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Should Pension Funds Invest In Equities?
An Analysis of Risk-Return Tradeoff and Asset Allocation Decisions

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Should Pension Funds Invest In Equities? An Analysis of Risk-Return Tradeoff and Asset Allocation Decisions

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Superior equity return and the associated excess volatility pose a policy dilemma of whether retirement savings should be invested into equity stocks. Using a simulation based approach, this paper investigates the suitability of equity exposure for provident and pension funds in India. A hypothetical real bond portfolio is considered as the benchmark case to measure the attractiveness of pure equity and balanced portfolio investment strategies for pension funds. While excess return over the terminal accumulation value of the real bond portfolio is considered as benefit, the shortfall probability vis-à-vis the benchmark is taken as the risk measure. Our results indicate that an all-equity portfolio strategy, inspite of its much superior mean terminal accumulation value, may entail substantial risk taking. Balanced portfolios, on the other hand, perform much better in terms of shortfall risk but fair poorly in low inflation regime. Also, our calculations show that if annuities are actuarially fair, the shortfall risk is marginal for balanced portfolios and declines further with rise in real interest rate. Our results, thus, show that equity exposure could help pension funds to provide better returns to the retirees.

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1. Introduction

Amidst the ongoing debate over whether pension systems should be defined-benefit or defined-contribution and whether such systems should be publicly managed or privately, there is an emerging consensus that unfunded pension schemes should be either replaced or supplemented by advanced funding mechanism [Holzmann (1997), Leinert and Esche (2000)]. There is, however, less consensus on where to invest the assets of such pre-funded retirement programs.

Low returns from bonds and government securities, where traditionally retirement funds are invested, have prompted many to argue for investing pension assets into equities. Given the experience of significant appreciation in equity prices over long term, many expect that such investment strategy could help improve the performance of retirement funds. On the other hand, many experts have raised their concerns over equity exposure by pension funds, as it involves substantial risk taking. Proponents of equity investment, however, claim that existence of equity-premium and inflation-hedging characteristic of equities make them ideal investment vehicle for pension funds. Equity returns are, nevertheless, more volatile than bond returns. But pensions are long-term contracts, and much of equities' volatility is smoothed out over the multi decade horizon of pension investment.

In the Indian context, the experience of low returns from provident funds is leading many to advocate for relaxing portfolio investment limits [Sen (1999), Dave (1999), Thomas (2000)]. The real rate of return from provident funds has been about 2.6% between 1985 and 1997. In contrast, long run annual equity return is about 14% after adjusting for inflation. Many experts are therefore advocating in favor of allowing retirement funds to invest in equity stocks.

Against this backdrop, this paper examines the suitability of equity exposure for retirement funds in India. Using historical data for equities, bonds and inflation, we simulate the performance of different asset allocation strategies and examine their relative attractiveness. We analyze the potential benefit of equity investment for pension funds from two perspectives. First, we measure returns from an all-equity portfolio as well as from equity/debt combination portfolios for pension funds, measured against a stringent benchmark of a real bond (inflation-indexed) portfolio. Second, we analyze performances of these portfolios using actuarially fair life annuity factors under alternative scenarios of real interest rates.

Our results suggest that a pure equity portfolio strategy may not be consistent with the risk tolerance level of pension fund managers. Mean return from the all-equity portfolio is much superior. However, there is a greater chance that the retiree will risk poverty. On the other hand, performances of balanced portfolios are more stable. For balanced asset allocation strategy, shortfall risk

is minimal when annuities are either priced in an actuarially fair manner or if the real interest rate is high. Balanced portfolios, however, fair poorly in a low and stable inflation rate regime.

The remainder of the text is organized as follows. Section 2 describes previous research on equity investment issues pertaining to pension funds. Section 3 provides details of the retirement fund investment performance in the Indian context. The regulatory constraints are also discussed. The portfolio simulation model is described in section 4. Section 5 discusses the results for the fixed longevity and actuarially fair simulations. Sensitivity analysis of these portfolios is also discussed. Concluding comments are provided in Section 6.

2. Literature Review

World over, pension fund managers are increasingly recognizing the importance of greater returns on investment. The experience of low returns from unfunded social security programs and pre-funded schemes with investment restricted to bond portfolio has prompted many to advocate that pension funds should invest in equity stocks.

Existence of equity premium makes equities attractive for pension funds. Since equities provide superior returns compared to any other asset class, Bodie (1990) argues that pension funds could provide better returns to the retirees if the assets are invested in equity stocks. On the other hand, many claim that the volatility in equity market return implies that significant risks are involved in such decisions. For example, Davis (1998) cautions that if investments are excessively risky, pensioners risk poverty if they retire in unfavorable market circumstances, even if the mean rate of return is high.

The proponents of equity investment counter this argument in two ways. First, they claim that much of equities' volatility is smoothed out over the multi decade horizon of pension investment. Second, they argue that appropriate strategic investment decisions like percentage of equity exposure and investment styles could further reduce the equity related risks for pension fund managers.

Further, superior real returns on equities over long horizon have prompted many to argue that equities provide the best hedge against inflation.[1] Brown, Mitchell and Poterba (1999), however, find low covariance between unanticipated inflation and stock returns and concludes that inflation-hedging properties of equities are limited. Even if equities are not perfect hedge against inflation, Bodie (1990) argues that equities are attractive for pension funds as they offer greater returns. The appeal of equity investment for pension funds,

[1] The long vesting period during the working life of a participant implies that unless the accumulated contribution grows at a fair real rate, the worker may face destitution after retirement. Hence, Stuart (1975) and Bodie (1988) argue that pension funds should focus on earning better real returns.

thus, mostly comes from the existence of equity premium and not due to inflation mitigation characteristic of equities.

On balance, therefore, it can be said that equity exposure for pension funds is desirable but it should be supported by a well-conceived asset allocation strategy. Cooper and Brooks (1999) show that nearly ninety percent of the pension funds investment performance is a result of strategic allocation and only ten percent is due to the skills of the fund managers. Tepper (1977) also argues that the optimal stock-bond mix is the single most important element of the investment policy decision for a pension plan.

Although, Thaler and Williamson (1994) advocate in favor of 100% investments into equities for pension funds, Asness (1996) suggests that such asset allocation decision is sub-optimal as it bereft the plan participant from the benefit of diversification. Ambachtsheer (1987) argues that an appropriate asset mix policy for pension funds should consider 40 to 70% investment in equities and the rest in other assets. Although there is some debate over the exact asset mix ratios, pension fund managers and other practitioners traditionally recommend a 60/40 or 50/50 mix of equities and bonds. Papke (1991) supports such asset mix strategy claiming that while fixed income portion will protect the portfolio value in adverse conditions, the equity portion will help in capital appreciation during favorable circumstances.

Another popular balanced portfolio strategy is to shift investments away from stocks and towards bonds over time. Commonly known as the age-adjusted or life-cycle investment strategy, it offers benefit of excess returns from equities, while reducing equity related risk by gradual reduction of equity exposure.[2] Such investment strategies often pursue the '100 – age' rule that allocates a percentage amount that is equal to the participant's age into bonds and the balance in equities. As a participant gradually reaches seniority, his personal retirement fund exposure in equity declines and is substituted by debt instruments.

Another possible approach for risk reduction without compromising in equity exposure is through international diversification. In reality, however, pension funds in developed and emerging markets alike display a strong home bias i.e. preference for domestic assets.[3] Folkerts-Landau and Ito (1995) argue that such preference is governed by low risk tolerance of the trustees of the funds. Griffin (1997) however supports such investment policies claiming that

[2] Planners commonly justify this advice in three ways. They argue that stocks are less risky over a young person's long investment horizon, that stocks are often necessary for younger people to meet large financial obligations, and that younger people have more years of labor income ahead with which to recover from the potential losses associated with stock ownership.

[3] It is well known that investment in foreign markets that have negative or low correlation with the domestic market could substantially reduce the portfolio risk. Alternatively stated, such diversification increases the rate of return for a given level of risk.

the benefit of international diversification is marginal if measured relative to the pension liabilities and adjusted for equity and currency related risks. On the other hand, Reisen (1997) discovers that international diversification could significantly improve pension fund performance. Especially, the developing countries running a privatized pension scheme can hedge their idiosyncratic risks, arising out of vulnerability to home country risks by investing in foreign assets.

3. Pension Fund Investment Performance

A cautious approach marks the investment pattern of retirement funds in India. Current regulations stipulate that the entire corpus of pension assets to be invested in the public and quasi-public debt instruments. Investments in equities or private debts are not permitted except for the group superannuation schemes and individual retirement annuities offered by the Life Insurance Corporation (LIC) of India.[4] Such conservative investment norms have hampered the performance of pension schemes - resulting in poor rates of return.

For provident fund schemes – the largest retirement saving program in India, the central government, through various nodal agencies, stipulates the investment norms. The government also declares the minimum annual interest rate for provident funds which is revised from time to time. For example, until recently, the guaranteed annual return for various provident funds was 12%. The rate, however, has been reduced to 9.5% in March 2001.

The investment management of provident funds, both exempted and non-exempted has largely remained passive due to a variety of reasons including investment restrictions, complex regulations, and under developed market for debt securities.[5] Investments of the funds are restricted only to public and public sector debt securities.[6] Typically, a large portion of provident fund assets is invested in Special Deposit Schemes (SDS) while the balance is held in gilt securities, state government and government guaranteed debt instruments and public sector unit bonds.

Nevertheless, compared to publicly managed schemes, privately managed provident funds earn better returns. For example, Patel (1997) shows that

[4] Even for these schemes, regulation approves equity investment only into the public sector units satisfying certain eligibility criteria.

[5] Provident funds can be either publicly (non-exempted) or privately (exempted) managed. Non-exempted provident funds are administered by the provident fund authority where employers regularly deposit contributions. Alternatively, the employer, upon fulfilling certain eligibility conditions, can set up a trust to manage the fund. This is known as exempted provident fund.

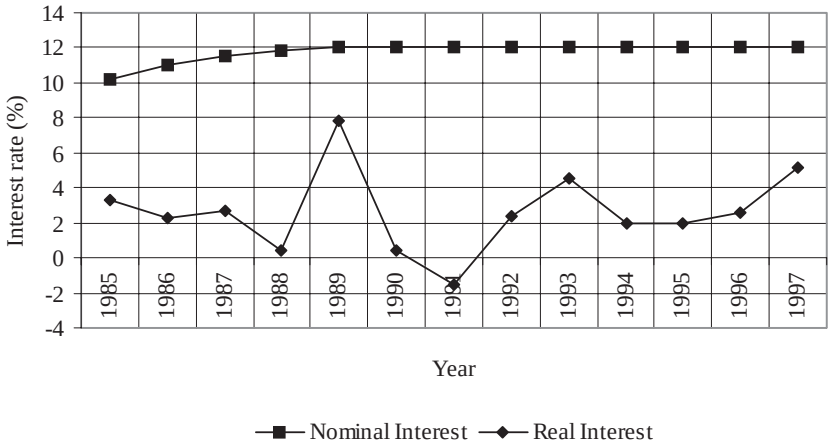
[6] As per the latest guideline issued in March 1997, provident funds are required to place 25 and 15% of their investments in central and state government securities respectively; 40% in public financial institutions' securities and certificate of deposits issued by public sector banks; and 20% in special deposit schemes, which also provide financing for the central government.

exempted provident funds usually earn an annual return between 13.5 and 14%. Dave (1999), however, shows that while some exempted funds earn better returns, many funds provide only the minimum stipulated return and some exempted funds even under-perform.[7] According to Mehta (2000), newly set-up exempted funds are earning better returns vis-à-vis the old funds. While the old funds hold a sizeable portion of their asset in illiquid and low yield SDS, new funds have significantly reduced their exposure to SDS.

The return from provident funds is however meager when adjusted for inflation. According to World Bank (1994) estimates, the average real rate of return from the Employees' Provident Fund (EPF) scheme was below 1% in the 1980s. The annual returns from the Employees' Provident Fund for more recent period are shown in Figure 1. The average annual real rate of return between 1985 and 1997 is only about 2.63%. These returns are too low to generate a sizeable accumulation of pension assets during a lifetime.

Figure 1: EPF interest rates

Annual nominal interest rate declared and the real interest yield for EPF scheme between 1985 and 1997. The real interest rate is computed using the Consumer Price Index for Industrial Workers (CPI-IW). While the nominal interest rate for EPS has mostly remained constant at 12%, the real interest rate has varied between –1.5 and 7.8% during the period. The average annual real yield from EPF is about 2.63%.



[7] If an exempted provident fund fails to earn the minimum rate of return prescribed, the employer has to meet the shortfall amount.

The low rates of return have prompted many to advocate for relaxing the investment norms [Patel (1997), Dave (1999)].[8] Dave (1999) also argues that given the better yields from LIC group and personal pension plans which are allowed to invest in equities, provident funds should be permitted to invest in equity stocks. The government is also contemplating reform in the pension sector for some time and appointed the Malhotra Committee (1994) to study the insurance and pension business. The committee recognized the need for better investment performance from pension funds and suggested some changes in the asset allocation composition.

More radical suggestions have come from the Project OASIS workgroup - set up by the Ministry of Social Justice and Empowerment, Government of India to study the pension system. OASIS (2000) outlines a liberal, multi-option investment norm for pension funds that is consistent with the risk tolerance level of the participant. A highlight of the recommendation is that suggestion for investment in private corporate debts and equities including international equities.[9]

4. Simulation Model Description

This section develops a portfolio simulation model to examine the relative merits of different asset allocation policies for the proposed individual retirement saving accounts. The attractiveness of the proposal hinges crucially on its ability to offer a benefit that is superior to the benefit level of the existing pension schemes. Given the experience of sustained inflation in the Indian economy, the need for inflation-insulated retirement saving products is compelling. Central to the model proposal, therefore, is the idea of maintaining retirement benefits in real terms.

It should be noted here that a pre-requisite to provide real annuities to the retirees is the existence of a market for indexed bonds especially index-linked treasury bills. Indexed treasuries, besides providing pension plans a tool to hedge inflation risk, offer many a benefits to the monitory authority.[10] In many countries like Chile, UK, Canada and elsewhere, existence of such indexed treasuries have helped pension funds to insulate the participants against inflation, both before and after retirement. In US, Diamond (1996) recognized the need

[8] Srinivas and Yermo (1999) favor relaxing the investment norm for pension funds to offer the retirees better rate of return. They argue that the net welfare gain from a liberal investment regime measured against market benchmarks should be an important consideration for pension reform.

[9] OASIS (2000) argues that pension funds investment in equities should be implemented initially through index funds on the NSE-50 or the BSE-100. Investment in corporate bonds should be limited to investment grade liquid bonds. International equity investment might be considered at a later stage and should also be implemented using index funds.

[10] For example, Barone and Masera (1996) argue that long-term indexed treasuries foster a low inflationary regime.

for such securities to offer inflation-adjusted private pension. Subsequently, in 1997, the US government started issuing treasury inflation protected securities (TIPS). Govardhan (1999) also underlines the need for inflation-indexed assets to provide real annuities in India. For the present purpose, we assume that the inflation indexed treasury securities (IITS) are available and are used to construct the benchmark portfolio.

To start with, a number of assumptions are made about the plan participant. A typical participant starts working at the age of twenty-five and retires at the age of sixty and therefore has a thirty-five years span for retirement planning. Further, it is assumed that the wage increases at the rate of inflation i.e. there is no real wage growth. The final income of the worker is taken as Rs.200,000 and target retirement income is Rs.100,000. This effectively implies a target replacement rate of 50%. The life expectancy after retirement is assumed to be 20 years. If the nominal interest rate is 11%, a corpus of about Rs. 7,96,330 will be required to provide Rs.100,000 per annum for the next 20 years. However, as already discussed, it is more important to maintain benefit levels in real terms. If the real rate of return were 3%, this would require accumulation of Rs.14,87,419 to make annual payments of Rs.100,000 for twenty years after adjusting for inflation.[11]

Considering investment in inflation protected treasury securities (IITS) as the benchmark strategy, the performances of alternative investment strategies are analyzed. For the benchmark strategy, it is assumed that 100% of the worker's annual contribution is invested in the IITS. To reach Rs.14,87,419 at the age of sixty, a participant will need to contribute 12.29% of wages each year, assuming a constant real rate of 3%. This compares well with the prevailing provident fund contribution rate of 12%.

The alternative investment strategies involve investing in equities and debts with different exposure styles. To be specific, three asset allocation strategies are considered.

- The all equity portfolio as the name suggests, makes 100% investment in equity stocks.
- The balanced portfolio follows the general norm of investing 60% in equity and the remaining 40% in IITS.
- The age-adjusted portfolio recognizes the decline in risk bearing capacity with aging. The percentage of equity exposure is governed by the 100 - age rule. As age increases, the proportion of equity exposure is reduced in favor of IITS. At the end of each year, the portfolio is rebalanced so that percentage investment in IITS remains equal to the age of the worker while the remaining portion (100 - age) is invested in equity.

[11] The terminal portfolio value is derived by computing the present value of the future cash outflow. To pay a nominal annuity of Rs. 100,000 for 20 years assuming annual interest rate is 11%, the final portfolio value should be Rs. 100,000 x PVIFA(11%, 20) = Rs.7,96,330. The corresponding figure for a 3% real annuity is Rs. 100,000 x PVIFA(3%, 20) = Rs. 14,87,419.

The equity investment is implemented through index based investing. The Bombay Stock Exchange Sensitive Index (BSE-Sensex or simply Sensex) is considered as the market proxy. For each investment strategy, the portfolio is rebalanced at the beginning of each year to adjust for annual contribution of the plan participant, together with any accrued interest and dividend received. The model ignores transaction costs.

To implement the above portfolio strategies, a further set of assumptions about stock returns and inflation is necessary. These parameters are estimated analyzing historical data. Thomas (2000) computes long run average annual return for Indian stock market is about 23%. Examination of more recent data of BSE-Sensex and NSE-Nifty, however, suggests that the average annual stock index return is not as high. We therefore take the yearly return on stock index as 15% with a standard deviation of 20%. Further, the annual dividend yield of the index is taken as 1%.

Since it is commonly used for indexing wages and salaries, inflation is proxied by the Consumer Price Index (CPI) for industrial workers. Callen and Chang (1999) show that between 1983 and 1999, the mean CPI value is 9.19% with a standard deviation of 2.73%. However, the rate inflation has significantly declined in recent times. Assuming that this trend will continue in future, the mean and standard deviation values for CPI is taken as 8% and 3% respectively. Finally, since the correlation between CPI and Sensex is statistically not significant, we assume no correlation between inflation and equity return.[12]

The simulation process involves random generation of 1000 scenarios for stock return and inflation for each investment strategy. These values are used to determine the portfolio value over the entire duration of the pension plan. For each investment strategy, the performance is judged on the basis of whether the final portfolio value at the time of retirement achieves the target value of Rs.14,87,419.

[12] Since CPI values are available only on quarterly basis, I computed quarterly returns on the Sensex to make it comparable with the former. The time interval considered is between 1990 and 1999. The correlation value is statistically insignificant.

5. Analysis of Results

5.1. Results for fixed longevity simulations

Table 1 reports the result of the simulations. Because of the higher expected return, the all-equity investment strategy achieves a much higher average portfolio value at age sixty *vis-à-vis* the benchmark strategy of 100% investment in IITS. For 1000 simulation runs, the mean portfolio value is about Rs. 41.4 lakh. This however involves greater exposure to downside risk. This is evident from the fact that in 16.8% of the simulation runs, the final portfolio value fails to reach the targeted amount of Rs. 14,87,419.

In comparison, the balanced portfolios are less risky. Yet, a significant proportion of simulation runs fail to reach the targeted portfolio value at the time of retirement. Average value at age sixty for the 60/40 portfolio is close to Rs. 27.14 lakh but 14.6% times it fails to reach the target value at retirement. The age-adjusted portfolio is slightly less risky as it falls below the target only 12.9% of the simulation runs. The mean final portfolio value equals Rs. 25.59 lakh – slightly lesser than the 60/40 portfolio strategy. Figure 2 plots the frequency distribution of the terminal value of wealth for each investment strategy.

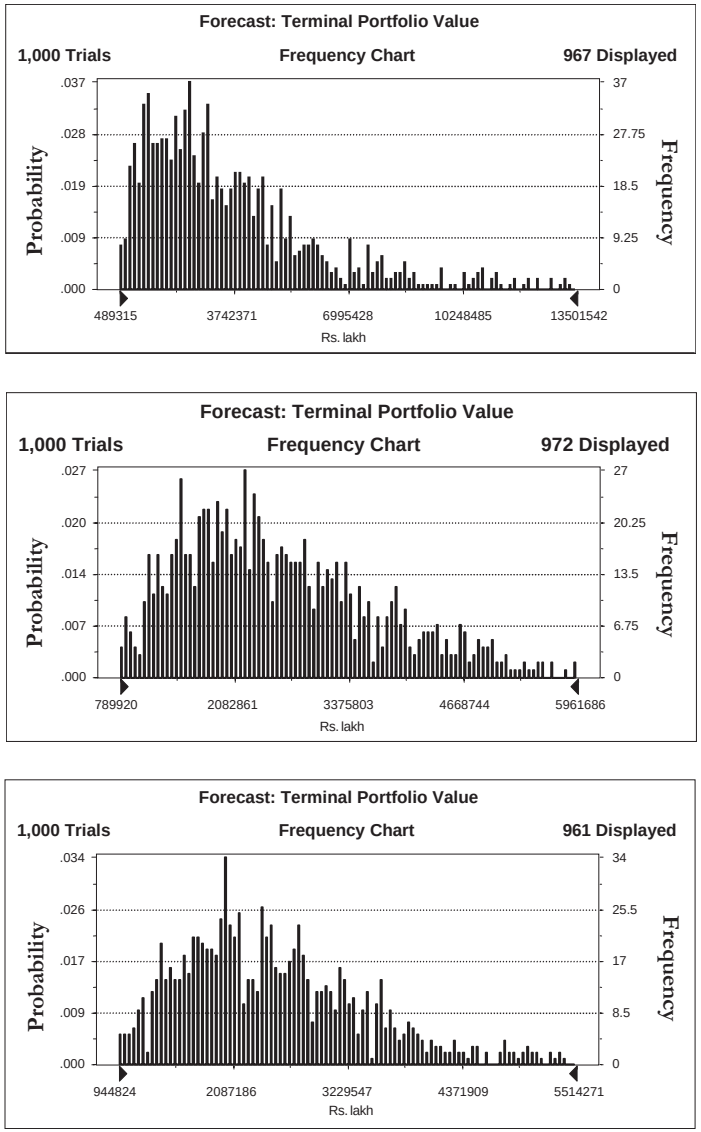
Table 1: Performance of alternative portfolio strategies

Summary portfolio simulation results for various asset allocation strategies. Investment in Inflation Indexed Treasury Securities (IITS)[a] is the benchmark strategy with no shortfall risk. The terminal benchmark portfolio value provides a 3% real annuity of Rs. 1 lakh for 20 years, post-retirement[b]. Other portfolio strategies include a pure equity[c] strategy or balanced exposure to equity and IITS. The risk involved with other portfolio allocation decisions are measured as percentage times the final portfolio value is below the benchmark portfolio value. The real annuity payouts from alternative investment strategies are computed based on the mean portfolio value. The replacement income ratio is obtained by dividing the real annuity payout by the yearly earnings at the time of retirement[d].

Investment strategy	Terminal portfolio value (Rs. lakh)	Returns below target (%)	Annual real annuity payoff (Rs. lakh)	Replacement ratio (%)
100% in IITS	14.87	0	1.00	50.00
All-equity	41.45	16.8	2.79	139.34
60-40 Equity-Debt	27.14	14.6	1.82	91.23
Age-adjusted	25.59	12.9	1.72	86.02

[a] Mean annual inflation rate is assumed 9% with s.d. of 3%
[b] Assuming a 35 years of employment life and wage grows at the rate of inflation, the contribution rate for accumulating the benchmark portfolio is 12.43%.
[c] Mean annual equity return is 15% with s.d. of 20%
[d] Final earnings is taken as Rs. 2 lakh per annum

Figure 2: Frequency distribution of terminal portfolio values



60/40 Equity/Debt Portfolio
Age-adjusted Portfolio

These results are also compared with the benchmark strategy to find the annual real annuity the different strategies could provide. Taking the mean terminal values of each of the portfolio investment strategy, the real annuity payoffs are computed assuming 3% real rate of return for a post-retirement life of 20 years (Table 1). The 100% equity investment strategy pays a real annuity of Rs.279,000 against the benchmark pension of Rs. 100,000. This amounts to a replacement income of about 139%[13]. The real annuity payouts for the balanced portfolios are also significantly higher. The 60/40 portfolio generates an inflation-adjusted annual income stream of Rs.146,000 for 20 years resulting about 91% replacement income. The age-adjusted portfolio provides a slightly lesser real retirement income of Rs. 172,000 per annum for 20 years. This corresponds to about 86% of replacement income.

5.2. Actuarially fair robustness estimates

In the preceding discussion, we have assumed that the plan participant will live for 20 years after retirement. In this section, we analyze the result based on the actuarial estimate of mortality. The Actuarial Society of UK has estimated the present value factor of a life annuity for different combinations of age and interest rate. Taking the 3% real rate of interest as the base case scenario for a worker retiring at the age of 60, we compare the percentage times our previous simulation results exceed the minimum corpus required. The sensitivity of the result with variation in real interest rate is also examined.

The result is reported in Table 2. In the base case, for 3% real rate of interest, a sum of Rs. 13.227 lakh is required to provide a yearly real annuity of Rs. 100,000. We find that the all-equity portfolio fails to reach the targeted value in 12.9% of the simulation runs. The percentages of failure for the balanced portfolios are somewhat less. The 60-40 portfolio fails to reach the targeted corpus for 9.4% of the simulation runs while the corresponding figure for the age-adjusted portfolio is 7.4%.

In order to find the sensitivity of the result obtained so far, to the fluctuation in real rate of interest, the exercise is repeated with interest rates set at 4, 5 and 6% respectively. With rise in real interest, the amount required to provide the life annuity decreases resulting improved performance of all the portfolio strategies (Figure 3). In case of 6% real rate of interest, all equity, 60-40 and age-adjusted portfolios fail to reach the final targeted corpus value 6.7, 2.5 and 2.1% of times respectively. Thus, the results show that with higher real rates of interest, portfolio performances improve secularly and significantly.

[13] Replacement income is a ratio, expressed in percentage, of pension obtained to final earnings before retirement.

Table 2: Actuarial estimates of performance of alternative portfolio strategies

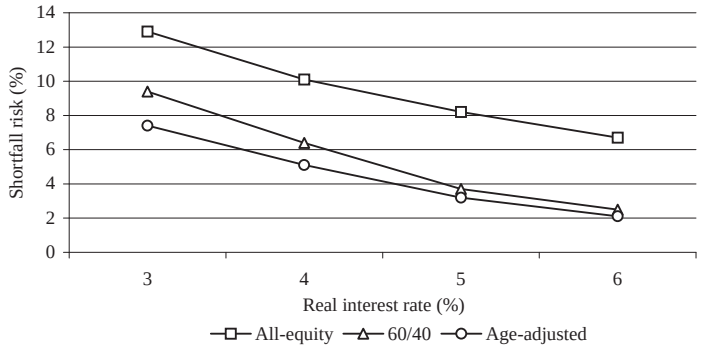
Simulation result of performance of alternative investment strategies in reaching an actuarially fair corpus value at retirement under varied rates of real interest. Life annuity factors are used to estimate the total corpus required for a person retiring at the age of 60 years. The corpus provides a life annuity of Rs. 1 lakh maintained in real terms. Note that with rise in real interest rates, the downside risk exposure reduces secularly and significantly.

Annual real interest rate (%)	Fund value[a] (Rs. lakh)	Percentage of failure for alternative portfolio strategies		
		All equity	Balanced portfolio	
			60-40	Age-adjusted
3	13.227	12.9	9.4	7.4
4	12.087	10.1	6.4	5.1
5	11.107	8.2	3.7	3.2
6	10.258	6.7	2.5	2.1

[a]Targeted corpus value at retirement age (60 years)

Figure 3: Sensitivity of final portfolio values to real interest rates

Sensitivity of alternative portfolio allocation strategies in reaching the target corpus value at the time of retirement to real interest rate fluctuations. The all-equity portfolio is the most susceptible to changes in the real rates of interest. Shortfall risk is marginal for balanced portfolios at higher real interest rates.



5.3. Portfolio sensitivity tests

The simulation results obtained so far are based on the assumptions made about the stock return and volatility and the inflation rate. This section examines the performance of different portfolio strategies if these parameter values are changed. We perform two additional sets of simulations. First we decrease the annual stock return value to 12% while keeping the other parameters unchanged. Next, we restore the equity return to 15% but reduce annual dividend yield to 0.5%. The mean annual inflation is also changed to 5% with a standard deviation of 1%. In both cases, the real interest rate is kept constant at 3%. We again generate 1000 scenarios of simulations for each of the portfolio strategies for both the scenarios. The terminal portfolio value is then compared with our benchmark portfolio value of Rs. 14.87 lakh. Table 3 reports the results of the simulation.

The drop in mean annual equity return significantly depresses the final portfolio values (Panel A of Table 3). For the all-equity portfolio, the mean terminal value is Rs. 21.35 lakh. This implies that a three percentage point drop in annual equity return value (from 15 to 12%) has almost halved the final portfolio corpus. The balanced portfolios are also depressed. Mean terminal value of the 60/40 portfolio is Rs. 18.83 lakh while that of the age-adjusted portfolio is Rs. 18.31 lakh. These terminal portfolio values are, however, still greater than the targeted value of Rs. 14.87 lakh. But this result should be treated with caution. With drop in equity return, the downside risk of failing to surpass the benchmark portfolio value increases sharply. While, the all equity portfolio fails to cross the benchmark value about 44.4% times of the simulation runs, the corresponding figures for the 60/40 and age-adjusted portfolios are 39.3% and 36.7% respectively.

For the other scenario, the portfolio performances are reported in Panel B of Table 3. Since, the mean equity return value is restored to 15% (with half percentage drop in dividend yield), the performance of the all equity strategy improves. The mean terminal value of the all equity strategy is Rs. 27.49 lakh. Yet, in about 36% times of the simulation runs, the final portfolio value is smaller then the target corpus. In contrast, the balanced portfolios perform even worse. With drop in inflation rate, both the 60/40 and the age-adjusted portfolios fail to surpass the benchmark value in all the simulation runs.

The results thus show that the portfolio simulations are highly sensitive to the parameter estimates. Drop in equity return or dividend yield significantly destabilize the terminal portfolio value for an all-equity strategy. However, mean terminal values of the all-equity portfolio are still higher than the benchmark

Table 3: Sensitivity test for alternative portfolios

Summarized simulation results of various portfolio investment strategies under alternative equity return, dividend yield and inflation rate. The real interest rate is 3%. Service period is 35 years and post retirement longevity is 20 years. Mean terminal portfolio values at the time of retirement, shortfall risks vis-à-vis the benchmark portfolio, annual real annuity payoffs based on the mean portfolio value and the replacement income ratio based on the real annuity amount is computed. Panel A reports simulation results assuming 12% annual stock return with 20% volatility and 1% yearly dividend yield, 8% annual inflation 8% with 3% volatility. Panel B reports simulation results assuming 15% annual stock return with 20% volatility and dividend yield 0.05%, 5% inflation with 1% volatility.

Investment strategy	Terminal portfolio value (Rs. lakh)	Returns below target (%)	Annual real annuity payoff (Rs. lakh)	Replacement ratio (%)
		Panel A		
100% in IITS	14.87	0	1.00	50.00
All-equity	21.35	44.4	1.44	71.77
60-40 Equity-Debt	18.83	39.3	1.27	63.30
Age-adjusted	18.31	36.7	1.23	61.55
		Panel B		
100% in IITS	14.87	0	1.00	50.00
All-equity	27.49	35.9	1.85	92.41
60-40 Equity-Debt	14.49	100.0	0.97	48.71
Age-adjusted	12.92	100.0	0.87	43.43

portfolio value. But, such depression in equity return increases the risk exposure substantially. More than one-third of the times, the final portfolio value fail to reach the targeted value. The effect of drop in inflation is more severe on balanced portfolios. Under low inflation regime, the balanced portfolios comprising inflation indexed bonds and equity stocks do not achieve the targeted corpus at all.

6. Conclusion

Inadequate return from pension schemes is a serious challenge to develop a creditable retirement system in India. In recent times, therefore, there have been some suggestions for creation of individual account based pre-funded defined-contribution retirement accounts, which will invest in diversified portfolios including equity stocks. On the other hand, the conservatives challenge such

reform proposal on the ground that the excess return from equity stocks will entail significant risk exposure.

In this context, this paper examines the suitability of different portfolio diversification strategies from a pension investment perspective using a simple simulation based approach. Given the experience of sustained inflation in India, central to the model proposal is the idea of maintaining retirement benefits in real terms. Hence, we consider investment in inflation indexed securities as the benchmark strategy, and compute a target corpus that would be sufficient to provide a real annuity to the retiree for an assumed period of 20 years of post retirement longevity. The performances of the alternative portfolio strategies in reaching the targeted corpus at retirement are then measured against the benchmark.

Our results suggest that the all-equity portfolio provides superior rate of return, but involves substantial risk taking. On the other hand, returns from the balanced portfolios are very susceptible to fluctuation in inflation rate. While balanced portfolios offer adequate returns at moderate inflation regime, the return values decrease sharply with drop in inflation rate. Further investigation, using actuarially fair values for pension annuities, suggests that the shortfall risk (from the targeted terminal portfolio value) is modest especially in case of balanced portfolios and at higher levels of real interest rate.

To summarize, we find that equity exposure by pension funds could enhance rate of return for the retirees. Bur it entails significant exposure to downside risk. Balanced portfolios, on the other hand appear more stable and the risk involved is marginal if the annuities are actuarially fair. However, fluctuation in inflation rate could depress returns from these portfolios. On balance, our results lend credence to the suggestion that pension funds should be allowed to invest in equity stocks. However, this should be done with adequate caution and implemented progressively.

REFERENCES

Ambachtsheer, Keith P. (1987), Pension Fund Asset Allocation: in Defense of a 60/40 Equity / Debt Asset Mix, Financial Analysts Journal, Sept-Oct, 14-24.
Asness, C.S. (1996), Why Not 100% Equities?, Journal of Portfolio Management, Winter Issue, pp.29-34.

Barone, Emilio and Rainer S. Masara (1996), Index-Linked Bonds from an Academic, Market and Policy-Making Stand Point, Ricerche Economiche 50, 1-25.

Bodie, Zvi (1988), Pension Fund Investment Policy, Working paper 2752, NBER Cambridge.

Bodie, Zvi (1990), Pension Funds and Financial Innovation, Financial Management, Autumn, pp. 11-22

Brown, Jeffrey R., Olivia S. Mitchell and James M. Poterba (1999), The Role of Real Annuities and Indexed Bonds in an Individual Accounts Retirement Program, Working paper 7005, NBER, Cambridge.

Callen, Tim and Dongkoo Chang (1999), Modeling and Forecasting Inflation in India, Working Paper 119, International Monetary Fund.

Cooper, G. and Brooks, P.(1999), Pension Fund Management Fundamentals, A Paper Presented at the Asian Development Bank Pension Funds reform Workshop, Singapore.

Dave, S.A. (1999), "Restructuring Pensions for the Twenty-First Century", in James A. Hanson and Sanjay Kathuria (ed.), India A Financial Sector For The Twenty-First Century, Oxford University Press, New Delhi, pp.305-333.

Davis, Philip E. (1998), Investment of Mandatory Funded Pension Schemes, Working Paper, Pensions Institute, Birkbeck College, London.

Folkerts-Landau, D. and T. Ito (1995), International Capital Markets: Developments, Prospects and Policy Issues, IMF.

Govardhan, N. M. (1999), The Pension Promise – Issues, Concerns and Regulatory Aspects, Management Review 11, 3, Indian Institute of Management Bangalore.

Griffin, Mark W. (1997), Why Do Pension and Insurance Portfolios Hold So Few International Assets?, Journal of Portfolio Management, Summer Issue.

Holzmann, Robert (1997), Fiscal Alternatives of Moving from Unfunded to Funded Pensions, Technical Paper 126, OECD Development Centre, Paris.

Leinert, Johannes and Andreas Esche (2000), Advance Funding of Pensions, International Reform Monitor, October Special Issue.

Malhotra, R.N. (1994), Report of the Committee on Reforms in the Insurance Sector, Ministry of Finance, Government of India, New Delhi.

Mehta, Baman (2000), Pension reforms: The role of the private sector, paper presented at the conference on 'Reforming pension systems in South Asia', New Delhi.

OASIS (2000), The Project OASIS Report Part II, Ministry of Social Justice and Empowerment, Government of India, New Delhi.

Papke, Leslie E (1991), The Asset Allocation of Private Pension Plans, Working Paper 3745, NBER, Cambridge.

Patel, Urjit R. (1997), Aspects of Pension Fund Reform: Lessons for India, Economic and Political Weekly, Vol. 38, pp. 2395-2402.

Reisen, H. (1997), Liberalising Foreign Investments by Pension Funds: Positive and Normative Aspects, Technical Paper 120, OECD, Paris.

Sen, B. (1998), A Critique of India's Pension System, Paper Commissioned for the Conference on Old Age Social and Income Security, November 27-29, Goa, India.

Srinivas, Pulle Subrahmanya and Juan Yermo (1999), Do Investment Regulations Compromise Pension Fund Performance? Evidence from Latin America, Discussion paper, World Bank.

Stuart, C.F. (1975), Planning for Pensions In Inflation, Long Range Planning, Dec. 13-19.

Tepper, Irwin (1977), Risk vs. Return in Pension Fund Management, Harvard Business Review 55, March-April, 100-107.

Thaler, R.H., and J.P. Williamson (1994), College and University Endowment Funds: Why Not 100% Equities?, Journal of Portfolio Management, Fall Issue, pp.27-38.

Thomas, Susan (2000), Equity Investment in Pension Asset Management in India, IGIDR, Mumbai.

World Bank (1994), Averting the Old Age Crisis; Policies to Protect the Old and Promote Growth, Oxford University Press, New York.