Market Structure and Difficulty with Cost Reduction in Privatized Social Security

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Introduction

In many countries around the world, pension privatization has become a hot topic of discussion. There are fierce debates as to whether privatization is a good thing. But, none of these debates has generated more heat than the debate over the perceived high cost of the pension funds. For example, Kay (1997), in his criticism of the Chilean reform, notes that "One problem is huge management fees. Up to 20 percent of worker contributions go to middlemen." This problem of high management fees is not unique to Chile alone. As we document below, it is endemic in almost all the Latin American countries. High charges do not just plague the pension systems in the developing economies. It also affects private pension in the developed countries as well. For example, Murthi et al. (1999) document the problem for the United Kingdom.

In this paper, we document the problem for the Latin American countries. We show that the fees are lumped together with the death and disability component. Therefore, it is not always easy to delineate the effects of management fees per se.

Catalog of Charges

Table 1: Approaches to Management Fees by Country

Type	*Country*
No restriction	Australia (superannuation), UK (personal pension), Hong Kong, US (401(K))
Cross subsidy	Mexico
Limits on Structure	Argentina, Chile, Hungary
Partial Ceiling	Poland
Variable Ceiling	Sweden
Competitive bidding, multiple portfolios	US (thrift savings)

Fixed charge ceiling	El Salvador, Kazakhstan, UK (stakeholder pension)
Monopoly rights with bidding	Bolivia

Source: Whitehouse (2000)

In table 1, different approaches to management fees in different countries are depicted. From the top of the list, as we go down, we get more restrictions. So, in the US (401(K)) plans, there is very little restriction on how much charge is imposed and on whom. Specifically, there may be differential fees based on the type of the affiliate. In Mexico, restrictions are generally on the proportion. Thus, if a fund charges 1.7% of wages on the flow to one customer, it cannot charge a different amount to a different customer. As we go down the list, the restrictions become stringent. Thus, as the bottom of the table, where Bolivia appears, the charges imposed are severely restricted. The pension fund is given a monopoly in exchange for the lowest bid for charges.

Alternative Forms of Charges

How much does a fund charge (commission) for managing money? This is a very simple question. But, how the charges are expressed, makes the answer complex. (1) Commissions come in three basic flavors (a) commission over the flow of funds, (b) commission over the account balance and (c) commission over the real rate of return. In addition, some companies charge commission by combining (a), (b) and (c). (2) In addition, the commissions mentioned in (1) do not stay constant over time. They vary with the number of years one stays in the fund. (3) Income of each individual does not stay constant during his/her working life. (4) Commission is sometimes expressed including death and disability insurance (often called "total" commission) and at other times excluding it. Moreover, the coverage of death and disability is not the same across

countries (although, they are the same within a given country). (5) There are additional charges (in some countries) for entering a new fund or for leaving an old fund.

Therefore, even if we try to convert the charges in the form of "equivalent charges" (as a percent of new contribution or as a percent of account balance), these conversions are sensitive to the assumptions about the length of affiliation, interest rates assumed etc.

In the appendix, we set up a model where all those elements are taken into account. In the Mexican context (see below) where all forms of charges are allowed (and used by funds), the formula for calculating charges can be extremely complex.

The general point of the story is depicted above. In general, charges on flow shows high charges in the short run but low charges in the long run. On the other hand, charges on balance come up with the opposite effect. The logic is simple: if the account balance is low, the absolute amount of charge stays low with charges on the balance. As the amount of money in the account grows, the absolute amount gets bigger.

Below, we analyze the management fees country by country. Detailed discussions about the pension reform in each of these countries can be found in Sinha (2000).

Should there be a pattern in fees reported? As we observe a split between the net management fees and the death and disability insurance, we should expect a larger variation in the net management fee component across companies and very little variation in the death and disability component. The reason is that there should be very similar portfolios of affiliates among the pension funds. Except for Chile, no other country follows such a pattern.

Should there be a relation between the market share of a fund and the charges imposed? If the restrictions on investment across funds is high, then affiliates should pay a lot of attention to the fees charged as there would not be a great variation in rates of return of different funds. But, in general, this does not seem to be the case (except in Chile).

Argentina

Argentina started privatized pension scheme with Ley 24241 in 1993. The charges show substantial variation within the system. It is interesting to note that the variation of the total fee is lower than the variation in the insurance component. The insurance component varies from a low of 0.60% of wages to 1.45% of wages.

There is no clear relation that bigger companies are charging lower insurance. However, one fact does emerge when we compare total fees for the affiliates with market share. Total fees are higher for pension funds with larger market share (see graph). In a curious twist, the fund Nación owned by the state owned Banco de la Nación did not manage to win large market share.

Table 2: Market Share and Charges in Argentina

Argentina	*affiliates*	*percent*	*total*	*fees*	*insurance*
Arauca - Bit	263,538	3.25%	2.77	1.83	0.94
Consolidar	1,408,021	17.37%	3.30	2.40	0.90
Futura	129,533	1.60%	3.00	1.74	1.26
Generar	152,935	1.89%	2.47	1.87	0.60
Máxima	1,302,361	16.07%	3.57	2.47	1.10
Nación	647,987	8.00%	3.25	2.26	0.99
Orígenes	1,539,581	19.00%	3.55	2.47	1.08
Previnter	706,713	8.72%	3.51	2.31	1.20
Previsol	260,714	3.22%	3.58	2.58	1.00
Profesión + Auge	111,806	1.38%	3.00	2.20	0.80
Prorenta (1)	358,629	4.43%	3.50	2.50	1.00

Siembra (2)	1,112,178	13.72%	3.56	2.58	0.98
Unidos	109,978	1.36%	3.49	2.04	1.45

Source: FIAP, figure for end of June 2000

Colombia

Table 3: Market Share and Charges in Colombia

Colombia	*Affiliates*	*percent*	*total*	*fees*	*insurance*
Colfondos	624,353	16.81%	3.50	1.45	2.05
Colpatria	246,922	6.65%	3.50	1.40	2.10
Horizonte	566,390	15.25%	3.50	1.50	2.00
Porvenir	959,543	25.84%	3.50	2.00	1.50
Protección	601,394	16.20%	3.50	1.50	2.00
Santander (1)	679,650	18.30%	3.50	1.56	1.94
Skandia	35,097	0.95%	3.34	1.35	1.99

Source: FIAP, figure for end of June 2000

The Colombian congress approved a pension reform package in December of 1993 by passing the "Ley 100 de 1993." The market shares of various companies are listed above. One remarkable fact can be immediately seen from the above table. Except Skandia, all funds have exactly the same total charge (fees plus insurance). The government set out a limit of 3.5% gross charge. Every fund (except Skandia) has touched that limit. The curious element here is that despite the lowest charge, Skandia has not managed to capture more than 1% of the total market.

It would appear that all funds should have very similar portfolios of affiliates. Thus, all funds should charge approximately the same for death and disability insurance. The variation should come from different management fees. This does not appear to be the case.

Chile

Table 4: Market Share and Charges in Chile

Chile	*percent*	*total*	*fees*	*insurance*

Aporta Fomenta	27,194	0.44%	2.95	2.30	0.65
Cuprum	422,669	6.87%	2.52	1.87	0.65
Habitat	1,391,678	22.61%	2.16	1.51	0.65
Magister	91,724	1.49%	2.85	2.20	0.65
Planvital	312,837	5.08%	2.55	1.90	0.65
Provida	2,461,695	40.00%	2.25	1.60	0.65
Santa María	953,141	15.49%	2.39	1.74	0.65
Summa Bansander	493,085	8.01%	2.38	1.73	0.65

Source: FIAP, figure for end of June 2000

Chile privatized its pension system with the "Decreto Ley 3500" of 1980. The system has been in existence for more than two decades. It is the longest running privatized pension system with individual accounts in the world.

Funds in Chile show the pattern of what we might expect from an Economics 101 text where affiliates care about the charges and nothing else. The insurance component is exactly the same for all funds. The variation in pension fees is very similar to their market shares: companies with higher market shares have lower fees.

Chile is the only country to have long enough experience to see what happens over the long run. When we consider fees as a percentage of salary over time, we see that it is falling after a short initial rise. It was more or less stable over 1990-97. Then, it started to fall again (see graph).

A completely different picture emerges when we consider fees as a percentage of average contribution (see graph). After a short decline, the fees rise steadily until 1996. It then takes a turn downward.

Why do we get such radically different pictures? The first graph looks at the combined fee: it includes both management fees and the death and disability insurance. A fall in total fee can mask a rise in management fee itself.

El Salvador

El Salvador passed its social security privatization law with Decreto 927 in 1997. The new system was up and running in 1998. It is the newest addition to the group of countries with privatized pension system.

Charges in El Salvador show the same curious pattern as in Colombia. The total fee for a pension fund (total means actual management fees plus insurance cost) is capped at 3.25%. Except one fund (Porvenir), all other funds charge exactly at the limit. However, their insurance component shows a large variation: those with high insurance costs show a low net fee component and vice versa.

Table 5: Market Share and Charges in El Salvador

El Salvador		*percent*	*total*	*fees*	*insurance*
Confía	292,647	37.31%	3.25	1.90	1.35
Máxima	116,556	14.86%	3.25	2.15	1.10
Porvenir	175,828	22.42%	2.95	1.65	1.30
Previsión	170,514	21.74%	3.25	1.95	1.30
Profuturo	28,731	3.66%	3.25	1.75	1.50

Source: FIAP, figure for end of June 2000

Mexico

Mexico privatized pension with Ley de Seguro Social of 1995 and Ley SAR of 1996. There have been a number of changes in the charges imposed by different companies. For example, in the beginning (1997), Banamex offered a reduced fee. XXI also changed its fee structure.

Table 6: Market Share and Charges in Mexico

Mexico	*affiliates*	*share*	*on flow*	*on balance*	*on real return*
Banamex	2,047,392	12.35%	1.70		
Bancomer	2,671,234	16.12%	1.68		

Bancrecer	636,609	3.84%	1.60	0.50	
Banorte	1,470,461	8.87%	1.45	1.00	
Bital	1,688,509	10.19%	1.68		
Garante	1,794,443	10.83%	1.63	0.50	
Inbursa	382,695	2.31%			33%
Principal	502,786	3.03%	1.60	0.45	
Profuturo GNP	2,055,038	12.40%	1.67	0.70	
Santander (*)	2,315,873	13.97%	1.70	1.00	
Tepeyac	279,220	1.68%	1.60	0.15	
XXI	523,099	3.16%	1.50	0.20	
Zurich	206,903	1.25%	1.65	0.50	

Source: FIAP, figure for end of June 2000

Among the privatized mandatory pension schemes in the world, Mexico has the most complex fee structure. Three very large funds charge purely on the flow of money (Banamex, Bancomer and Bital). One charges purely on the real rate of return (Inbursa). Thus, for example, Inbursa would charge nothing if the real rate of return happens to be negative in a given year. The rest have a mixture of charges on the flow and on the balance.

There are some clear cases where one fund charges less on both counts than others. For example, XXI charges less than Profuturo in both dimensions. XXI also charges less than Principal. Yet, it did not seem to have helped XXI in capturing market share that much.

Peru

Peru privatized its pension system with Decreto Ley 25897 in 1992. The system actually started operating in 1993.

Table 7: Market Share and Charges in Peru

Peru		*percent*	*total*	*fees*	*insurance*
Horizonte	614,114	26.08%	3.74	2.30	1.44
Integra	595,654	25.29%	3.70	2.35	1.35

Unión Vida (*)	581,856	24.71%	3.67	2.39	1.28
Profuturo	563,520	23.93%	3.80	2.50	1.30

Source: FIAP, figure for end of June 2000

Among the four private pension funds operating in Peru the market shares are fairly evenly distributed. Even then, there is variation among the insurance charges of the funds. The variation in total fees is less than the variation in insurance charge.

Uruguay

Table 2: Market Share and Charges in Uruguay

Uruguay		*percent*	*total*	*fees*	*insurance*
Capital	73,261	13.27%	3.100	2.200	0.900
Comercial	95,179	17.24%	2.555	1.955	0.600
Integración	73,297	13.28%	2.950	2.200	0.750
República	208,972	37.86%	2.550	1.970	0.580
Santander	69,350	12.56%	2.930	2.250	0.680
Unión	31,924	5.78%	2.450	1.820	0.630

Source: FIAP, figure for end of June 2000

Uruguay privatized pension with the Ley 16713 of 1995. Unlike most other Latin American countries, Uruguay's system is supervised directly by the Central Bank of Uruguay. Once again, Uruguay shows a curious variation in the net fee and the insurance charges.

Bolivia

In 1996, with Ley 1732, Bolivia started off on privatizing pension. The system came on board in 1996. Unlike all other countries in the region, the government split the country in two regions and gave monopoly to a company with the lowest management fees in each region. Since both of these companies are virtually owned by the same

parent company (BBVA), it is a virtual monopoly. Thus, in this case, we cannot even address the question of market share and management fees.

Policy Issues

We investigated the cases of Latin American countries that have reformed their pension systems. With the exception of Bolivia, all the other countries have "management fees" in the region of 20% to 30% of the annual contribution. In some of these countries, these fees are obscured by the fact that the governments allows the funds to lump their management fees with death and disability insurance.

The upshot of the management fee is that the final benefits at retirement are 20% to 30% lower than what it would have been in the absence of the fee. Even the supporters of reform acknowledge that the fee is very high (James, 1995). In defense of high fees, some supporters point out that in the case of mutual funds in developed countries, the management fees can be of the same order of magnitude. This argument is invalid. For the affiliates of mutual funds, there is a choice. They may or may not join a mutual fund. For countries with a compulsory second pillar (that includes all the countries in question), there is no choice. Affiliates do not have an option of opting out of the system.

Most funds in most of Latin American charge the fee "up front". That is, fees have to be paid when contributions are made. This creates an additional incentive problem. Fund managers would have less incentive to manage the fund well if they get their commissions right at the start. In other words, it reduces the incentive for fund managers to maximize the rate of return of the fund. There is no incentive for them to do so when the fees are fixed and have no relation with the performance of the fund.

Others have put a different spin to the management fees. For example, Valdés-Prieto (1998) argues that the high management fees are an outcome of regulatory distortions of the commissions!

Unfortunately, the problem of management fees does not stop at the point of contribution alone. At the point of retirement, the affiliate has to choose between a programmed withdrawal and an annuity. In many countries, only a certain amount can be taken out in the form of a programmed withdrawal. Buying an annuity is the only other option. The management fees for annuities can be large. In Chile, the average fee is 5% (Queisser, 1999, p. 27).

Thus, a person buying an annuity immediately loses 5% of the value of the deposit in the form of management fees. This is not a phenomenon of a developing country like Chile. For example, Murthi et al. (1999, p. 44) report fees in the order of 5% to 10%.

The Singapore Alternative?

One way to reduce the cost of transaction is to grant a monopoly. A company with monopoly will automatically have all the affiliates. Therefore, it does not have to spend money on marketing the product (in this case, pension accounts). From an administrative point of view, the government is the natural choice of running such a monopoly. This was the alternative chosen by Singapore.

In Latin America, the model of Singapore is a non-starter. First, for the monopoly to operate with any degree of certainty, workers need to trust the government. Unfortunately, the track record of almost all the governments in Latin America has been rather weak. Governments are known to have squandered away money in projects of

prestige without any long-term return. Many government officials are known to have stolen money outright. Therefore, most governments in Latin America lacked (and still lack) public trust. This was not the case in Singapore.

Even if the problem of trust could be overcome, there is another problem. The government investments conservatively - either by investing in "safe" vehicles or by forcing the funds to invest in government bonds (by law). For example, the Economist (1998, b, p. 15) notes, "Singapore's Provident Fund, earns low returns, thanks to a politically driven investment strategy." Others have argued that even though the rates of return for affiliates may be low in Singapore, the rates of return for the fund itself may not be low (Sinha and Sinha, 1991).

We could view this difference in the rates of return between what a fund could have earned if it was allowed to invest freely versus what it does earn as a "tax". This is precisely the view taken in Sinha et al. (1999). A similar view is echoed by Valdés-Prieto (1998). He notes, " Regardless of the cause, from the point of view of a worker management charges play the same role as the sum of expenses plus taxes in state-managed pension funds. The Latin American experience in this connection is that the charges of private pension fund companies are much below the taxes reported above. For example, in Chile until 1996 the average charge (excluding insurance premia for disability and death) was 2.3% of the reported wage, which equals 2.3/12.3 = 18.7% of each gross contribution. As there were no more charges, the continuation of this structure over a lifetime implies that at age 65 the account balance of any worker will be 18.7% below what it would have been in the absence of charges.

To convert this figure into an annual charge on assets, we use the result that for a contributor whose taxable earnings grows at 1% per year, one extra point in the rate of return during 40 years raises the final balance by 23.3% . Thus, the annual equivalent commission charged by Chilean AFPs is { 1- log(0.813)/log(1/1.233) } = 1.16% per year over plan assets. This is still substantial, but is just half of the tax levied by the relatively efficient provident funds of Singapore and Malaysia. Thus, privatization pays off even under the expensive Chilean marketing practices."

The Real Alternative

The second alternative is to grant a monopoly to a private company. This alternative avoids the risks (such as bad management or theft) associated with the government-managed funds. The presumption is that a private company with experience is better suited to manage money. Monopoly is granted on the basis of the lowest management fee charged. This was the alternative tried in Bolivia. By granting a monopoly, Bolivia has managed to keep a lid on management fees. The winning bid charges 0.5% of funds managed. Note that 0.5% charge of funds managed is not negligible if converted in terms of flow of funds. For a person with 40 years in the labor force with reasonable assumptions about wage growth and rates of return, the charges would be equivalent to 10% of contribution each year (Diamond, 1999, table 1).
There is a downside to the above solution. In the case of a monopoly, we also face the problem of bad service. The monopolist has no incentive to provide good service. This has happened in Bolivia. Unfortunately, it is hard to evaluate the monetary value of bad service. Therefore, it is difficult to carry out a cost benefit analysis of granting a private monopoly for a pension system.

The Third Way

Suppose we agree on privatization. The question then is how decentralized should we have it. If the Bolivian monopoly or the Chilean individual account systems are not solutions, is there any other viable alternative? Some economists think so (Valdés-Prieto, 1999a, b). The solution is to have enterprise level funds. Thus, each enterprise chooses its fund (in consultation with the workers). But, any worker within the enterprise cannot choose any other fund. This method has been tried in Australia and Switzerland with some success (Vittas, 1998a). In the case of Australia, at least in the beginning, the cost was in the same order of magnitude as in Bolivia. It has since started to creep up (Quinlivan, 1998).

This method has other problems too. For example, small businesses have workers who work with many employers only for short duration (e.g., seasonal workers). Therefore, the enterprise-based system with many part-time workers is problematic. Any equitable system has to make special provision for such workers. Benedict and Sinha (1994) show that such problems can be addressed through "special accounts" for workers with low take-home pay.

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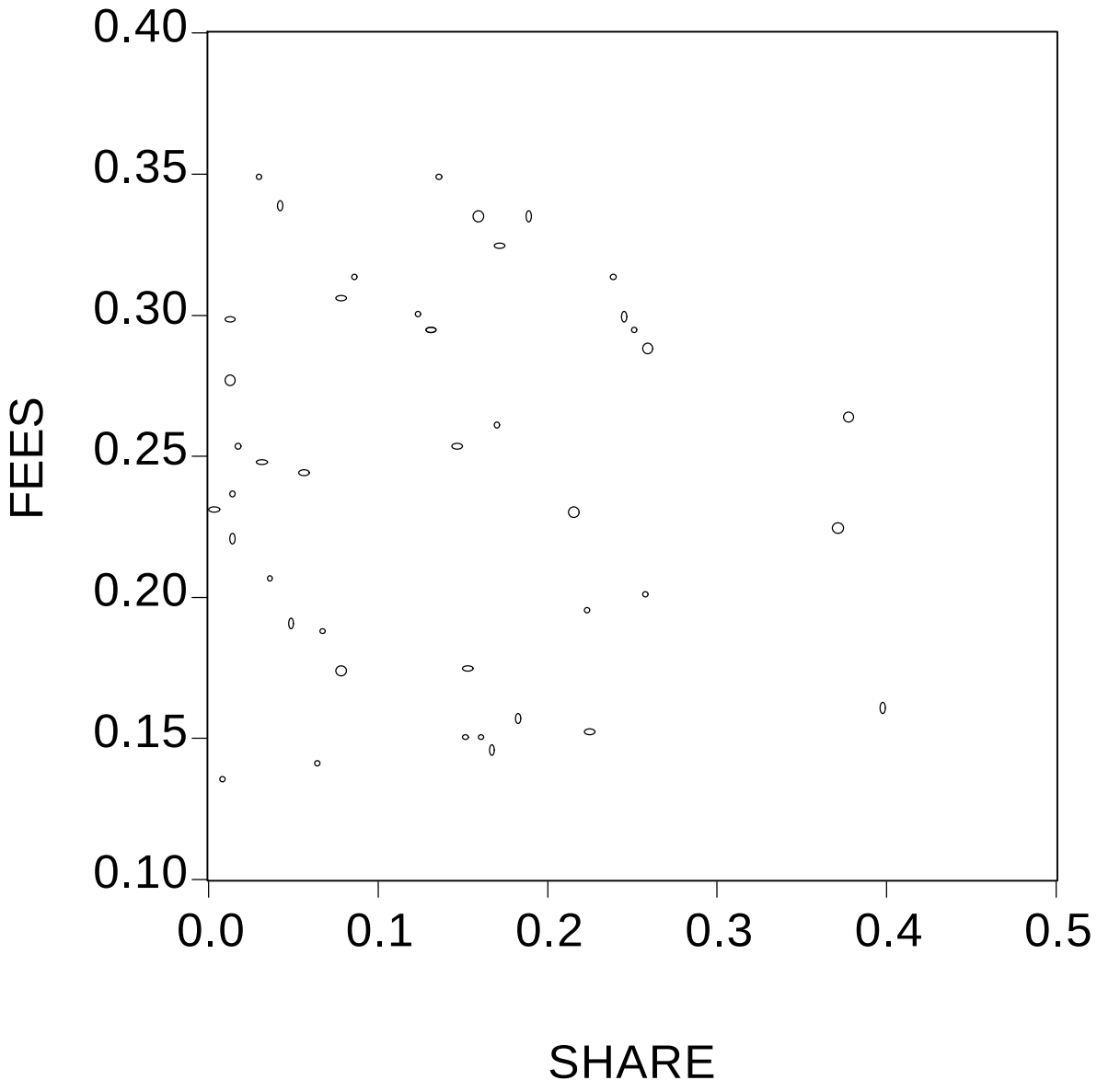
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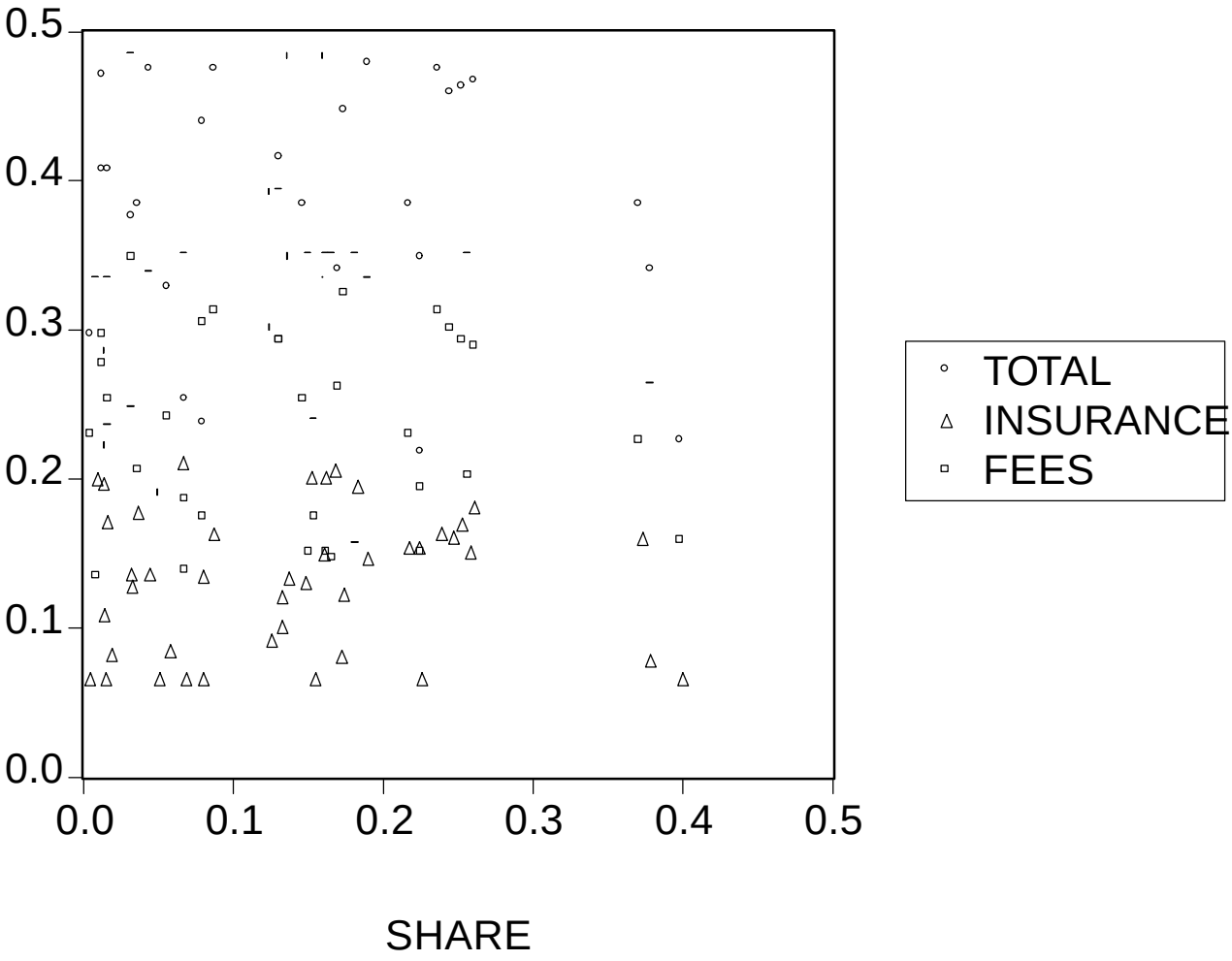
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Appendix 1

Calculating Future Value of AFORE in Presence of Transactions Costs

Developing the model

Essentially, individual retirement benefits are calculated by using a future value formula. However, the simple future value formulas we find in Kellison (1991) or other similar treatment does not deal with some of the complexities we find in the Mexican system: (1) Government contribution to the individual account does not apply every month, and the indexing is also not applicable monthly. (2) Commissions come in three basic flavors (a) commission over the flow of funds, (b) commission over the account balance and (c) commission over the *real* rate of return. In addition, some companies charge commission by combining (a), (b) and (c). (3) In addition, the commissions mentioned in (2) do not stay constant over time. They vary with the number of years one stays in the fund. (4) Income of each individual does not stay constant during his/her working life. Such changes have to be taken into account. For these reasons, the following discussion will be based on a recursive development of the formula for calculating retirement benefits.

What is the right measure of cost?

Because charges apply to different parts of the AFORE, it is not easy to compare charges across AFOREs. If we look at the system as a whole, there is a problem of charges when the system starts up. Charges appear too high! In Chile, for example, in 1984, charges amounted to 9% of wages or 90% of contributions to the retirement system (Edwards (1996), p. 17). However, the costs have come down to about 15% of contributions in 1990, (see, World Bank, (1994), p. 224).

Simple formula

For individual AFOREs, it makes it difficult to compare across funds. For example, suppose we want to compare the charges for Inbursa and Banamex. Since Banamex charges 26.15% of total contribution up-front but Inbursa charges nothing up front, it may seem like charges for the AFORE run by Banamex is very high. However, charges for Inbursa are complicated because their charges apply to the *real rate of return,* over the long run, it adds up. Thus, it makes little sense to calculate charges as a percentage of total assets in a system that just starts up.

There are several ways to look at the charges: (1) operating costs as a percentage of total annual contribution, (2) operating costs as a percentage of average total assets, (3) operating costs as a percentage of covered annual wages, (4) operating costs as a percentage of affiliates times per capita income.

There are two components of the new system: (1) contribution by the worker, (2) contribution by the government. The contribution by the worker is 6.5% of his or her base wage. The contribution by the government is 5.5% of the minimum salary *indexed to the rate of inflation.* There are two additional complications: (1) interest rate is

calculated for every account every *two* months and (2) indexation of the government contribution takes place every *three* months. Let S_k denote the accumulated sum in the kth month.

Therefore, we can write the accumulated value in the AFORE as follows in a recursive formula in the simplest case:

$$S_k = \begin{cases} (6.5\% * BW * 2 + G_k) * (1 + i_1^{(12)}) & k = 1 \\ S_{k-1} * (1 + i_k^{(12)}) & k = 2i \quad i = 1,2,\ldots,\frac{CP}{2} \\ (S_{k-1} + (6.5\% * BW * 2 + G_k)) * (1 + i_k^{(12)}) & \\ & k = 2i+1 \;\; i = 1,2,\ldots,\frac{CP-2}{2} \end{cases}$$

where, the government contribution (G, also called Social Contribution)

We write $G_k=CS_k+CS_{k+1}$

Where CS_k is defined as follows:

$$CS_k = \begin{cases} 5.5\% * MW - where \ldots k = 1 \\ CS_{k-1}(1+\rho^{(4)}) - where \ldots k = 3i, i = 1,2,... \\ CS_{k-1} - in\_all\_other\_cases \end{cases}$$

There are several peculiar natures of the formula above: calculation of benefit account uses a *simple interest* rate for the adjustment for one month's rate of return to a bimonthly rate. Therefore, we get the factor BW.2 in the above equation. Every even month, the accumulated value is simply the value of the fund with compounded interest. Every odd month, *two* monthly contributions of BW are added. Along with it, the government contribution (G) is thrown in at every odd month. The G was set at the 5.5% of the minimum salary in Mexico City for the year 1997 (about US$1 per day under the exchange rate at the end of 1997). Every three months the government contribution is adjusted according to the consumer price index. Thus, we have a factor $\pi^{(4)}$ that indicates this adjustment.

Table A1 Fee structure of AFOREs

Mexico	*affiliates*	*share*	*on flow*	*on balance*	*on real return*
Banamex	2,047,392	12.35%	1.70		
Bancomer	2,671,234	16.12%	1.68		
Bancrecer	636,609	3.84%	1.60	0.50	
Banorte	1,470,461	8.87%	1.45	1.00	
Bital	1,688,509	10.19%	1.68		
Garante	1,794,443	10.83%	1.63	0.50	

Inbursa	382,695	2.31%			33%
Principal	502,786	3.03%	1.60	0.45	
Profuturo GNP	2,055,038	12.40%	1.67	0.70	
Santander (*)	2,315,873	13.97%	1.70	1.00	
Tepeyac	279,220	1.68%	1.60	0.15	
XXI	523,099	3.16%	1.50	0.20	
Zurich	206,903	1.25%	1.65	0.50	

Making the Formula more realistic: Charges

In the formula above, we did not take into account charges that funds impose on the account holders (affiliates). Some AFOREs have charges on contribution as a percentage of wages (for example, for Banamex). Others have charges on the balance in the AFORE account (such as Bancrecer). Still others have charges on the real interest rate (such as Inbursa). Let CW be the charge on wage (rate). Let CB be the charge on balance. We need to modify the above formula as follows:

$$S_k = \begin{cases} \left(6.5\% * BW * 2 * \left(1 - \frac{CW}{6.5\%}\right) + G_k\right) * \left(1 + i_1^{(12)}\right) * \left(1 - \frac{CB}{12}\right) & k = 1 \\ S_{k-1} * \left(1 + i^{(12)}\right) & k = 2i \quad i = 1,2,\ldots,\frac{CP}{2} \\ \left(S_{k-1} + \left(6.5\% * BW * 2 * \left(1 - \frac{CW}{6.5\%}\right) + G_k\right)\right) * \left(1 + i_k^{(12)}\right) * \left(1 - \frac{CB}{12}\right) & \\ & k = 2i+1 \quad i = 1,2,\ldots,\frac{CP-2}{2} \end{cases}$$

There is a third element of charges. For two funds (Inbursa and Atlantico) charges apply to the real rate of return. Thus, we need to modify the formula to incorporate that element.

Therefore, if we include charges on the *real* interest rate, the formula becomes

$$
S_k = \begin{cases}
\left(6.5\% * BW * 2 * \left(1 - \frac{CW}{6.5\%}\right) + G_k\right) * \\
\left((1 + i_1^{(12)}) * \left(1 - \frac{CB}{12}\right) - \left(\frac{i^{(12)} - \pi^{(12)}}{1 + \pi^{(12)}}\right) * CY\right) & k = 1 \\
S_{k-1} * \left((1 + i_1^{(12)}) * \left(1 - \frac{CB}{12}\right) - \left(\frac{i^{(12)} - \pi^{(12)}}{1 + \pi^{(12)}}\right) * CY\right) \\
k = 2i \quad i = 1, 2, \ldots, \frac{CP}{2} \\
\left(S_{k-1} + \left(6.5\% * BW * 2 * \left(1 - \frac{CW}{6.5\%}\right) + G_k\right)\right) * \\
\left((1 + i_1^{(12)}) * \left(1 - \frac{CB}{12}\right) - \left(\frac{i^{(12)} - \pi^{(12)}}{1 + \pi^{(12)}}\right) * CY\right) \\
k = 2i + 1 \quad i = 1, 2, \ldots, \frac{CP - 2}{2}
\end{cases}
$$

where $\pi^{(12)}$ is the monthly inflation rate, and CY is the charge on the real interest rate and $i_R^{(12)}$ is the real interest rate

$$
i_R^{(12)} = \frac{\left(i^{(12)} - \pi^{(12)}\right)}{1 + \pi^{(12)}}
$$

One assumption made here is that the charges remain fixed for the total life of the system. Charges for each company depends on the number of years a person has been in the AFORE. For example, AFORE Banamex charges 1.70% of wages up to year 4. However, for a person who stays with it for the fifth year gets a reduction in charges. Thus, year 5 charge becomes 1.68% of wages, year 6 charge becomes 1.66% of wages and so on. This process continues until year 39 with the AFORE with a reduction of 0.02% of wages for every additional year. Hence, our formula needs to take such a reduction into account.

$$S_k = \begin{cases} \left(6.5\%*BW*2*\left(1-\frac{CW*(1-f_k)}{6.5\%}\right)+G_k\right)* \\ \left((1+i_1^{(12)})*\left(1-\frac{CB*(1-f_k)}{12}\right)-\left(\frac{i^{(12)}-\pi^{(12)}}{1+\pi^{(12)}}\right)*CY*(1-f_k)\right) & k=1 \\ S_{k-1}*\left((1+i_1^{(12)})*\left(1-\frac{CB*(1-f_k)}{12}\right)-\left(\frac{i^{(12)}-\pi^{(12)}}{1+\pi^{(12)}}\right)*CY*(1-f_k)\right) & \\ k=2i \quad i=1,2,\ldots,\frac{CP}{2} & \\ \left(S_{k-1}+\left(6.5\%*BW*2*\left(1-\frac{CW*(1-f_k)}{6.5\%}\right)+G_k\right)\right)* & \\ \left((1+i_1^{(12)})*\left(1-\frac{CB*(1-f_k)}{12}\right)-\left(\frac{i^{(12)}-\pi^{(12)}}{1+\pi^{(12)}}\right)*CY*(1-f_k)\right) & \\ k=2i+1 \quad i=1,2,\ldots,\frac{CP-2}{2} & \end{cases}$$

Note that f_k is not the same for all funds. For example, AFORE Bancomer offers a rising discount rate starting with 0.01% of wages up to 0.05% of wages.

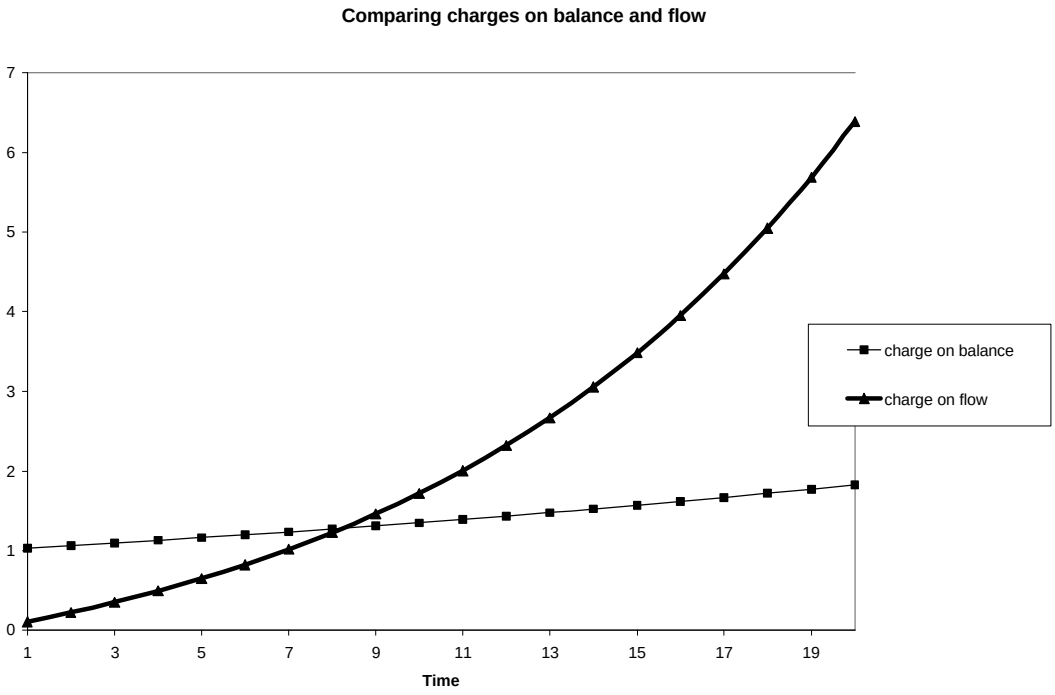
More Refinements

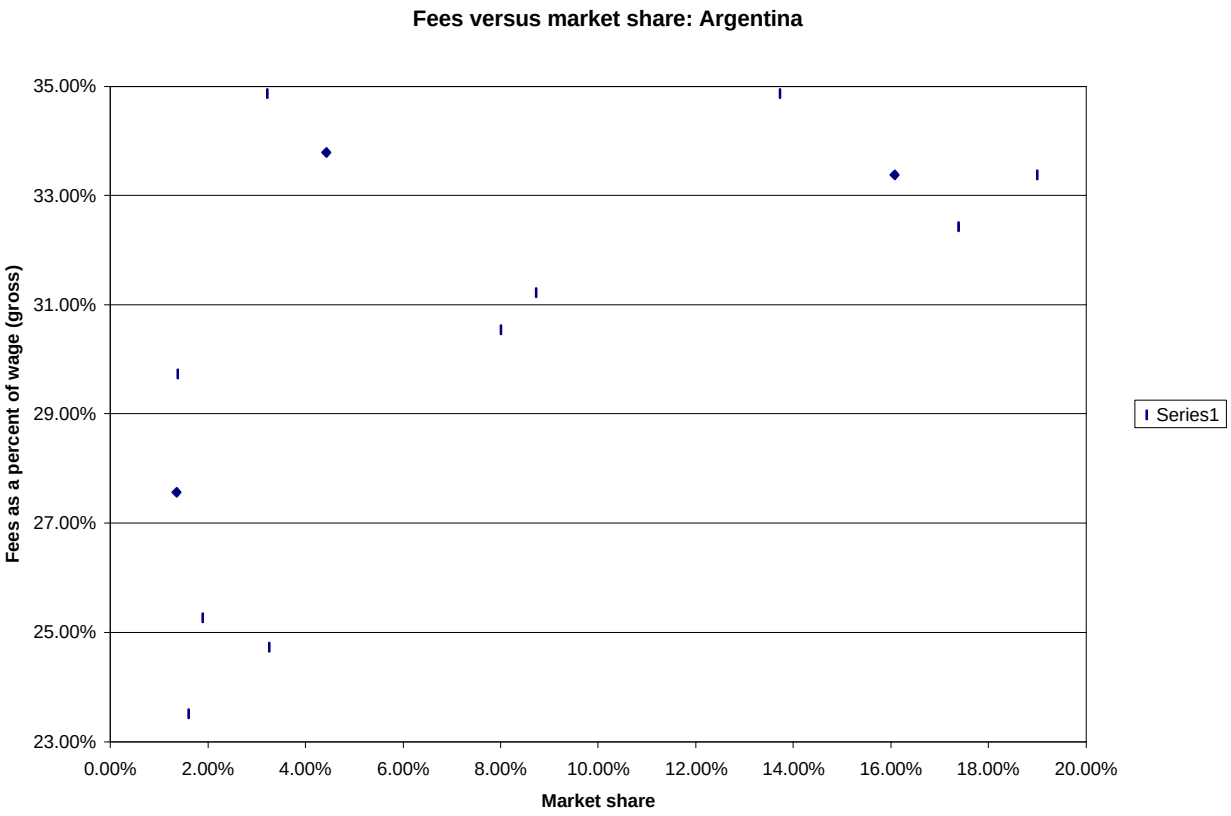
There is still one realistic element missing in our formula: growth in wages. In Chile, the average wage rate has grown at a rate of 6% per year over the last twenty years. But, the rise in average wage rate is not important here as it represents the average across many individuals at a given point of time. For individuals, the more meaningful number is the growth of wage rate longitudinally. Therefore, we need to modify our formula thus:

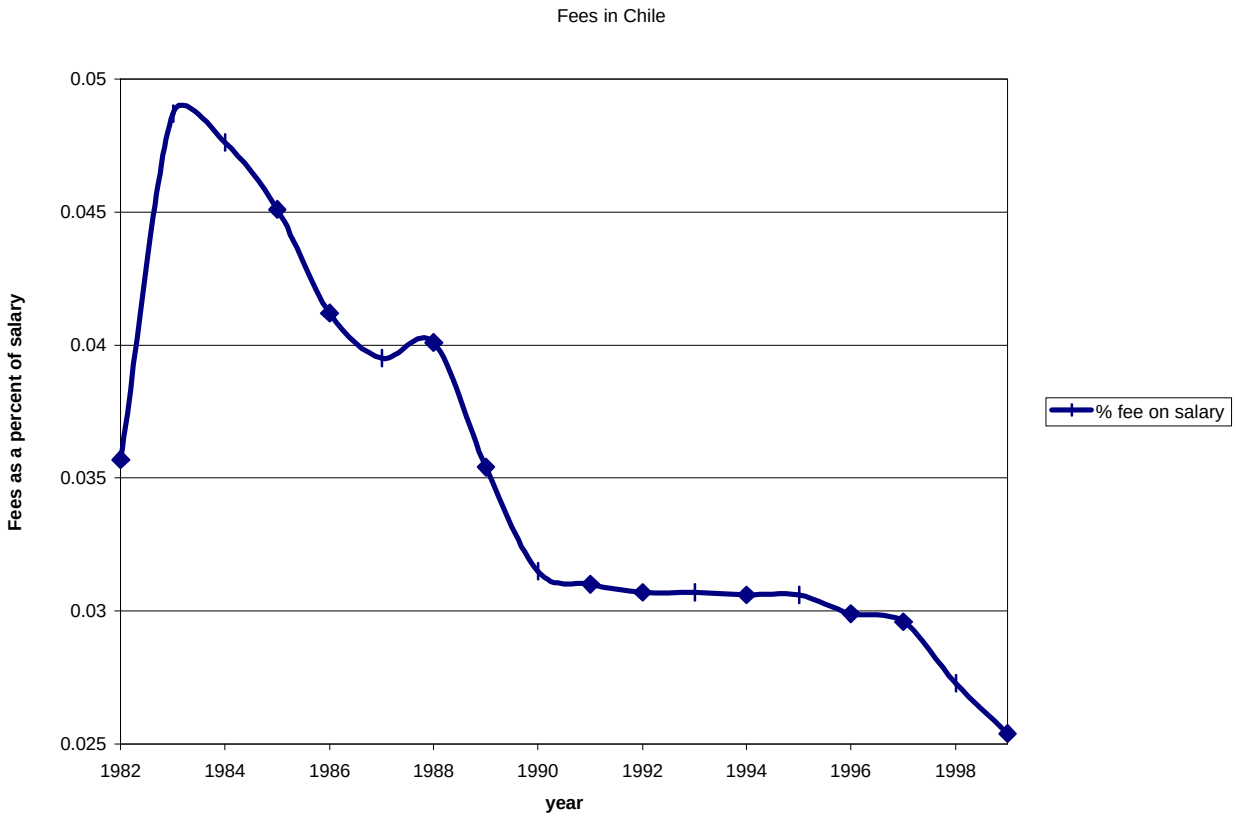
$$S_k = \begin{cases} \left(6.5\%*BW*2*\left(1-\frac{CW*(1-f_k)}{6.5\%}\right)+G_k\right)* \\ \left((1+i_1^{(12)})*\left(1-\frac{CB*(1-f_k)}{12}\right)-\left(\frac{i^{(12)}-\pi^{(12)}}{1+\pi^{(12)}}\right)*CY*(1-f_k)\right) & k=1 \\ S_{k-1}*\left((1+i_1^{(12)})*\left(1-\frac{CB*(1-f_k)}{12}\right)-\left(\frac{i^{(12)}-\pi^{(12)}}{1+\pi^{(12)}}\right)*CY*(1-f_k)\right) & \\ k=2i \quad i=1,2,\ldots,\frac{CP}{2} & \\ \left(S_{k-1}+\left(6.5\%*BW*(1+\Delta s^{(6)})*2*\left(1-\frac{CW*(1-f_k)}{6.5\%}\right)+G_k\right)\right)* & \\ \left((1+i_1^{(12)})*\left(1-\frac{CB*(1-f_k)}{12}\right)-\left(\frac{i^{(12)}-\pi^{(12)}}{1+\pi^{(12)}}\right)*CY*(1-f_k)\right) & \\ k=2i+1 \quad i=1,2,\ldots,\frac{CP-2}{2} & \end{cases}$$

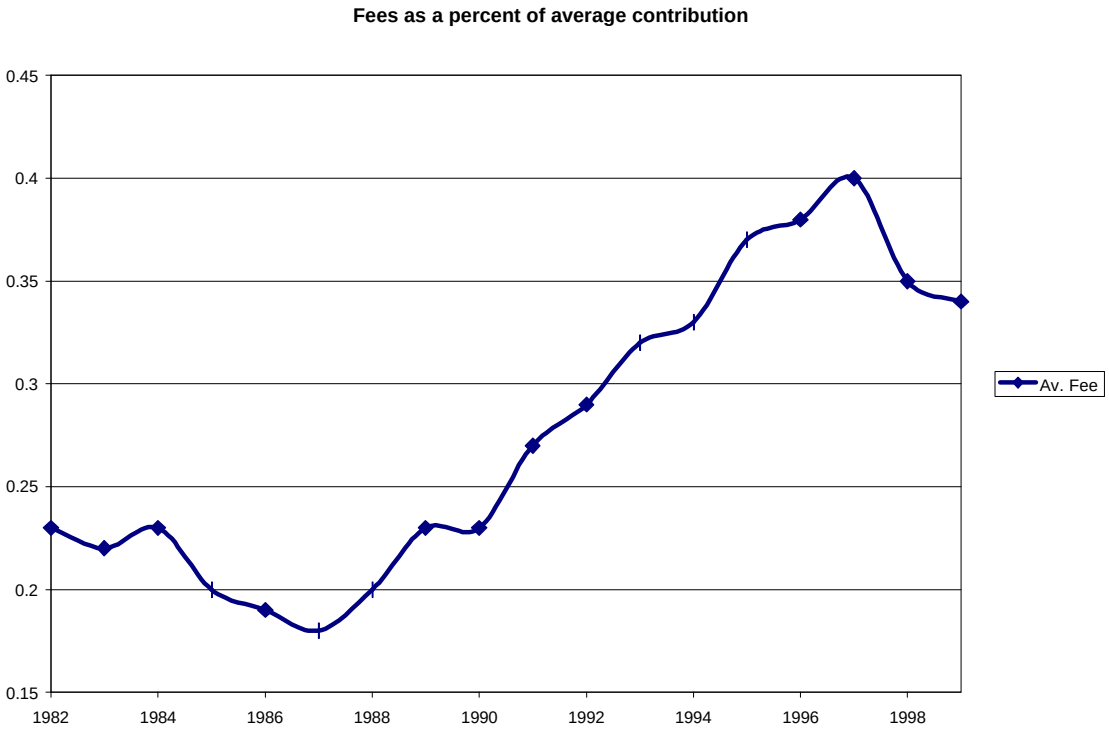
where $\Delta s^{(6)}$ is the bimonthly growth rate of wage rate of an individual worker over his or her lifetime. Here, we are assuming that the growth rate is constant. However, because of the recursive nature of the formula, it is easy to incorporate non-linear growth rate in wages. In some countries (Chile, South Korea), the average wage rates have risen by more than 6% in real terms per year. In others (Mexico), the average real wage rate has fallen over the past two decades. However, here we should be looking at wage rate for each individual *longitudinally* and not the average wage for the population.

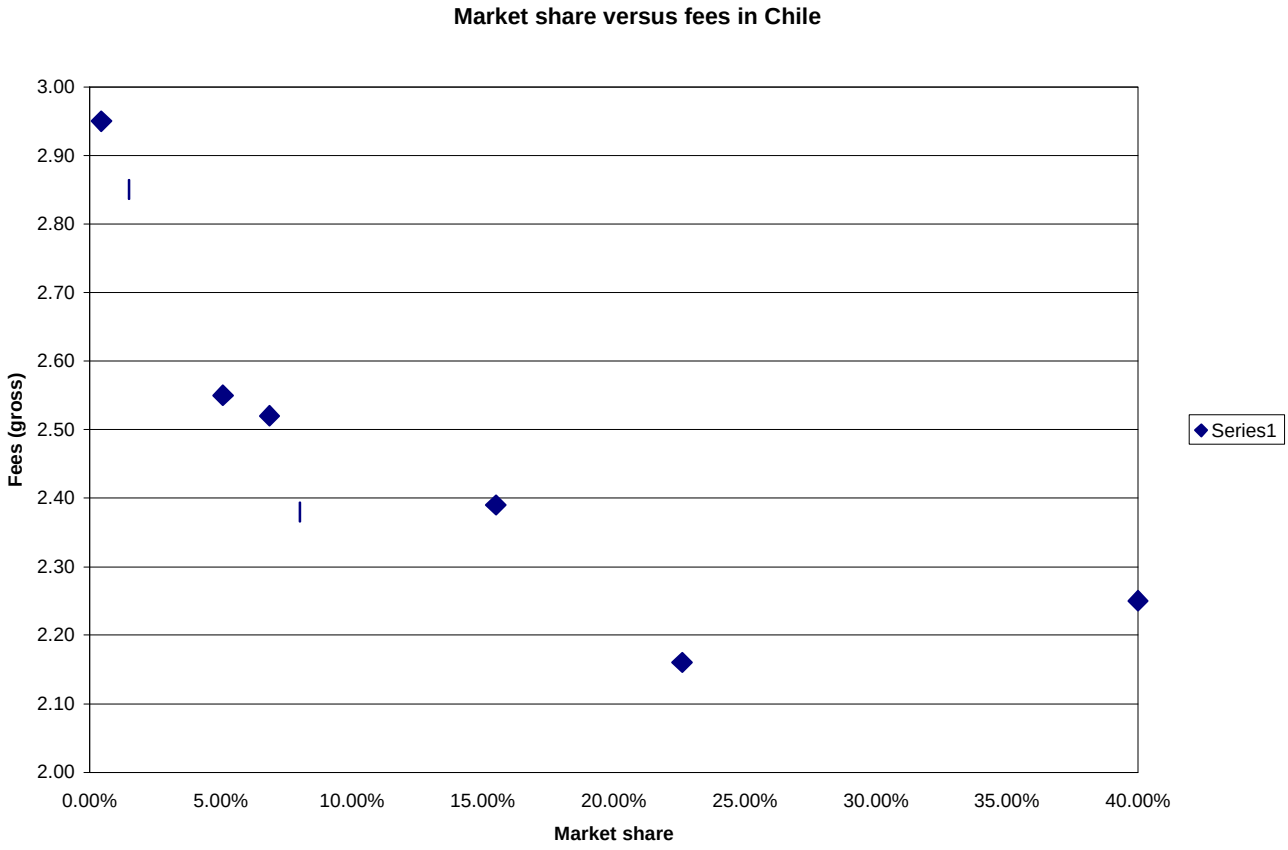
Finally, the formula may seem somewhat strange for charges applying to real rates of return. For example, what happens when the real rate of return turns out to be negative? We took that into account by simply adding a restriction that took a zero value (for CY) when the real rate of return was negative.


Comparing charges on balance and flow
7
6
5
4
3
2
1
0
1
3
5
7
9
11
13
15
17
19
Time
charge on balance
charge on flow


Fees versus market share: Argentina
35.00%
33.00%
31.00%
29.00%
27.00%
25.00%
23.00%
Fees as a percent of wage (gross)
0.00%
2.00%
4.00%
6.00%
8.00%
10.00%
12.00%
14.00%
16.00%
18.00%
20.00%
Market share
Series1


Fees in Chile
0.05
0.045
0.04
0.035
0.03
0.025
Fees as a percent of salary
1982
1984
1986
1988
1990
1992
1994
1996
1998
year
% fee on salary


Fees as a percent of average contribution
0.45
0.4
0.35
0.3
0.25
0.2
0.15
1982
1984
1986
1988
1990
1992
1994
1996
1998
Av. Fee


Market share versus fees in Chile
3.00
2.90
2.80
2.70
2.60
2.50
2.40
2.30
2.20
2.10
2.00
Fees (gross)
0.00%
5.00%
10.00%
15.00%
20.00%
25.00%
30.00%
35.00%
40.00%
Market share
Series1

Whitehouse (2000) comparison of management fees