Pension Fund Management in Mexico

8.1 Introduction

In this chapter, we describe the actual behavior of the AFOREs over the past three years. We discuss how the funds could have performed had some or all restrictions on the funds been lifted. Finally, we discuss how *private company* pension funds have performed in Mexico and how the publicly mandated funds would perform if they were to behave as if they were the private company pension funds. In Mexico, private pension funds have operated over a long period of time, run (almost exclusively) in the form of defined benefit plans. In most cases, to be eligible for the plan, a worker has to work continuously for the company for at least 10 years. Data from some of these funds give us a glimpse of what we *might* see in the publicly mandated but privately run AFOREs in the future.

8.2 General Structure of Publicly Mandated Pension Funds

There is much debate about comparing defined contribution and defined benefit plans (see Orszag and Stiglitz, 1999). In the following section, we follow Blake (1998) to illustrate how the publicly mandated plan in Mexico can be seen as a defined contribution plan with an option attached to it.

Under a pure defined contribution plan, the assets and liabilities of the fund always match in the present value sense (by definition). Under a defined benefit plan, the assets of the fund could be larger than the liabilities (a surplus). By the same token, the assets of the fund could be smaller than the liabilities (a deficit). A defined benefit fund is thus fully funded if there is no deficit. In a privately managed pension fund of a company, if there is a deficit, the company has to make it up. If not, the workers end up losing their pension benefits (e.g., Maxwell case in the UK). To eliminate a deficit in a defined benefit fund, either contribution (by the worker or by the company) must be raised and/or benefits must be reduced. Therefore, as Blake (1998) argues, a defined benefit plan can be thought of as a defined contribution plan plus a put option written by the sponsor and bought by the worker and a call option written by the worker and bought by the sponsor. The options are exercised at retirement with an exercise price equal to the required level of assets to finance the liabilities.

In Mexico, the government has promised under the newly privatized publicly mandated scheme, a minimum pension guarantee (MPG) for the workers who have been in the labor force before July 1997. What effect does this guarantee have on the pension system?

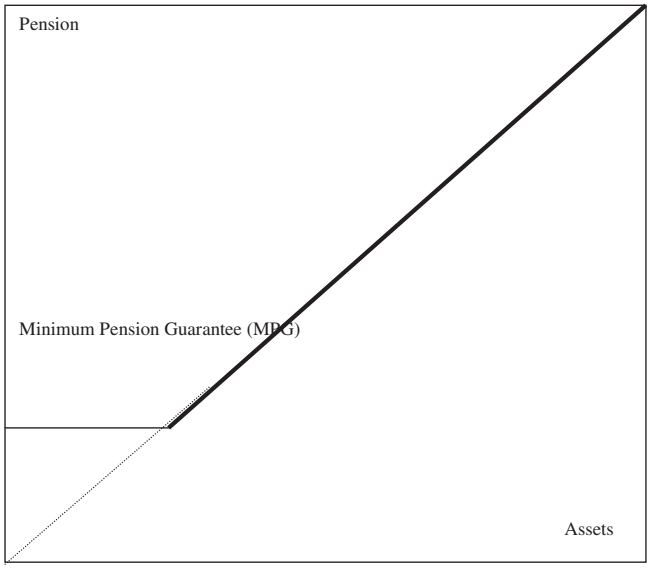
From figure 8.1, we can see that the MPG provides a floor for the pension benefits that a worker can get if the funds accumulated fall short of one minimum salary (the MPG promised by the government).

Thus, it is like an option written by the government at no cost to the worker. The option may be exercised at retirement with an exercise price equal to MPG. If the accumulated assets in the individual account are less than MPG, the option is in the money. The worker will exercise the option. The government (and by implication, taxpayers) will therefore assume the difference in value of the MPG and the assets in the fund.

8.3 Performance of the AFOREs

How have the AFOREs performed during their (short) existence? Probably one way of assessing that is to examine their rates of return. Annualized monthly nominal rates of return are depicted in figure 8.2 during July 1997 and April 2000.

FIGURE 8.1
AFORE AS AN OPTION



The figure reveals several interesting facts. (1) The rates of return are highly correlated. (2) The correlation *increased* substantially after the first year of operation. (3) There is tremendous variability in the rates of return. (4) Correlation with monthly inflation rates has been low.

8.3.1 Correlation

How high are the correlations? They range from 0.885 to 0.966. In fact, a simple test of equality of means of returns cannot be rejected at any reasonable level of significance. In table 8.1, we list all the correlations. Note that even though these are calculated as the correlation between the real rate of return, it makes no difference for the study because we are simply deducting the same inflation rates from all the numbers to calculate the real rate from the nominal rate.

From table 8.2, it becomes clear how the correlation among different AFOREs increases after July 1998.

With slight easing of investment regulations, one would have thought that the correlations might decrease. But exactly the opposite has happened. It seems to point to some type of herd behavior among fund managers. It seems that it took the first few months for fund managers to understand what other managers were doing and subsequently follow suit.

There is one fund that has performed almost consistently below the others. The fund is Inbursa. It shows up in their average than lower return over the time horizon (see table 8.3).

How could Inbursa follow such a strategy and still capture a substantial market share? The answer lies in their management fee structure. Recall that they charge solely on the account balance. Therefore, in the short run (and in some cases, for the first two decades), they can give higher rates of return to the affiliates, net of management fees, even though they might have lower gross rates of return (see the tables in chapter 7).

Even though there have been high correlations between the rates of return of the funds, there has been a tremendous variation in the rates of return over time. The rate of return (annualized) has been in the range of 5% to 8.5% (in real terms), with standard deviations of 8% to 10% (table 8.3). We observe that *all* the funds have shown negative real rates of return in some months over this period (see figure 8.2). Therefore, the idea that funds developed with bonds have only very low risk for the affiliates is far from the truth once we consider the *real* rates of return.

If we calculate the correlation between the rate of inflation and the rate of return for the pension funds, we find them in the range of 0.3 and 0.4. Thus, month-to-month variation in the rate of inflation has not been well protected by the bonds in which AFOREs have invested. Therefore, the restrictions imposed on the AFOREs have not been able to protect the workers from movements in inflation if we consider a month-

FIGURE 8.2
ANNUALIZED RATES OF RETURN OF AFOREs (AUGUST 1997-APRIL 2000)
Rates of Return of the AFOREs

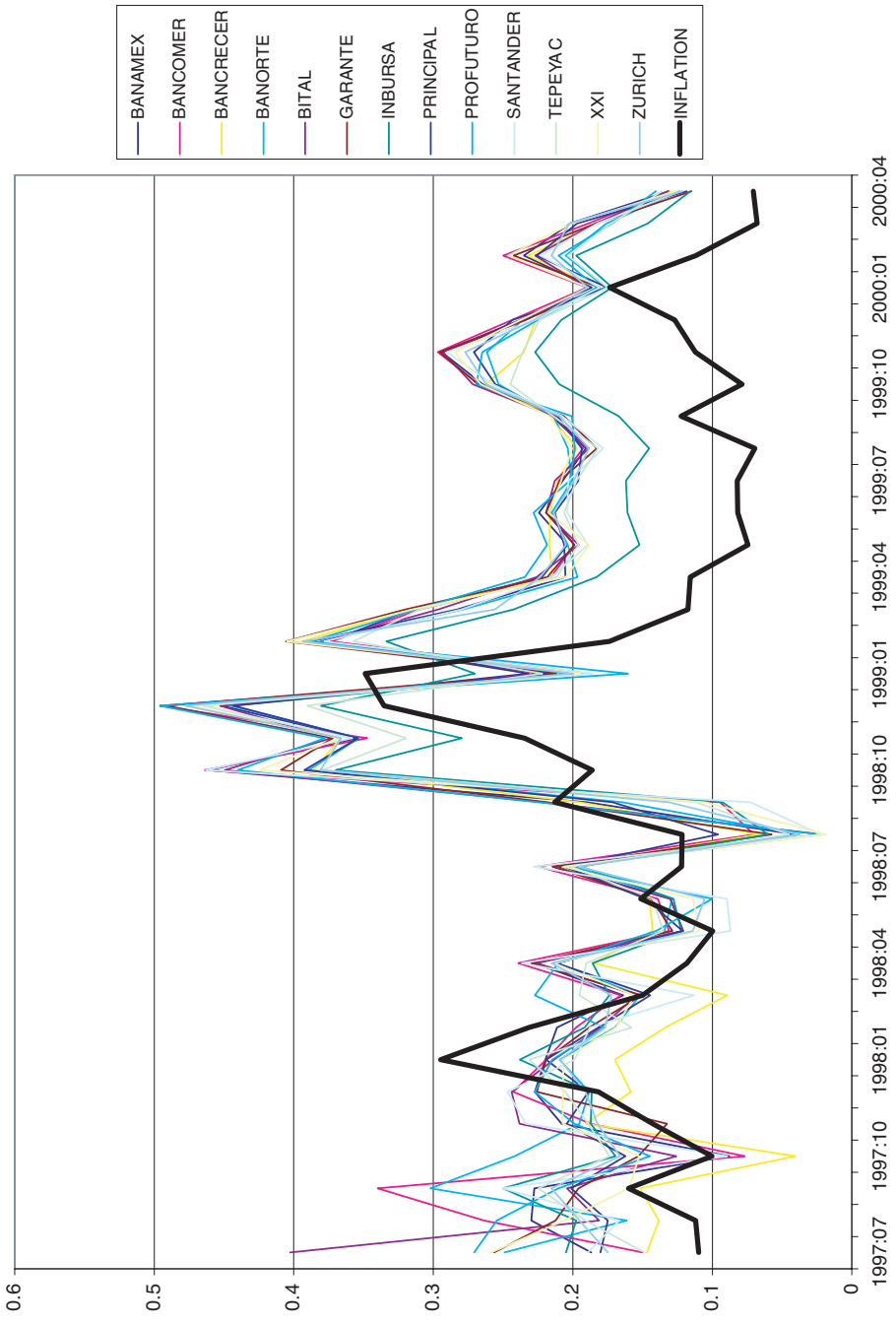


TABLE 8.1
CORRELATIONS OF RATES OF RETURNS OF AFOREs JULY 1997 TO APRIL 2000

	RBANA	RBANCO	RBANCRE	RBANOR	RBITAL	RGARAN	RINBURSA	RPRIN	RPROF	RSANTA	RTEPE	RXXI	RZURICH
RBANA	1.000000	0.951130	0.933020	0.895776	0.902345	0.950900	0.905629	0.957361	0.946380	0.965676	0.933810	0.955946	0.952652
RBANCO	0.951130	1.000000	0.865190	0.877916	0.807104	0.889438	0.915097	0.910962	0.885993	0.957382	0.917587	0.900691	0.926126
RBANCRE	0.933020	0.865190	1.000000	0.852070	0.849850	0.922173	0.804622	0.952092	0.885325	0.896851	0.890516	0.915513	0.915976
RBANOR	0.895776	0.877916	0.852070	1.000000	0.893358	0.922541	0.934281	0.943953	0.914891	0.910689	0.932846	0.930814	0.948476
RBITAL	0.902345	0.807104	0.849850	0.893358	1.000000	0.928534	0.857627	0.885874	0.931726	0.892300	0.833818	0.934386	0.876205
RGARAN	0.950900	0.889438	0.922173	0.922541	0.928534	1.000000	0.878884	0.957128	0.958407	0.914273	0.904888	0.963102	0.951914
RINBURSA	0.905629	0.915097	0.804622	0.934281	0.857627	0.878884	1.000000	0.913159	0.880074	0.927229	0.950168	0.932358	0.924624
RPRIN	0.957361	0.910962	0.952092	0.943953	0.885874	0.957128	0.913159	1.000000	0.925699	0.945842	0.954177	0.968542	0.977791
RPROF	0.946380	0.885993	0.885325	0.914891	0.931726	0.958407	0.880074	0.925699	1.000000	0.905506	0.908927	0.950053	0.943563
RSANTA	0.965676	0.957382	0.896851	0.910689	0.892300	0.914273	0.927229	0.945842	0.905506	1.000000	0.926245	0.953542	0.952267
RTEPE	0.933810	0.917587	0.890516	0.932846	0.833818	0.904888	0.950168	0.954177	0.908927	0.926245	1.000000	0.944485	0.955528
RXXI	0.955946	0.900691	0.915513	0.930814	0.934386	0.963102	0.932358	0.968542	0.950053	0.953542	0.944485	1.000000	0.971642
RZURICH	0.952652	0.926126	0.915976	0.948476	0.876205	0.951914	0.924624	0.977791	0.943563	0.952267	0.955528	0.971642	1.000000

TABLE 8.2
CORRELATIONS OF RATES OF RETURNS OF AFOREs JULY 1998 TO APRIL 2000

	RBANA	RBANCO	RBANCRE	RBANOR	RBITAL	RGARAN	RINBURSA	RPRIN	RPROF	RSANTA	RTEPE	RXXI	RZURICH
RBANA	1.000000	0.970261	0.965125	0.979338	0.991506	0.976777	0.945123	0.974113	0.970116	0.974260	0.961615	0.978015	0.962033
RBANCO	0.970261	1.000000	0.951128	0.965575	0.947308	0.953378	0.962747	0.971846	0.938333	0.992384	0.959032	0.984221	0.968543
RBANCRE	0.965125	0.951128	1.000000	0.985814	0.964006	0.981639	0.907559	0.981446	0.979318	0.946852	0.959835	0.971962	0.969118
RBANOR	0.979338	0.965575	0.985814	1.000000	0.976829	0.977286	0.936538	0.988925	0.973308	0.970506	0.971406	0.985942	0.985690
RBITAL	0.991506	0.947308	0.964006	0.976829	1.000000	0.980680	0.913387	0.961500	0.981409	0.958369	0.940078	0.964869	0.957185
RGARAN	0.976777	0.953378	0.981639	0.977286	0.980680	1.000000	0.901249	0.975843	0.981238	0.949672	0.932114	0.970276	0.966115
RINBURSA	0.945123	0.962747	0.907559	0.936538	0.913387	0.901249	1.000000	0.943551	0.873696	0.970787	0.970450	0.960841	0.934100
RPRIN	0.974113	0.971846	0.981446	0.988925	0.961500	0.975843	0.943551	1.000000	0.956570	0.968459	0.966718	0.981042	0.980484
RPROF	0.970116	0.938333	0.979318	0.973308	0.981409	0.981238	0.873696	0.956570	1.000000	0.938588	0.923768	0.951388	0.955480
RSANTA	0.974260	0.992384	0.946852	0.970506	0.958369	0.949672	0.970787	0.968459	0.938588	1.000000	0.964072	0.987103	0.975930
RTEPE	0.961615	0.959032	0.959835	0.971406	0.940078	0.932114	0.970450	0.966718	0.923768	0.964072	1.000000	0.973517	0.954289
RXXI	0.978015	0.984221	0.971962	0.985942	0.964869	0.970276	0.960841	0.981042	0.951388	0.987103	0.973517	1.000000	0.986070
RZURICH	0.962033	0.968543	0.969118	0.985690	0.957185	0.966115	0.934100	0.980484	0.955480	0.975930	0.954289	0.986070	1.000000

TABLE 8.3
VALUE AT RISK OF AFOREs AS OF AUGUST 18, 2000

	RBANA	RBANCO	RBANCRE	RBANOR	RBITAL	RGARAN	RINBURSA	RPRIN	RPROF	RSANTA	RTEPE	RXXI	RZURICH
Mean	0.079093	0.080637	0.059209	0.072621	0.083706	0.079301	0.050342	0.070853	0.081110	0.065579	0.062581	0.072420	0.067598
Median	0.099423	0.108007	0.076285	0.093689	0.100988	0.101360	0.068412	0.086407	0.095118	0.095078	0.076130	0.094210	0.085195
Maximum	0.275184	0.277680	0.220679	0.207297	0.292858	0.231904	0.183650	0.214194	0.254074	0.276852	0.193620	0.237846	0.219530
Minimum	−0.117210	−0.159794	−0.151890	−0.145326	−0.125050	−0.137095	−0.120369	−0.130072	−0.188267	−0.162987	−0.126966	−0.154672	−0.149219
Std. Dev.	0.087468	0.097606	0.095276	0.086896	0.094978	0.088454	0.067024	0.080494	0.094636	0.100319	0.080052	0.098309	0.088032
Skewness	−0.257508	−0.541694	−0.404911	−0.722374	−0.169696	−0.405217	−0.599055	−0.444443	−0.813021	−0.533176	−0.639762	−0.548454	−0.637705
Kurtosis	2.838577	2.939380	2.408148	2.800480	3.023790	2.659186	3.234344	2.787569	3.661055	2.898927	3.039705	2.648720	2.813991
Jarque-Bera	0.412674	1.667990	1.425311	3.013395	0.163984	1.095023	2.111381	1.183264	4.364756	1.625372	2.321575	1.879357	2.353463
Probability	0.813559	0.434311	0.490340	0.221641	0.921279	0.578387	0.347952	0.553423	0.112773	0.443665	0.313239	0.390754	0.308285

to-month variation. Below, we explore what happens in different forms of restrictions imposed on the AFOREs.

8.4 Risks of the AFOREs: Value at Risk (VaR)

Value at Risk (VaR) is now a commonly used method for valuation of market risk. It got a boost after the Bank for International Settlement (BIS) strongly recommended this method for banks (see Bank for International Settlements 1994, 1995, 1996). However, the exact method of implementing VaR is far from settled. The use of particular methods is of great significance in volatile emerging markets. In Mexico, the regulatory authority (using the Riskmetrics™ methodology) routinely examines the AFOREs to measure the VaR. Sinha and Chamú (2000) showed these methods as used by CONSAR could lead to serious errors in estimating VaR in the world of volatile markets. In this section, we simply report and discuss the estimated VaR calculations (see tables 8.4a, 8.4b, 8.4c, 8.4d).

The Value at Risk (VaR) is the expected maximum loss over a given planning horizon within an interval of statistical confidence. In other words, VaR tells us the loss that is expected to be exceeded exactly in $\alpha\%$ days of planning horizon. Thus, the loss exceeding the VaR occurs on the average $\alpha\%$ during the planning horizon. Roughly speaking, VaR gives us an estimate of the largest losses that a portfolio is likely to suffer during all but very exceptional days.

Definition. The VaR of portfolio P with $(1 - \alpha)\%$ of statistical confidence, during a period of τ days is defined in terms of money relative to an initial value of the portfolio as $\mathrm{VaR}_{\tau,(1-\alpha)}(\mathrm{P}) = \mathrm{P}_0 - \mathrm{P}_{\tau,\alpha} = -\mathrm{P}_0\mathrm{R}_{\tau,\alpha}$ where $\mathrm{P}_{\tau,\alpha}$ is the α-th quantile of the price and $\mathrm{R}_{\tau,\alpha}$ is the α-th quantile of the rate of return.

Example. Suppose a fund manager specifies τ as one week and the frequency of maximum loss to 99% ($1 - \alpha$=99%). Suppose the VaR calculated is −$1m. Then, on the average, 99 out of 100 trading weeks, the fund would not lose more than $1m. To put it differently, the fund would expect to lose more than $1m once every 100 weeks. We could also specify these losses in terms of rates of return.

In Tables 8.4a, 8.4b, 8.4c and 8.4d, we report the risk calculated using the Riskmetrics method by category. Since the portfolios of the AFOREs contain bonds that are set in nominal terms (such as CETEs), we have risk arising from the interest rate risk in nominal terms. For example, for Banamex, for one week of τ, and α = 5%, the nominal interest rate risk is

TABLE 8.4A
VALUE AT RISK WITH 1 WEEK AND 95% CONFIDENCE

	VaR (1 Week 95%)				
	Type of Risk				
	Interest Rate				
	Nominal	Real	x-Rate	Diversification	Total
Banamex	0.32%	0.51%	0.00%	−0.11%	0.72%
Bancomer	0.20%	0.57%	0.01%	−0.10%	0.67%
XXI	0.27%	0.48%	0.00%	−0.10%	0.65%
Zurich	0.14%	0.58%	0.00%	−0.08%	0.64%
Santander	0.20%	0.51%	0.00%	−0.08%	0.63%
Profuturo	0.29%	0.38%	0.01%	−0.13%	0.56%
Principal	0.16%	0.44%	0.01%	−0.09%	0.53%
Tepeyac	0.14%	0.44%	0.00%	−0.08%	0.50%
Garante	0.20%	0.34%	0.01%	−0.07%	0.47%
Bancrecer	0.13%	0.41%	0.02%	−0.10%	0.46%
Bital	0.15%	0.29%	0.00%	−0.06%	0.39%
Inbursa	0.14%	0.23%	0.00%	−0.06%	0.31%
Banorte	0.15%	0.18%	0.00%	−0.05%	0.27%
Total	0.22%	0.43%	0.00%	−0.09%	0.56%

TABLE 8.4B
VALUE AT RISK WITH 1 WEEK AND 99% CONFIDENCE

	VaR (1 Week 99%)				
	Type of Risk				
	Interest Rate				
	Nominal	Real	x-Rate	Diversification	Total
Banamex	0.44%	0.72%	0.00%	−0.17%	0.99%
Bancomer	0.28%	0.80%	0.01%	−0.18%	0.91%
Zurich	0.19%	0.82%	0.00%	−0.12%	0.90%
XXI	0.37%	0.68%	0.00%	−0.17%	0.88%
Santander	0.27%	0.73%	0.00%	−0.15%	0.85%
Profuturo	0.40%	0.54%	0.02%	−0.17%	0.79%
Principal	0.23%	0.63%	0.02%	−0.14%	0.73%
Tepeyac	0.18%	0.63%	0.00%	−0.13%	0.68%
Garante	0.27%	0.49%	0.01%	−0.12%	0.65%
Bancrecer	0.18%	0.59%	0.03%	−0.15%	0.64%
Bital	0.21%	0.43%	0.00%	−0.12%	0.51%
Inbursa	0.20%	0.34%	0.00%	−0.10%	0.43%
Banorte	0.21%	0.26%	0.00%	−0.09%	0.38%
Total	0.30%	0.62%	0.01%	−0.15%	0.77%

TABLE 8.4C
VALUE AT RISK WITH 1 MONTH AND 95% CONFIDENCE

	VaR (1 Month 95%)				
	Type of Risk				
	Interest Rate				
	Nominal	Real	x-Rate	Diversification	Total
Banamex	0.68%	1.09%	0.00%	−0.24%	1.53%
Bancomer	0.42%	1.21%	0.02%	−0.21%	1.44%
XXI	0.58%	1.02%	0.00%	−0.21%	1.39%
Zurich	0.30%	1.23%	0.00%	−0.18%	1.36%
Santander	0.42%	1.10%	0.00%	−0.18%	1.34%
Profuturo	0.63%	0.82%	0.03%	−0.25%	1.22%
Principal	0.35%	0.94%	0.02%	−0.19%	1.12%
Tepeyac	0.30%	0.93%	0.00%	−0.17%	1.06%
Garante	0.42%	0.74%	0.02%	−0.16%	1.02%
Bancrecer	0.29%	0.88%	0.05%	−0.21%	1.00%
Bital	0.33%	0.63%	0.00%	−0.13%	0.84%
Inbursa	0.31%	0.49%	0.00%	−0.15%	0.66%
Banorte	0.32%	0.38%	0.00%	−0.12%	0.59%
Total	0.46%	0.92%	0.01%	−0.19%	1.20%

TABLE 8.4D
VALUE AT RISK WITH 1 MONTH AND 99% CONFIDENCE

	VaR (1 Month 99%)				
	Type of Risk				
	Interest Rate				
	Nominal	Real	x-Rate	Diversification	Total
Banamex	0.92%	1.55%	0.00%	−0.38%	2.10%
Bancomer	0.60%	1.72%	0.02%	−0.40%	1.94%
Zurich	0.41%	1.76%	0.00%	−0.25%	1.93%
XXI	0.80%	1.46%	0.00%	−0.37%	1.89%
Santander	0.59%	1.54%	0.00%	−0.32%	1.82%
Profuturo	0.86%	1.17%	0.04%	−0.38%	1.69%
Principal	0.50%	1.36%	0.03%	−0.31%	1.59%
Tepeyac	0.40%	1.34%	0.00%	−0.28%	1.46%
Garante	0.59%	1.06%	0.02%	−0.27%	1.41%
Bancrecer	0.40%	1.26%	0.06%	−0.33%	1.39%
Bital	0.45%	0.94%	0.00%	−0.27%	1.12%
Inbursa	0.43%	0.73%	0.00%	−0.23%	0.93%
Banorte	0.46%	0.57%	0.00%	−0.20%	0.83%
Total	0.64%	1.32%	0.01%	−0.33%	1.65%

0.32% (table 8.4a). The portfolio also contains bonds that specify interest rates in real terms (such as Bonde91). Therefore, we have a second category of risk corresponding to the real interest rate. In the case of Banamex, with the above specifications, the risk is 0.51%. The third category is exchange rate risk (called x-Rate in the tables). Some of the bonds are specified in U.S. dollars. Thus, these bonds have an exchange rate risk. Finally, with diversification of the portfolio, we have a reduction in risk. The column ''total'' is the sum of all of these risks. Comparing tables 4a and 4b, we notice that all the risks rise when the confidence level is changed from 95% to 99%. However, note that the rise in risk is not linear. Tables 8.4c and 8.4d illustrate the same risks with a one-month planning horizon instead of one week. As expected, there is a rise (in risk) in both areas. A rising planning horizon raises the risk of the portfolio. Once again, there is non-linearity in the change in risk. A quadrupling of time does not quadruple the risk.

8.5 Types of Restrictions Imposed on the AFOREs

CONSAR has set out the general rules of investment under various circulars (CONSAR, 1997a, 1997b, 1999, 2000). These rules are reproduced in table 8.5 below. For private bonds, it not only specifies the amount, but also the quality of investment. For example, the minimum bond rating (Standard and Poors) should be at the minimum mxA-3 for the short run and mxAA for the long run.

8.6 Restrictions of Investment by the AFOREs and Risk Return Tradeoff

In many countries, pension funds are often subject to pressures to invest according to non-financial objectives. For example, there is pressure to invest in infrastructure development (Vives, 1999). In other countries, there is often pressure to invest in ''socially responsible ways'' (Davis, 2001). These types of restriction are brought about by ''left-leaning'' political parties in many countries. In Mexico, demand for investment in infrastructure development has been heard during the 2000 presidential election from the candidate of the Partido de la Revolución Democrática (PRD).

On the other hand, the government of the Partido Revolucionario Institucional (PRI), which has ruled

TABLE 8.5
PENSION FUND INVESTMENT GUIDELINES (CONSAR)

Types of Assets	% of Asset Value
I Inflation Linked Bonds	51% minimum
IIa Bonds issued by either the Federal Government or Banco de Mexico	100% max
IIb Bonds issued by either the Federal Government or Banco de Mexico in US dollars	10% max
IIc Corporate bonds, Bank issued bonds, Financial intermediary bonds	35% max
IId Bonds issued by banks and other financial intermediaries	10% max
IIe Repurchase Agreements	5% max
IIf Checking accounts	$250,000 max
IIIa Bonds issued by a single issuer (except Federal Government or Banco de Mexico)	10% max
IIIb Bonds issued by a company where fund manager has interest	5% max
IIIc Bonds issued by companies as parts of single holding company	15% max
IIId % of a single issue (except Federal or Banco de Mexico)	10% max
IV Bonds with maturity less than 183 days	65% min

Mexico for the last seven decades, emphasized ''quantitative restrictions'' on investment by the AFOREs.

One clear way of discussing the restrictions imposed and their effects is to take a look at the portfolios of the funds directly. The composition of the portfolio was obtained from CONSAR on a given day (August 18, 2000). The portfolios of various funds are very similar. Most funds have 55%+ invested in an inflation-indexed government bond called bonde91. The second biggest item is Udibonos, another inflation indexed government bond. WAM indicates weighted average maturity of bonds in days. Given that the maturity of bonde91 is only 57 days (for the system) and is such a large part of the portfolio, the average maturity period of the portfolios is less than two years (529 days). Thus, the portfolios suffer from short-term interest fluctuations enormously.

8.7 A Critique of Quantitative Restrictions in the Mexican Context

The idea of portfolio restriction when capital markets are not fully developed *seems* sound. Unfortunately, it is not so. Davis (2001, pp. 30–31) notes:

> The case for portfolio restrictions is much weaker for pension funds, where it may be noted that any portfolio restrictions often apply to the whole of the portfolio. Indeed, for advanced countries, apart from the control of self-investment, the degree to which such regulations actually contribute to benefit security is open to doubt. This relates to the link of liabilities to average earnings growth (as well as the vulnerability of liabilities to regulatory changes). Since pension funds, unlike insurance companies, may face the risk of increasing nominal liabilities as well as the risk of holding assets, they need to trade volatility with return. Moreover, appropriate diversification of assets can eliminate any idiosyncratic risk from holding an individual security or type of asset, thus minimizing the increase in risk. Again, if national cycles and markets are imperfectly correlated, international investment will reduce otherwise undiversifiable or ''systematic'' risk. In the case of restrictions which explicitly or implicitly oblige pension funds to invest in government bonds, which must themselves be repaid from taxation, there may be no benefit to capital formation and the ''funded'' plans may at a macroeconomic level be virtually equivalent to pay-as-you-go. Meanwhile, changes in duration depending on the maturity of a fund require marked shifts in portfolios. Even for defined contribution funds, it is hard to argue a sound case for such rules, given the superior alternative of prudent person rules. There seems little evidence that defined contribution investors need ''protecting from themselves'' i.e. prevented from taking high risks. Indeed, in practice, experience suggests that investors in individual defined contribution funds at least historically tend to be too cautious to develop adequate funds at retirement,

while companies running defined contribution funds may invest excessively cautiously to avoid lawsuits.

Thus, quantitative restrictions are supposed to reduce risk-taking by the funds. However, setting the restrictions first, rather than allowing the funds to choose their own mix of assets to achieve certain maximum risk, results in a sub-optimal outcome. Below, we discuss why.

Following Markowitz (1959), given the correlation matrix of table 8.1, we can calculate the efficient frontier of investments. This is depicted in figure 8.3. Each point on figure 8.3 encapsulates the risk and return for each AFORE. The return ranges between 5% and 8.5% in real terms and the risk (measured by the standard deviation) ranges between 6.5% and 10%.

Therefore, the restrictions on the investment regime produce a maximal risk of 10%. Suppose we agree that the restrictions were meant to produce risk no more than 10%. One possibility for CONSAR is to specify to the AFOREs that they can choose whatever mix of *stocks and bonds* they want as long as the risk for their portfolios does not exceed 10%. Could the funds do better? Perhaps it is prudent not to allow the funds to invest in any types of stocks and bonds but only in blue-chip company stocks and bonds. Could they have done better? To answer this question, we turn to private company pension funds operating in Mexico.

8.8 Private Pension Funds

Many companies provide (mainly defined benefit) pension plans in Mexico. Watson Wyatt Worldwide in Mexico has been tracking these companies since 1987 (see Watson Wyatt Worldwide, 1999). In figure 8.4, we have plotted the stock and bond mix of these funds over the course of 13 years.

First, note that these funds have behaved extremely conservatively over these tumultuous years. They have held their funds mostly in bonds. In fact, the funds

FIGURE 8.3
Risk Return Tradeoff of the AFOREs

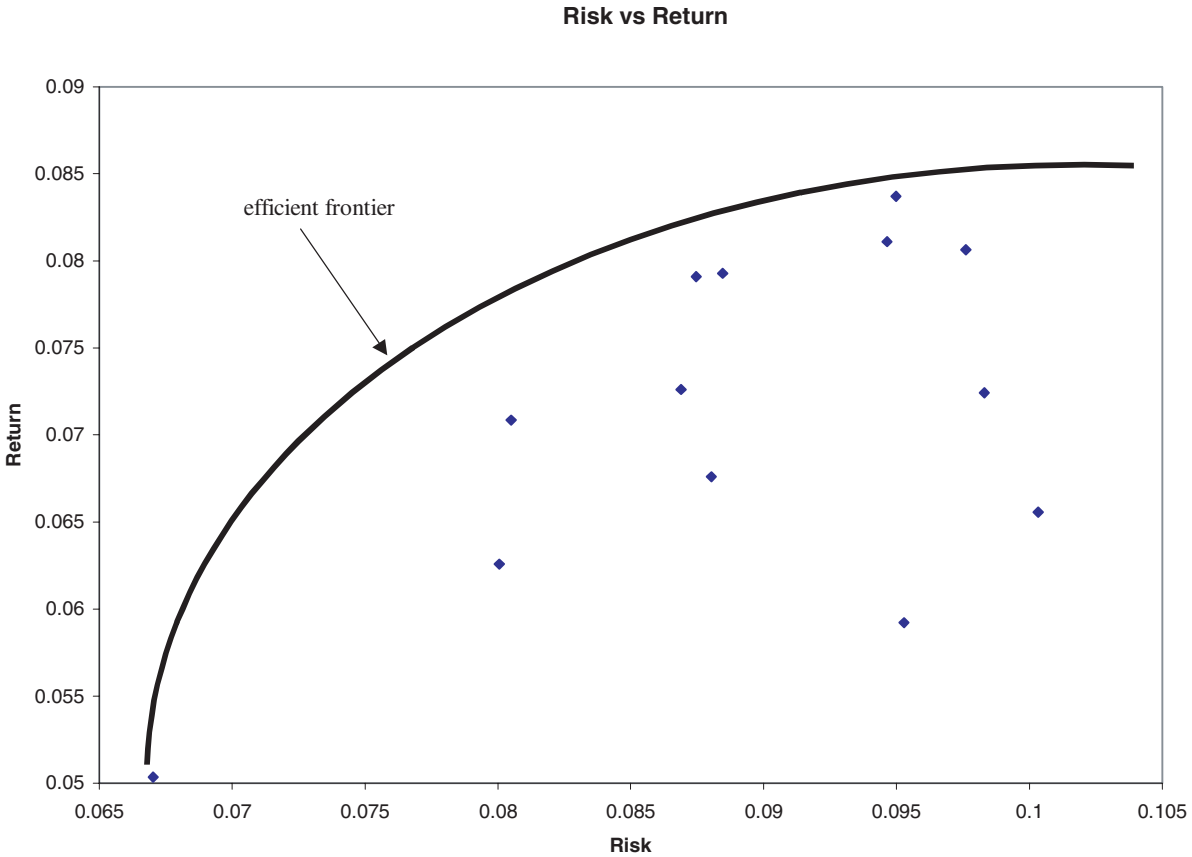
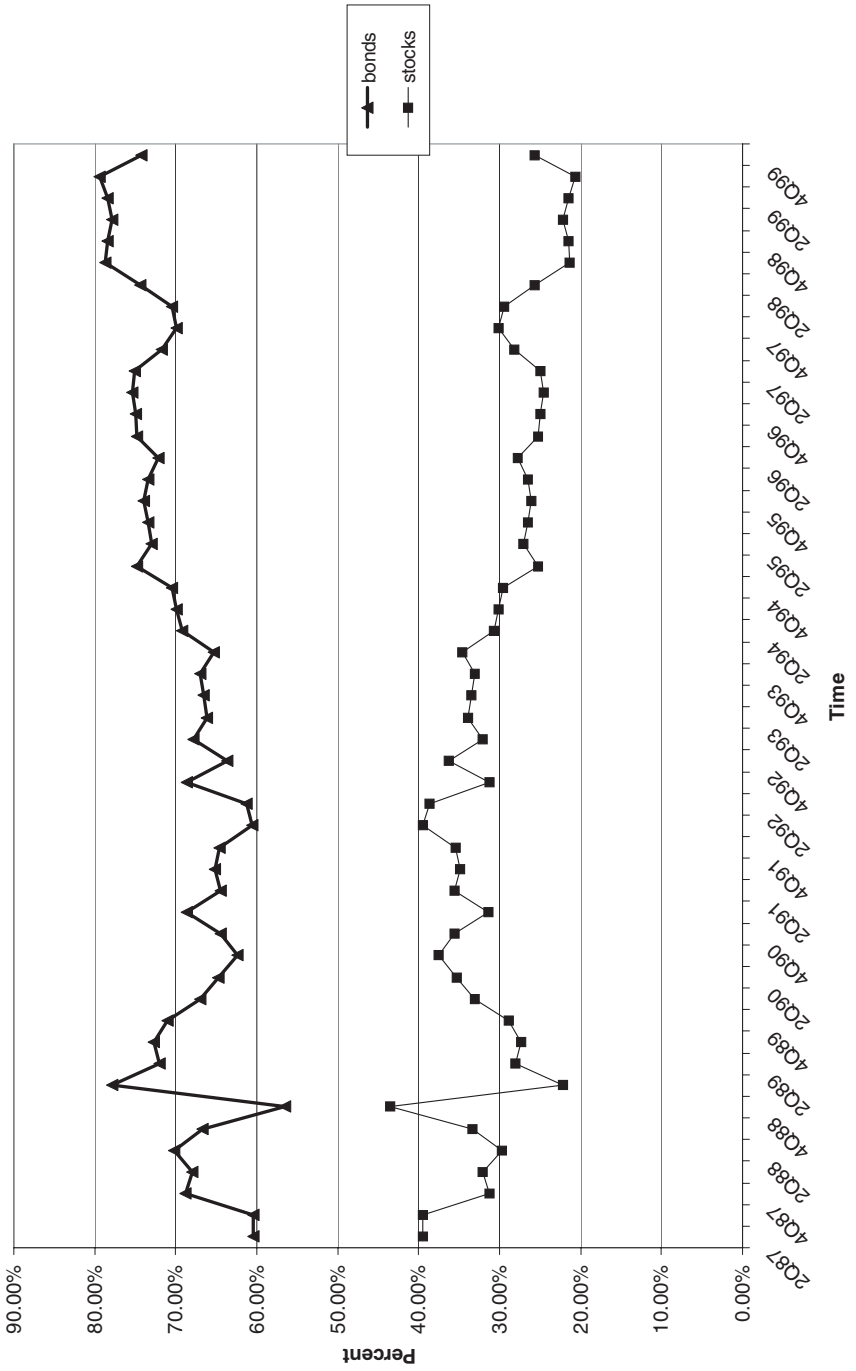


FIGURE 8.4
PORTFOLIO COMPOSITION OF PRIVATE PENSION FUNDS IN MEXICO 1987–1999



have become progressively more conservative holding more and more assets in bonds. As a result, they have largely missed out on one of the greatest stock market gains around the world (of course, by the same token, they also managed to avoid the corresponding volatility). The conclusion we would like to draw from figure 8.4 is that the rates of return obtained by these funds have been produced with great caution on the part of these fund managers.

The (average) annualized rates of return of these (100+) funds are plotted in figure 8.5. It also plots what the returns would have been had they invested totally in a proxy of the stock market (denoted by IPC, it is the rough equivalent of S&P500 in Mexico).

In addition, we also plot the rates of return had they invested totally in the bond market index. By investing in a combination of these two, the funds have avoided having the wild fluctuations of the stock market.

Suppose AFOREs were allowed to operate in the same market as the private pension funds in Mexico. How would it have expanded the efficient frontier for these funds? The results of this thought experiment are plotted in figure 8.6.

The curve intersecting point A is the same as in figure 8.3. In addition, we have recalculated the efficient frontier using the data from private pension funds. The first frontier contains point A and the second contains point B. Thus, had the AFOREs been allowed to operate like private pension funds in Mexico, they could have achieved an efficient frontier at a higher level.

Suppose CONSAR would have specified a maximum risk of 10% for the AFOREs without specifying the portfolio mix. Could they have performed better? The answer is affirmative. To see why, we have drawn a vertical line through 10% risk (passing through A

FIGURE 8.5
RATES OF RETURN OF PRIVATE PENSION FUNDS IN MEXICO (ALONG WITH RATES OF RETURN OF BOND ONLY AND STOCK ONLY FUNDS) 1987–1999

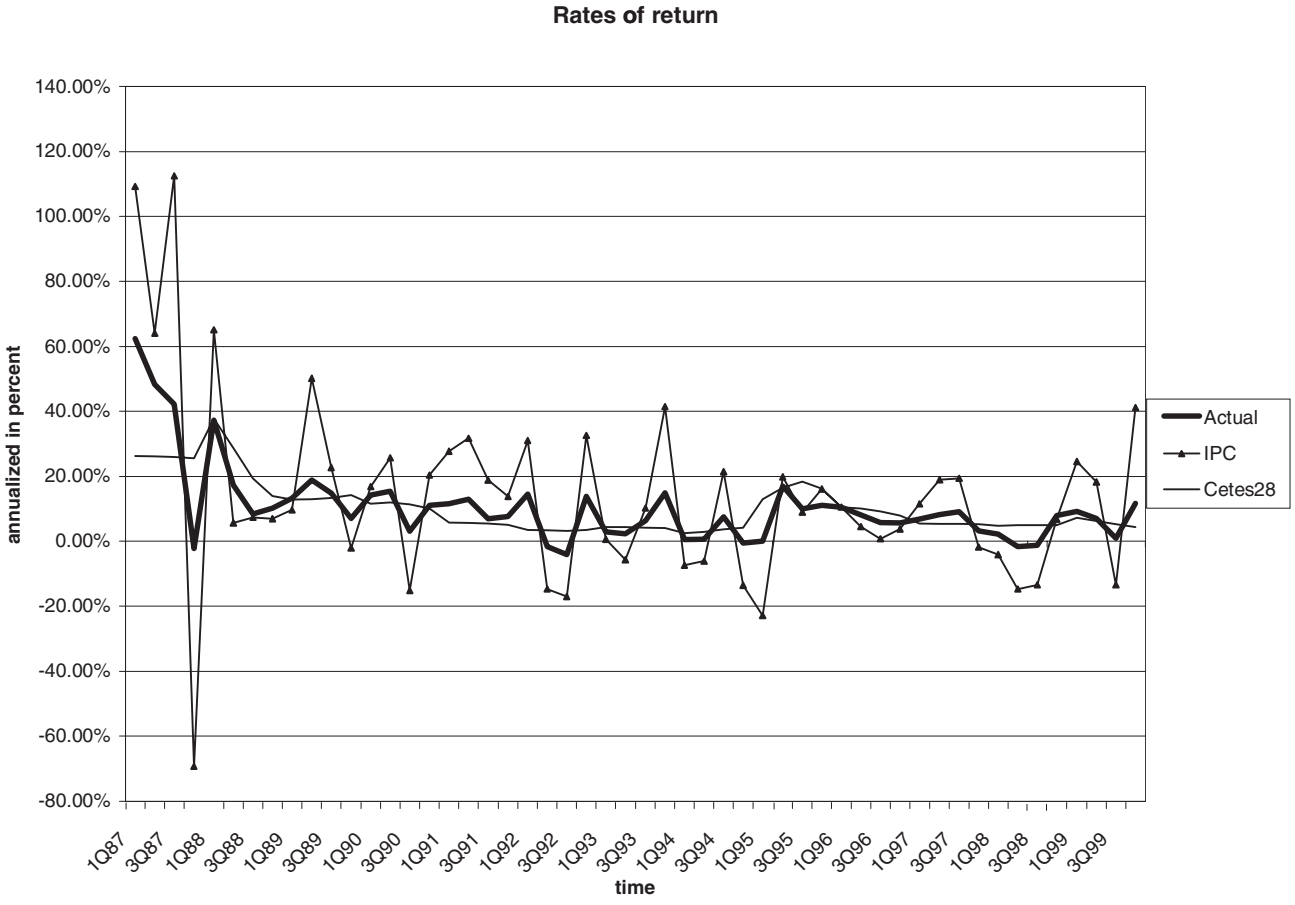
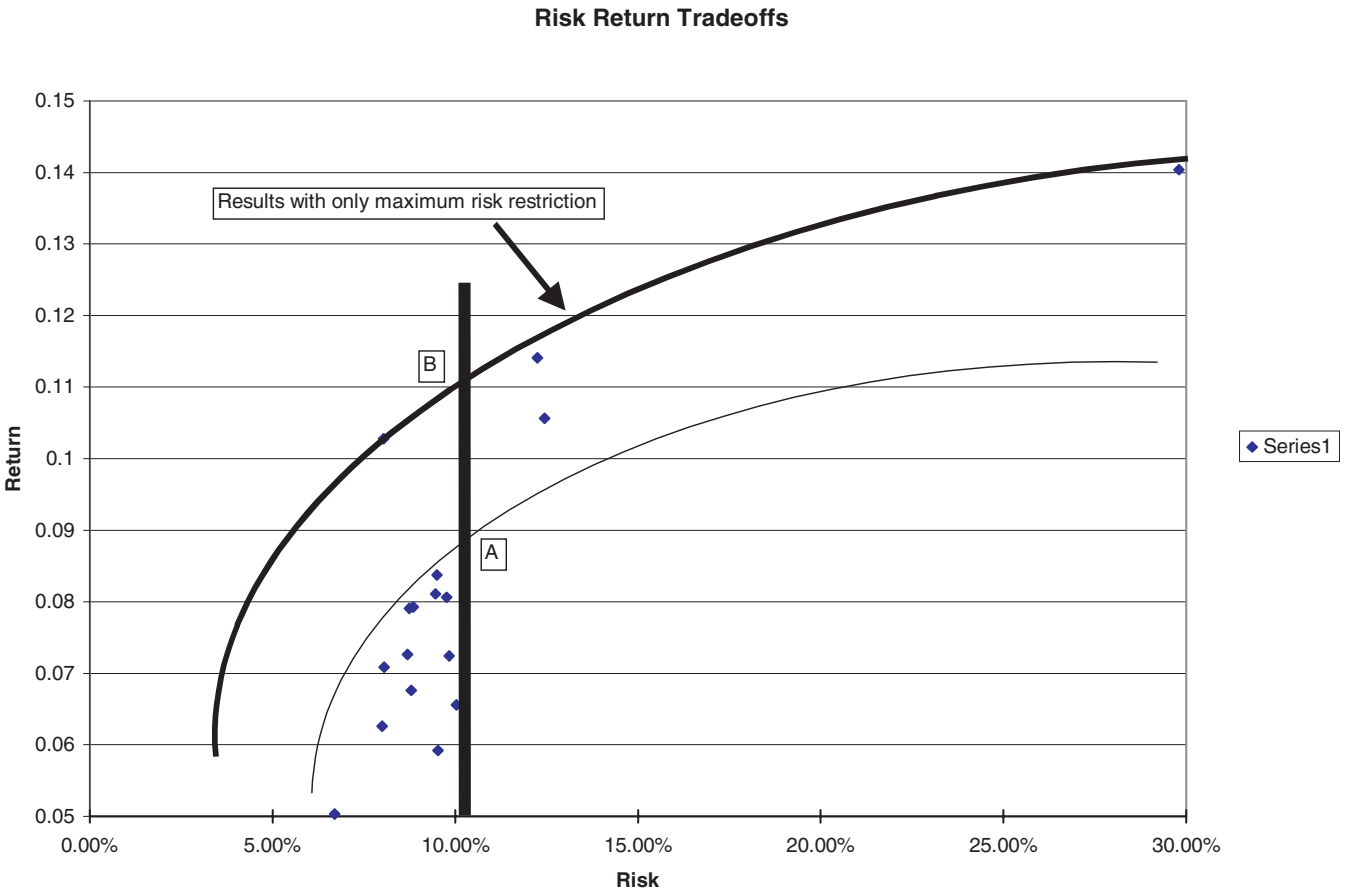


FIGURE 8.6
RISK RETURN TRADEOFFS WITH AND WITHOUT RESTRICTIONS



and B). With the quantity restrictions, the best the AFOREs could do is to achieve A (all AFOREs lie to the left of A). Under the regime of a simple portfolio risk restriction (without the underlying quantitative restrictions), the AFOREs could have achieved a rate of return depicted by B.

The difference may not seem very large but it is huge in terms of future value of benefits by the magic of compounding. For example, for a worker in the system for 25 years, the difference of 2.5% annual rate of return produces a pension lump sum that is 40% more. Thus, the result of the exercise suggests that huge gains can be made if funds are given a risk target for the portfolio rather than quantitative restrictions for each type of investment.

Note that this exercise did not require foreign investment. If investment in foreign assets is also allowed, presumably the gain will be even larger.

8.9 Conclusions

Restrictions placed on the portfolios of the AFOREs have virtually guaranteed that all the funds carry very large quantities of government bonds. This has in turn produced a highly correlated asset structure for all the funds. In order to achieve low risk for each individual fund, the government has generated high system risk (measured by the volatility of real rates of return of the funds).

One way the government could have avoided that is to specify the maximum risk that each fund could take and let the funds themselves choose their portfolios. With reasonable rules and conservative portfolios (that allow investment in stocks) they can produce substantial gains in return with the same level of portfolio risk.