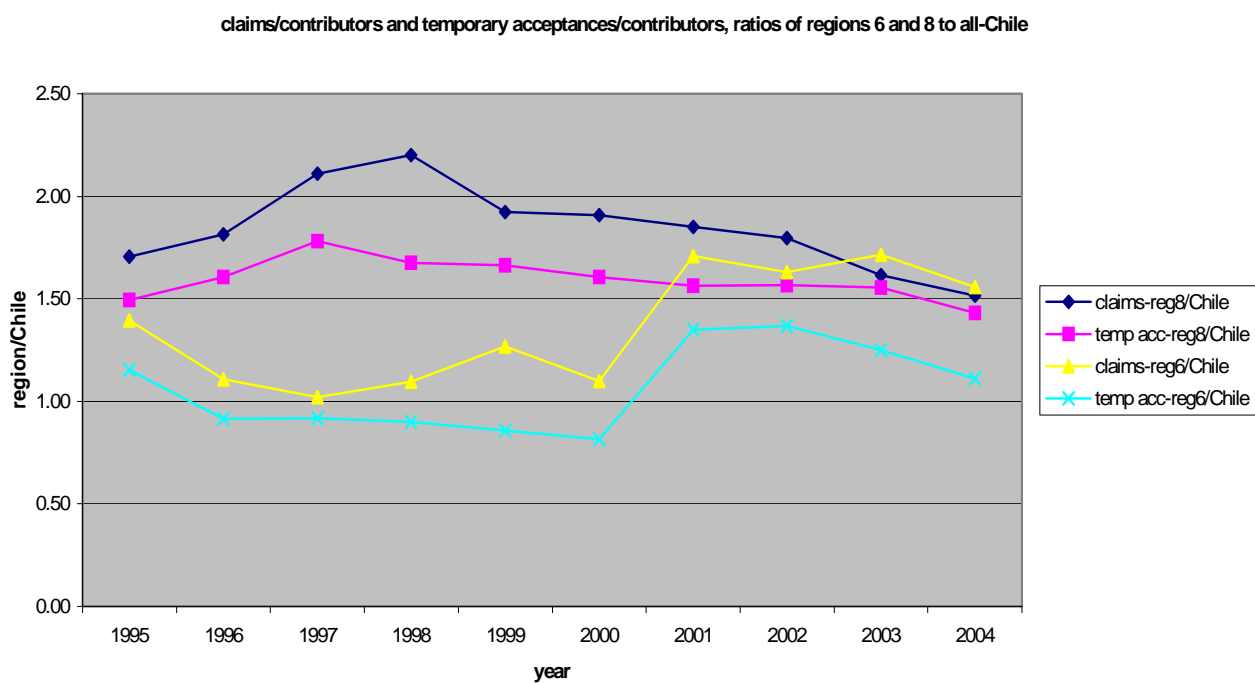
Figure 5: Simulated necessary capital, own capital and additional payment per $ of wage for disabled worker, by age

Necessary capital, own capital and Additional Payment by age, for a disabled worker
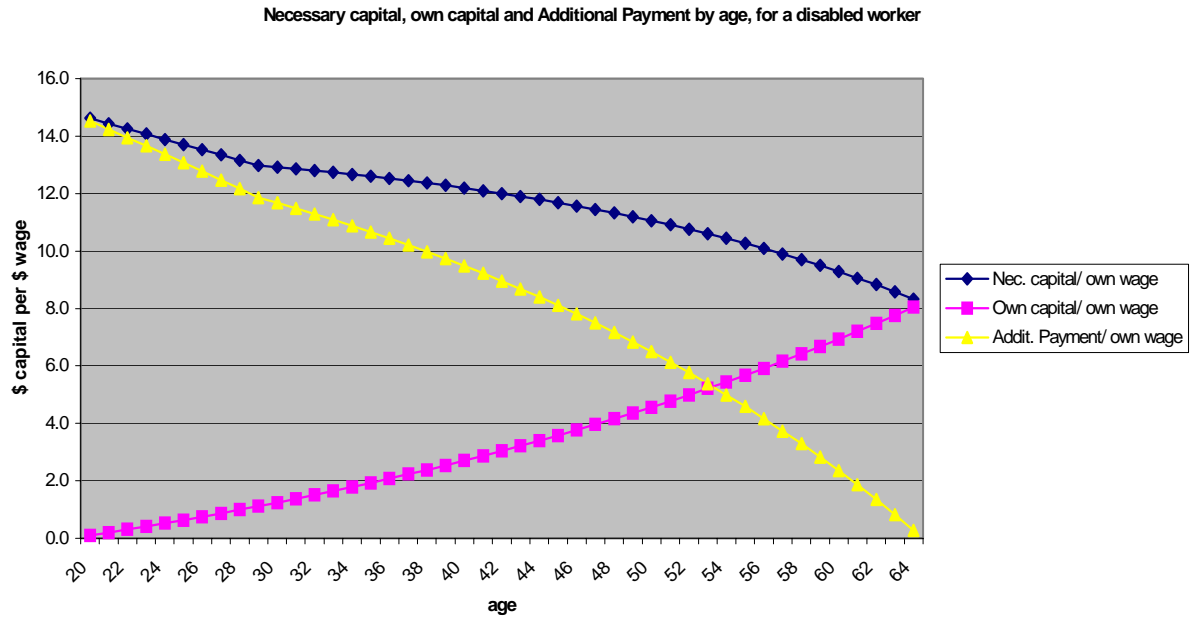
For assumptions see tables and text

Figure 6: Insurance premium, cost and cross-subsidy, by age

Insurance fee, cost and cross-subsidy, by age
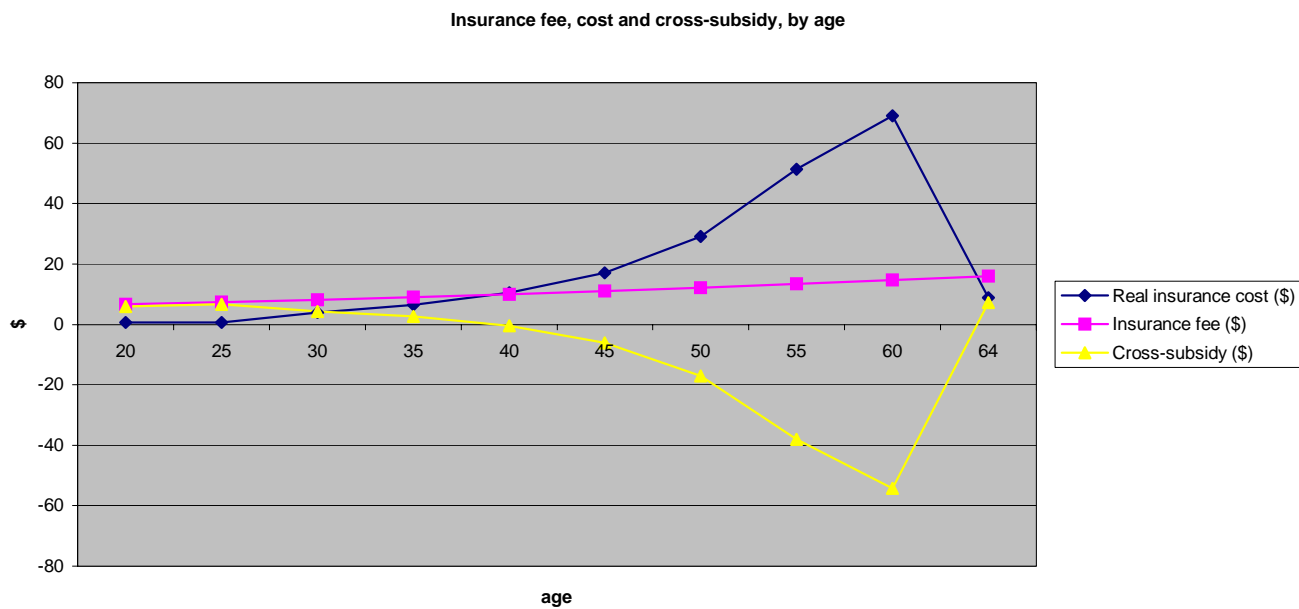
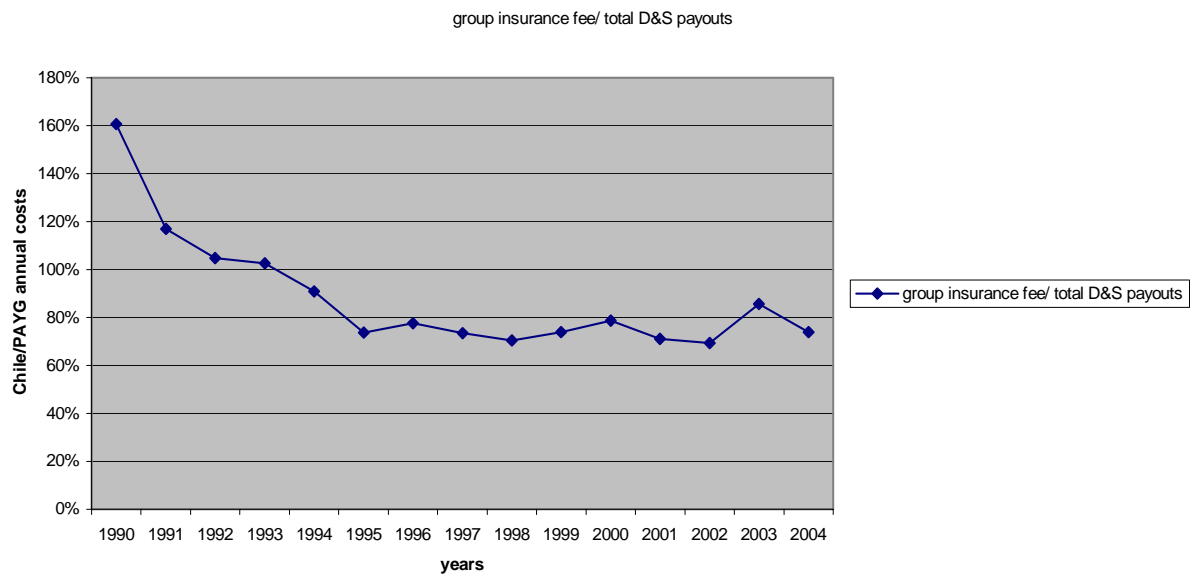**Figure 7: Annual D&S costs: ratio of Chilean/PAYG approach** (based on Table 1)

group insurance fee/ total D&S payouts

Figure 8: Growth in age-specific permanent disability rates

new permanent disability/contributors by age&year
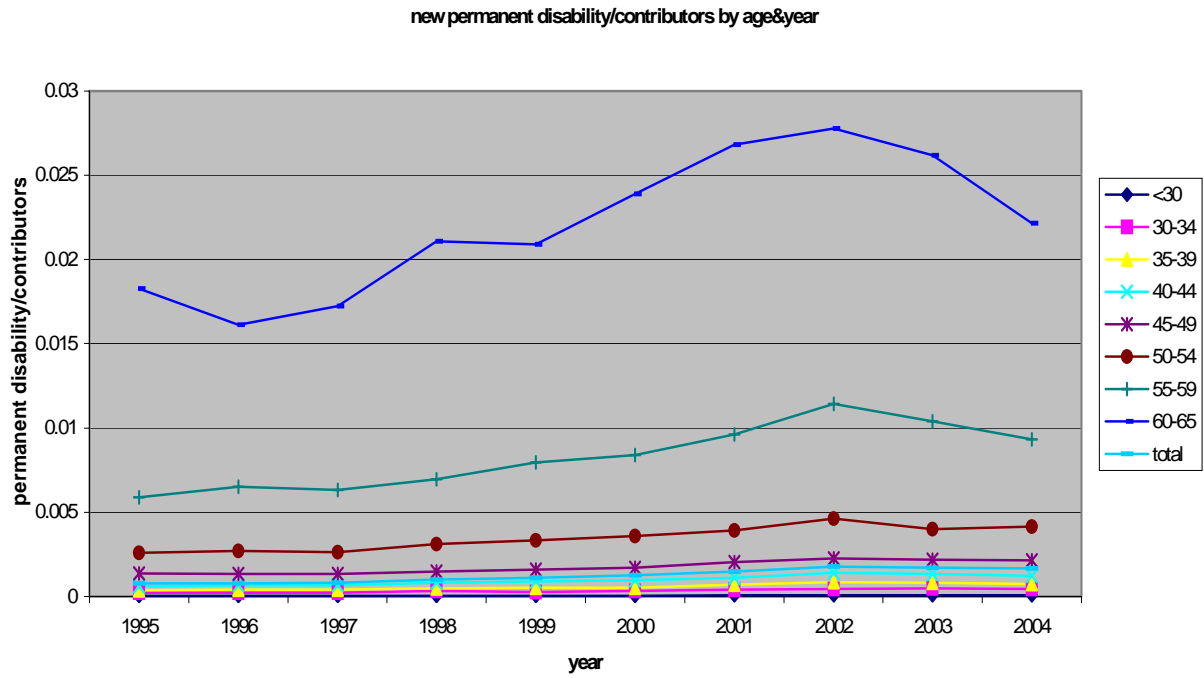
Figure 9: Differences in disability rates by gender

New accepted permanent disability claims/total contributors
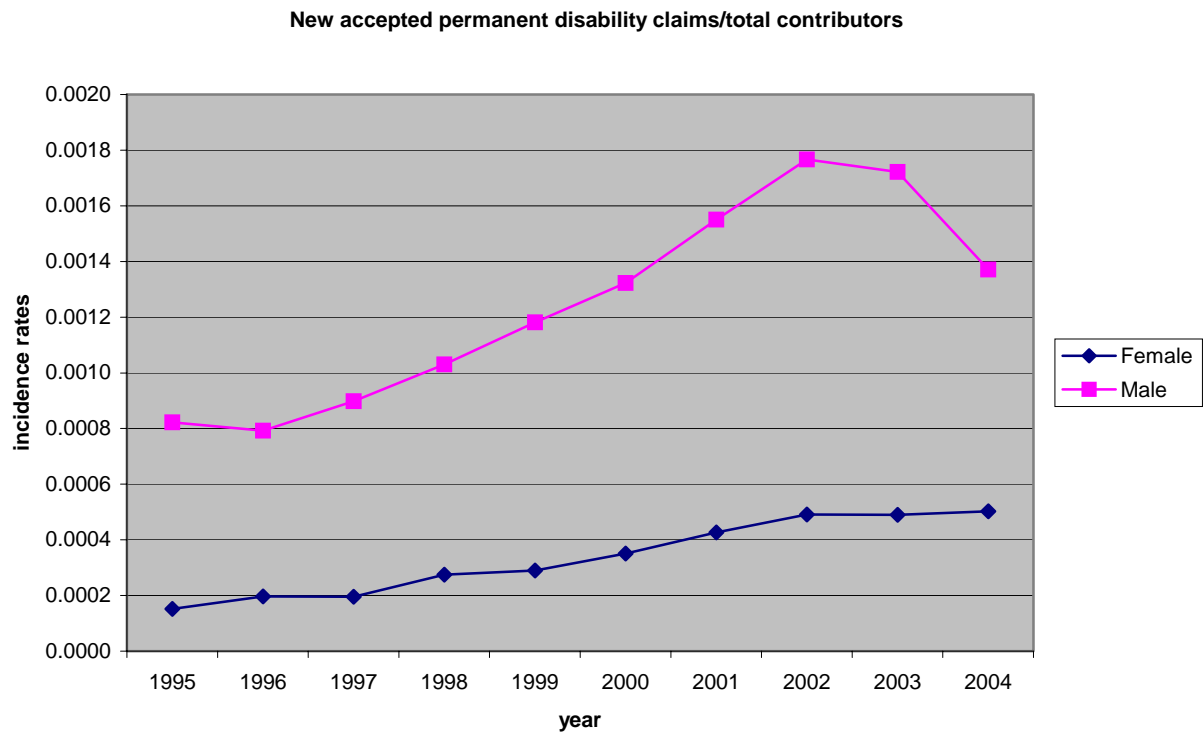
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Endnotes

[1] For previous discussions of disability insurance in Chile and other countries with individual accounts see Grushka and Demarco 2003, Castro 2005 and Wiese 2006. 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. We do not discuss them further in this paper.

[2] The breakdown given between disability insurance and survivors' insurance is based on data analysis by the authors. The worker faces a combined administrative fee that includes the cost of D&S insurance and general administrative charges.

[3] 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.

[4] 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, whether for total or partial disability, 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. In this sense, the Chilean disability system rewards work, as does the Chilean old age system (see Edwards and James 2005). However, workers who have withdrawn from the labor force during their provisional period may find it difficult to re-enter later on.

[5] For example, in the U.S., appeals can only be brought by workers whose initial claims have been denied, so appeals inevitably increase approved cases. In 2000, only 38% of claims were approved initially (with wide variation across states), rising to 55% after all the appeals. (Social Security Advisory Board 2001, pp. 8, 18, 19). It is possible that initial decisions are more negative than they would be otherwise, knowing that one-sided reversals will take place subsequently. Data are not available on how many appeals against denials were made by claimants in Chile.

[6] In the case of a member declared partially disabled, the additional payment is the difference between the necessary capital and 70% of the balance in the personal savings account. The remaining 30% of the balance allows the member to finance an additional pension, bringing his

ultimate replacement rate above 50%. Of course, this provision adds to total insurance costs. However, 80-90% of disabled workers are certified as totally disabled so this provision has not had a large impact. Members who are declared permanently partially disabled may later apply for a total disability declaration. This has no financial impact on the AFP or the insurance company because, if the application is successful, the person only gains access to the rest of the balance in his account.

[7] International comparisons are fraught with difficulties since details of the disability plans and their implementation vary widely, underlying economic and demographic conditions play a large role, and data is collected in different ways. 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. 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.

[8] Some people attribute the increase in claims to a rise in the rate of unemployment after 1999. Claims started to fall in 2002, as the unemployment rate fell. See Castro 2005. Worker learning about how to use the new system is another possible explanation for rising claims. In any event, AFPs have not pressed to increase the rejection rate—so long as the rise in approved claims is concentrated in those ineligible for insurance.

[9] This incentive has been mitigated by the very high (10% real) rate of return earned during the first 25 years of the new system; but we can expect these high rates of return to fall and therefore the incentive to retire on disability to rise in the coming years.

[10] This 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.

[11] 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 may be subject to political disapprobrium. Also, if a group of AFP shareholders has a larger participation in a life insurance company than in the ownership of the AFP, they may try to influence the AFP decision, to get the contract awarded to their life insurance company. Indeed, these things might have happened in the early years of the new system, when AFPs contracted directly with insurance companies to pay the benefits, without giving workers any choice in the matter. In Argentina (which has a similar system) in 2002, 11 of the 12 pension funds belonged to the same ownership group as their insurance company—an arrangement that apparently led to high insurance fees (Grushka and Demarco 2003). In 1987 the system was changed in Chile, as described in the text, to make the annuity market more competitive by giving workers a choice among annuity providers. Competitive bidding and reporting requirements may also have avoided these conflicts of interest. Since that time, 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, and there is no apparent difference in the contract terms between those with and without such a relationship.

[12] Current tables 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. 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. They also depend on years of exposure—in general, disability mortality rates tend to be especially high during the first few years after the claim is made and closer to the population average thereafter. (See James, Martinez and Iglesias 2006 for a more general discussion of overstated mortality and interest rates in the Chilean payout stage).

[13] However, only 40% of disabled workers choose to annuitize, many of these choose a guaranteed period annuity for which the market price may be charged, and some purchase an annuity on market terms from a different insurance company.

[14] Insurance companies and AFPs also take on some stock market risk, 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 (of course, the opposite is also true). This risk has not been very great in the past, since the proportion that could be invested in stocks was limited by regulations. The allowable percentage rose when portfolio choice was increased in 2002, but the transitory disabled are not allowed to invest in the riskiest portfolios.

[15] Insurance companies are not forced to re-insure the D&S contract. Although they have done this in the past, currently there is almost no general reinsurance. Apparently the price that would be charged by international re-insurance companies exceeds the price that domestic companies would be willing to pay. Most insurance companies, however, do have re-insurance to cover the risk that a group of workers will become disabled in a single event.

[16] 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. This means-test is supposed to be implemented by the AFPs that pay the programmed withdrawal pensions. However, it is not clear that they have an incentive to vigorously enforce it. See James, Martinez and Iglesias 2006.

[17] Consider the case of a half-average-wage worker with a 60% density of contributions, who qualifies for insurance. His defined benefit will be 50%*60%*70%=21% of the average wage. In this case, during the temporary disabled stage the AFP pays his provisional pension and the member takes out an additional amount from his personal account, bringing the total to 25% of the average wage. After a positive permanent assessment, the resources withdrawn from the account are subtracted from the required additional payment. The member must take a programmed withdrawal, withdrawing the minimum pension from his account until it is exhausted, at which point the state pays the whole minimum pension. Thus the low reference wage, which saves money for the insurance scheme, ultimately increases the fiscal burden.

[18] Actually, a larger percentage started with PW, but some have already used up their funds. If they do not qualify for the MPG, they would no longer show up as receiving a disability pension. Among those who started on PW, many did not choose to do so, but were required to take PW because they did not have an accumulation that was large enough to finance an annuity above the MPG level.

[19] For expositional simplicity, we abstract here from other insurance costs such as provisional pensions and contributions paid back to workers who are not declared permanently disabled.

[20] 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.

[21] We abstract there from the possibility of a changing density of contributions, which may lead to an uneven contribution pattern. In the past, recognition bonds that grant credit for service in the old pension system also constituted a large part of the individual's own accumulation. However, these recognition bonds are now diminishing in importance, as most newly disabled persons today had little service prior to 1981.

[22] The worker's total own capital rises faster and further, and the total necessary capital also rises despite the fewer years of annuitization, due to wage growth over the worker's lifetime. This partly moderates the decline in additional payment per unit of wage.

[23] If density of contributions falls after a certain age, this would reduce the reference wage, thereby partially offsetting the cost impact of higher disability probabilities. In this exercise we abstract from changing densities over the lifetime.

[24] Note that this simulation applies to permanent disability only. Costs of temporary disability and survivors' benefits would more than double the total cost of D&S insurance. However, actual interest and mortality rates have been much higher than our assumed rates, offsetting much of this higher cost in the past, but possibly not in the future.

[25] 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, 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).

[26] We cannot compare disability costs alone, since reported insurance premiums combine disability and survivors' 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 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 1 col. 2.

[27] The rapid aging of contributors is due in part to the fact that the new system started out with a relatively young age structure, as older workers stayed in the old system when the basic pension reform took place in 1981. Additionally, under the new system older workers have postponed pension age, which means that many stay in the contributory work force (Edwards and James, 2005).

[28] The Council for Pension Reform, set up by Chile's new President in 2006, recommended that husbands of female workers should also be considered survivors and, furthermore, that D&S insurance should be priced separately for men and women.

[29] Interestingly, the new unemployment insurance system instituted 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 winner bid was the one representing a consortium of AFPs.

[30] We may contrast this arrangement with funded defined benefit employer-sponsored plans, 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.

[31] Mexico was supposed to use a system similar to that in Chile, except that the old social security agency was entrusted with the responsibility for collecting the D&S premium and coming up with the additional payment, when necessary. The premium was set at 2.5%, by law, rather than by the market. The premium is much higher than that in Chile, in part because it was not market-determined and generous cost factors were built in, and in part because the size of the individual accounts was much smaller in Mexico, so larger additional payments were needed (smaller contribution rate, newer system, no recognition bonds). The agency was supposed to auction off each annuity contract to the lowest bidding insurance company. However, according to anecdotal evidence, the agency found that the cost of lifetime annuities exceeded 2.5%, while paying the benefits on a PAYG basis was much less than 2.5%--as we would expect during the early years of a new scheme. They therefore delayed the annuity process, and gave individuals the option of requesting direct payment from the agency. Data show that the number of annuity contracts authorized by IMSS rose dramatically at the start of the new system in 1997, but has decreased sharply over the past 4 years. The difference between 2.5% of wages and actual D&S payouts provides a cash surplus to the agency for its other purposes—but this surplus is only temporary, as in most new PAYG systems.