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Simulation of Risks and Benefits from a Money Purchase Pension Scheme for Turkey†

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During the last decade, the publicly managed pay-as-you-go (PAYG) pension (old-age insurance) system in Turkey began to face serious financial difficulties due to generosity of pension benefits relative to contributions, combined with unrealistically low statutory entitlement ages. When the deficits generated by the system exceeded tolerable limits, a major pension reform bill was prepared to set key program parameters straight. Legislated in Fall 1999, the bill introduced many changes including a significant increase in the statutory entitlement age. Following the legislation of the parametric pension reform act, another draft was sent to the Parliament to lay the legal grounds for allowing individuals to purchase defined-contribution pension schemes from private companies so as to supplement retirement benefits from the basic scheme provided by the state.

This paper considers such a defined-contribution (also called money purchase) pension scheme and simulates the possible levels of benefits that can be obtained with an 8% contribution rate, allowing for stochastic returns from alternative investment strategies and salary increases. The results indicate that investing in Turkish equities would yield the highest average retirement income with a reasonable downside risk relative to other investment strategies. (*JEL* G23, G11, H55, C15)

Observers usually agree that the direction of further development of Turkish financial markets in the years ahead depends largely on the outcomes of recently started process for reforming the financially troubled social security system in the country. The reform is expected to affect financial markets through two major channels. The first is the reductions to result in deficits of social security institutions which, by the end of the last decade, had become the major contributor to public deficits, diverting savings away from financial markets. The second channel is the currently planned introduction of privately managed defined-contribution (also called "money purchase") retirement plans –which are often argued to have the potential to boost the long-term savings and the volume of financial transactions in Turkey. Despite widespread talk about potential contributions of the reform process to further development and deepening of financial markets, and to the liberalization process of Turkish economy in general, a comprehensive and rigorous analysis on the feasibility or the likely magnitude of the expected boost is yet to appear in the literature.[1] This paper aims to contribute to the process of informed discussion on various aspects of social security reform-financial market

interaction, in the light of the planned introduction of money purchase schemes in Turkey.

Turkey's publicly managed, pay-as-you-go (PAYG) system began to generate large deficits after 1990. The rapidly growing contribution of social security system to public sector imbalances made the need for reform increasingly visible, eventually proving to be unsustainable by the end of the 1990s (Topal, 1999; Sayan and Kiraci, 2001a and 2001b). Since the primary reasons underlying the deficits were the generosity of benefits relative to contributions and unreasonably early retirement ages, the government responded by introducing a bill for parametric reform involving changes in the values of critical policy parameters such as the statutory entitlement (minimum retirement) ages and contribution/replacement rates. While the parametric reform bill legislated in September 1999 could be viewed as an imperative step to curb the growth in social security deficits in the short-run and is likely to reduce the deficit in the medium-run, its long-run impact is yet to be seen (IMF, 2000).[2] Since complete elimination of social security deficits was expected to require additional measures,[3] however, the legislation of 1999 was intended to be just the first stage of a larger reform to overhaul the system. A particularly important step towards the completion of reform process is the planned introduction of money purchase pension schemes to be managed by private sector (IMF, 2000). The legal and regulatory framework has already been drawn up through a bill currently awaiting ratification of the Turkish parliament. As stated in the Letter of Intent of December 1999 submitted to the IMF by the Turkish government,[4] the bill aims to intensify social security reform and diversify the sources of long-term savings by creating the legal infrastructure for the establishment and development of privately managed pension funds.

Pension companies to be established within this framework will offer pension income to active workers who contribute a predetermined portion of their work time salaries. Under these plans, contribution receipts will be accumulated and invested in each member's account and the retirement income will depend on the level of contributions and investment returns. Operation of such a defined-contribution based pension scheme requires involvement of such financial institutions as insurance companies, unit trusts and banks. Since the contributions collected need to be invested in various financial assets, the system has the potential to significantly boost the volume of financial transactions in Turkey, facilitate deepening of financial markets in the country and contribute to the privatization process.

Such schemes are also likely to have a positive impact on macroeconomic balances since they facilitate the management of public deficits by reducing the publicly managed social security systems' risks of default, and help increase long-term savings –making them even more desirable (World Bank, 1994). Yet, even if the bill awaiting ratification is enacted, creation of the legal framework to allow working individuals to purchase such retirement plans is only a first step towards collecting these benefits, since the existence of such a framework does not by itself guarantee that the anticipated outcomes will follow. For the system to actually take off and start operating in the direction foreseen by the bill, investors should be convinced that the demand for retirement plans to be offered would be large enough to make private pension business profitable. Even though the high population share of people in the working age at this stage of demographic transition in Turkey provides reason for optimism,[5] the emergence and actual growth of this demand will essentially depend on the working individuals' evaluation of i) the likelihood of obtaining comparable real returns to other financial instruments with matching risk structures, and ii) the affordability of contributions required to generate the desired flow of pension payments. In fact, one of the important characteristics of money purchase pension plans is the lack of risk-sharing mechanisms implying that members have to face all risks arising from the uncertainty about real income levels after retirement (Knox, 1993). Furthermore, differently than the common practice in many other countries, the bill to be legislated in Turkey allows contributing individuals to choose the asset composition of portfolios to be formed completely freely. In other words, the bill does not require individual members to maintain predetermined shares of portfolio in low risk assets. So, in the absence of government subsidies to the scheme or other guarantees on minimum pension levels or minimum rates of return on the fund, unfavorable investment returns or low salary levels might lead to insufficient levels of income after retirement. Then, what seems to be a good solution from the government's point of view may be disastrous for individuals who bear all the risks. This implies that evaluating the

feasibility of a transition to these schemes, whether complete or complementary, requires a detailed analysis of the risks involved.

The purpose of this paper is to analyze these risks and associated benefits under defined-contribution retirement plans (money purchase pension schemes) to be introduced in Turkey, and to assess the effectiveness of various risk-reduction strategies that might be pursued by individuals as well as the government. For this purpose, we consider a money purchase pension scheme supplementary to the basic state scheme and investigate the potential level of benefits from alternative portfolios that might be selected under a (presumably affordable) contribution rate of 8%, using an actuarial simulation model allowing for stochastic investment returns and salary increases.

The discussion in the rest of the paper is organized as follows. The next section describes the basic characteristics of pension schemes, particularly money purchase schemes. The model developed for simulation exercises carried out is introduced in Section II. Simulation results are presented in Section III. Finally, Section IV concludes the paper by summarizing the findings and discussing their implications.

I. Money Purchase Plans and Pension Provisions

Other than the assets owned by the individual, there basically are two sources of income available to cover working individuals against the loss of wage/salary income after retirement. The first is often compulsory and universal coverage of social security typically designed to provide basic retirement income on a PAYG basis. PAYG schemes finance pension benefits of current retirees out of contributions that currently active workers are required to make out of their salaries and are considered unfunded schemes. The second is complementary pension plans that are designed to generate additional retirement income and are generally financed on a funded basis. Under these plans, contributions from members and their employers are invested and accumulated in a fund and the stream of returns to this fund is used to finance pensions paid to those members.

There are two types of funded pension schemes distinguished by the distribution of risk and return between the members and the sponsor (generally the employer) (Davis, 1995).[6] Under a defined-contribution (or money purchase) plan, the fund is usually based on regular contributions fixed as a proportion of salary, accumulated and invested in each member's account. Since the retirement income is generally provided by purchasing an annuity with the accumulated assets in the individual's account, the amount to be collected depends solely on the level of contributions and investment returns. The investment of the fund could be carried out by various financial institutions, such as insurance companies, unit trusts and banks. The retirement income can normally be obtained from whole-life annuities offered by life insurance companies. A defined-benefit plan, on the other hand, provides a retirement income calculated according to a predetermined formula, typically taking into account the duration of service and the individual's average salary over a certain period of time. The employer (or sponsor) guarantees the promised pension by pledging to supplement the fund whenever necessary. Unlike such defined-benefit plans where the employer assumes the investment risk, there is no risk-sharing under defined-contribution schemes which put the employer under no obligation but a fixed contribution. Depending upon the market returns, the pension income actually received by the employee might be higher or lower than what (s)he would have received under a defined-benefit plan. So, all investment risk stemming from the variability of investment return on accumulated contributions is borne by the member/employee. Even though they do not allow for risk-sharing, money purchase schemes offer maximum flexibility and facilitate mobility of the employee across jobs. When the employee switches to another job, the accumulated amount can be moved from one scheme to another or left as it is.

Furthermore, since there is a direct relationship between investment returns and retirement benefits in money purchase schemes, there is no additional cost to the provider of deficit financing. This increases their popularity in pension reform proposals that are usually introduced to avoid deficit financing needs created by existing social security operations. In fact, the global experience of slow down in economic growth in the last decade made these deficits generated by PAYG-based systems even more visible. With additional consideration given to the prospects, in the light of aging populations, that these deficits will further grow in the years ahead, the pressure to switch away from existing social security systems has increased. The favorable rates of return on assets relative to the growth rates of wages during the 1990s have also added to the popularity of funded schemes against PAYG schemes, and many countries have moved towards funded schemes. Others like Turkey are in the process of setting up the legal and institutional framework to allow workers to have access to defined-contribution pension plans. However, the transition from a PAYG to a funded scheme can be difficult as the current generation is forced to pay twice to settle the existing debt of the old system. Besides this intergenerational fairness aspect and differing economic implications of each system,[7] the transition requires external finance, generally from the government budget and that is difficult to provide in a country already suffering from deficits created by the PAYG system.

Institutionally, money purchase pension schemes can be offered by two different types of financial institutions. The first is a mutual fund, in which contributions are accumulated and invested on behalf of members, such as AFP's (Administradoas de Fondos de Pensiones) in Chile. Maximising the return on the fund subject to an acceptable level of risk and expenses is the main concern of such funds. The second is life insurance companies that provide a monthly pension to the employee in return for his/her accumulated capital at retirement. These pensions are often in the form of annuities indexed to inflation. Therefore, assets which offer guaranteed real returns with minimum risk are required for those institutions to meet their liabilities.

II. Modeling of the Proposed Plan

In the light of uncertainty concerning the level of retirement income, evaluating the feasibility of a transition to these schemes first requires a detailed analysis of the risks involved from the member's point of view. The actuarial model introduced in this section is designed to investigate the possible variation in the retirement income of a member of the proposed money purchase plan. Three different investment strategies were considered to be available to the workers purchasing the plan described below and one thousand simulations were run under each strategy by allowing for stochastic changes in relevant returns to contributions collected and in salary levels of members. Simulation results reported in the next section point to the directions to reform the Turkish social security system.

The money purchase pension scheme we consider is designed to supplement the basic old age security scheme provided by the state which is assumed to cover benefits on death, early retirement, sickness etc. as well. The amount of accumulated contributions up to retirement is used to purchase a whole life indexed annuity (pension) at retirement. The contributions and the investment income of the proposed plan are assumed to be tax-free. Throughout this section we use real currency units adjusted for price inflation. Under these assumptions, the accumulation of contributions can be represented as

$$A_W = CR.(1-E).\left\{SAL_W + \sum_{t=1}^{W-1}\left[\prod_{u=t+1}^{W}(1+R_u)\right]SAL_t\right\}$$

where A_W : total accumulated fund after W years of plan coverage before retirement,

CR : the contribution rate as a percentage of yearly salary;

E : administrative expenses as a fraction of the contributions paid in year t;

SAL_t : the real annual salary paid at the of year t, and

R_t : the real rate of investment return earned in year t.

When the accumulated capital at the end of contribution period, A_W, is invested in a whole life index-linked annuity, the present value of the yearly retirement income that the member will collect by the end of his life is calculated using a constant discount rate of 3% per annum. Mathematically, the annual amount of indexed pension, P, at retirement is defined as

$$P = A_W / \ddot{a}_x$$

where $\ddot{a}_x$ is the actuarial present value of a whole life annuity due of TL 1 payable at the beginning of each year as long as the insured who is currently at the age of x survives and is given by

$$\ddot{a}_x = \sum_{k=0}^{\infty} \frac{{}_k p_x}{(1+d)^k}$$

where ${}_k p_x$ is the probability that an individual aged x will survive for k years, and d is the discount rate (Bowers, *et. al.*, 1986).

In the simulations, ILO (1995) mortality assumptions for Turkey for the year 2020 were used. In particular, with the retirement age, x, taken to be 55, the corresponding actuarial present value term was found to be $\ddot{a}_{55}$ = 15.026 (for male, and at d=3%).[8] Other scheme design assumptions used in simulations are as follows:

- Entry age: 20;

- Retirement age: 55;

- Life type: single male;

- Career pattern: Fully employed before retirement;

- Contribution rate: 8% of each salary;

- Probability of pre-retirement mortality: *nil*;

- Post-retirement mortality: ILO (1995) assumptions for Turkish mortality in 2020;

- Administrative expenses: 15% of the yearly contributions, *nil* after retirement.

Annual changes in the salary of an employee are assumed to be made through adjustments for price inflation and promotional raises and to account for productivity gains. The use of real currency units in our simulations eliminates the need to consider adjustments due to price inflation separately.[9] Promotional salary increases during the working life of an individual are assumed to be 1% a year. The increases to account for productivity gains are captured through the growth in national productivity –assumed to be represented by the growth in GNP per employee, allowing a one-year time lag. This one-year lag is introduced to mimic the role of the previous year's productivity increases on the wage bargaining process between employees and employer. As for employment growth, the annual increases in national employment are assumed to be

constant, for each year over the projection horizon, at 2% which is the average annual growth rate of employment between 1989 and 1998. Based on these assumptions, real salary growth is projected through

$$S_t = g_{t-1} + p$$

where S_t : the rate of change in real salary in year *t*,

g_{t-1} : the rate of real change in real GNP per employee in year *t-1*,

p : promotional salary increase,

To randomize projected salaries, stochastic changes in real GNP are modeled by letting Z_t represent an independently and identically distributed, unit normal random variable and expressing g_t as

$$g_t = \exp\{\sigma Z_t + \mu\} - 1$$

where σ and μ represent the standard deviation and mean of this distribution, respectively. Using historical data between 1924 and 1998, the estimators for the mean and standard deviation were obtained as $\mu = 0.045$ and $\sigma = 0.075$.

For the accumulation of contributions up to retirement, two types of assets were used in the simulations: equities and government bond*s*. The real investment return on Turkish equities, r_t, was calculated using the composite equity index and average dividend yield of the Istanbul Stock Exchange (ISE) over the 1986-1998 period. Estimators for the mean and standard deviation of the force of real equity returns, $\ln(1+r_t)$, were found to be 0.079 for the mean and 0.772 for the standard deviation reflecting the volatile nature of equity returns in Turkey – see, for example, Akdeniz, Salih and Aydogan (2000). As argued by Khorasanee (1995), the estimator for the standard deviation obtained from the historical data is too high for modeling equity returns as a log-normal, identically distributed, independent random variable as in the case of GNP growth. In search of an alternative, we considered the correlation coefficients of the force of real equity returns with its lagged values obtained from the same historical series. Table 1 reports correlation of $\ln(1+r_t)$ and $\ln(1+r_{t-k})$ for $k=\{1,2,3\}$.

TABLE 1–CORRELATION OF THE FORCES OF REAL EQUITY RETURNS

k	***1***	***2***	***3***
Correlation	-0.6601	0.0843	-0.0685

The negative correlation for k=1 and the alteration of signs for k=2 and k=3 suggest that a stationary first order autoregressive stochastic model for the force of real equity returns as described by Wilkie (1995) is suitable here. Following Wilkie (1995), therefore, the force of equity returns is modeled as

$$\ln(1+r) = \mu + \rho\,[\ln(1+r) - \mu\,] + \sigma\,(1-\rho\,)\,Z$$

where r_t : equity return for year t,

μ : mean value of $\ln(1+r_t)$,

σ : standard deviation of $\ln(1+r_t)$,

ρ : correlation coefficient of $\ln(1+r_t)$ and $\ln(1+r_{t-1})$, and

Z_t : Normally distributed unit random variable.

The equation above states that the value of force of return for year t depends on its previous value and a random error term, Z_t, as well as μ, σ and ρ . Using the values reported above, the equation becomes

$$\ln(1+r_t) = 0.079 - 0.660[\ln(1+r_{t-1}) - 0.079\,] + 0.580\ N(0,1)$$

As for the real returns on Turkish government bonds, i_t, the relevant rates were obtained from one year domestic borrowing interest rates series. Estimators for the mean, standard deviation and the correlation coefficients of the force of real bond returns, $\ln(1+i_t)$, with its lagged values were obtained using data for the 1984-1998 period. The mean and standard deviation were found to be 0.027 and 0.075, respectively, whereas the coefficients of correlation between $\ln(1+i_t)$ and $\ln(1+i_{t-k})$ for k={1,2,3} are as in Table 2.

TABLE 2–CORRELATION OF THE FORCES OF REAL BOND RETURNS

k	***1***	***2***	***3***
Correlation	0.465	0.161	-0.104

The positive correlation for k=1 and the rapid decline of the correlation for k=2 and 3 verify that a stationary, autoregressive stochastic model, as used to model equity returns, is suitable here as well (Wilkie, 1995). Given the reported values of estimators of μ, σ and ρ , the force of real Turkish government bond returns can be expressed as

$$\ln(1+i_t) = 0.027 + 0.465[\ln(1+i_{t-1}) - 0.027] + 0.067\ N(0,1)$$

III. Simulation Results

In this section, we present the results from simulation experiments conducted using the stochastic model described above to generate one thousand salary-return pairs and to calculate resulting pension incomes

under each of the four different investment strategies we consider. The discussion is then carried out in reference to statistical properties (such as the mean, standard deviation, and the values corresponding to 5th to 95th percentiles) of this large sample of pension incomes obtained by converting accumulated contributions into annuities at the time of retirement.

The possible variation of retirement income as a percentage of final salary is simulated for three different investment strategies, using the main scheme design assumptions described in Section III. The following investment strategies were considered:

Strategy A represents the option of investing the fund in Turkish equities throughout the employee's period of service (35 years).

Strategy B represents the option of investing the fund in Turkish government bonds throughout the employee's period of service (35 years).

Strategy C represents a balanced investment strategy with 50% of the fund invested in equities and the other 50% invested in government bonds for the whole period of service.

Possible levels of retirement income were obtained from simulations run under each investment strategy. Table 3 below reports retirement incomes expressed as a proportion of final salary (i.e., in the form of so called replacement rates) by strategies and specific percentiles of the resulting distribution of one thousand observations.

TABLE 3 – PENSION INCOME AS A PERCENTAGE OF FINAL SALARY PRIOR TO RETIREMENT

Strategy	*A:100% equities*	*B:100% bonds*	*C:50% equities-50% bonds*
Mean	2.30	0.17	1.08
Std. Deviation	15.60	0.09	3.23
5th Percentile	0.06	0.07	0.10
First Quartile	0.21	0.11	0.18
Second Quartile	0.49	0.14	0.32
Third Quartile	1.28	0.20	0.78

95th Percentile	7.65	0.34	3.67

The results in Table 3 indicate that Strategy *A* that is presumed to be the riskiest strategy provides the most generous retirement income relative to other strategies at all percentiles except for the 5th percentile. The pension income is expected to equal 49% of the final salary with a probability of 50% (see the row for second quartile). While yielding such high replacement rates and hence, retirement incomes, Strategy *A* also generates considerable variation in the retirement income received by individuals, varying between 6% and 765% (7.65 times) of final salary at the 5th and 95th percentiles.

The variability of the retirement income, which is one of the important risks of money purchase scheme, can be reduced by investing in less volatile assets. Investing in government bonds as in Strategy *B*, for example, is observed to clearly reduce the variability of income level. However, the median level of retirement income is also reduced from 49% to 14% of the last work time salary. It is worth noting that the 95th percentile of the low risk Strategy *B* represents a lower income than the 50th percentile (second quartile) of the high risk Strategy *A*.

The balanced investment strategy *C* reduces the variability relative to Strategy *A*, mainly by decreasing the likelihood of receiving a higher income. Yet, this strategy also reduces the possibility of receiving a lower income significantly: Compare 6% to 10%, minimum replacement rates that might result under strategies *A* and *C*, respectively. While Strategy *C* represents a higher retirement income than Strategy *A* under the worst circumstances (at the 5th percentile), it generates a lower income as compared to Strategy *A* for all other percentiles.

The probability that a particular investment strategy provides a higher retirement income than an alternative strategy is given in Table 4 for each strategy.

TABLE 4–PROBABILITY THAT STRATEGY *Y* PROVIDES HIGHER INCOME THAN STRATEGY *Z*

	Z:		
Prob(*Y*>*Z*)	Strategy *A*	Strategy *B*	Strategy *C*
Y:			
Strategy A	-	0.82	0.57
Strategy B	0.18	-	0.20
Strategy C	0.43	0.80	-

As observed in Table 4, investing purely in equities as in *A*, provides a higher retirement income than the alternative strategies *B* and *C* with probabilities of 82% and 57%, respectively. However, investing in low risk assets as in *B* provides a higher income than strategies *A* and *C* with probabilities of only 18% and 20%, respectively. The mixed investment strategy, *C*, has better probabilities than Strategy *B* as investment in equities improves the performance of mixed strategies.

IV. Conclusions

Currently planned introduction of privately managed defined-contribution (or money purchase) retirement plans within the framework of recent social security reform process in Turkey has widely been argued to have a significant potential to affect the direction of further development of financial markets in the coming years. While the likely benefits of the emergence of a market for money purchase pension schemes for the development and deepening of financial markets are widely agreed upon, there has been a severe lack of discussion on the question of whether there really is a potential for such a market to develop in Turkey. This paper aimed to help fill this gap by laying the ground for an evaluation of the prospects for the emergence and growth of a demand for money purchase retirement plans. For this purpose, the paper presented results from an actuarial simulation model developed to analyze employees' investment risks and associated benefits under these retirement plans.

Our results indicate that equities might have significant advantages over government bonds, as investing in equities alone (Strategy *A*) provides the highest median income with a reasonable downside risk compared to other strategies. In return for an 8% contribution rate invested in equities for 35 years, the proposed scheme might produce a pension income of about 50% of the final pre-retirement salary of the employee, with a probability of 50%. The downside risk that is likely to occur with a 5% probability is reasonable relative to other strategies, particularly the strategy *B*: The "worst case" level of pension income to be obtained corresponds to 6% of the final salary, and this is somewhat but not radically lower than 7% of the final salary to be received under the worst case of strategy *B*. To summarize, the employees who are willing to maintain a significant share of equities in their portfolios may collect windfall profits after the introduction of money purchase schemes, provided that the trends of returns to financial assets and GNP growth over the past decade continue. Given the large variation in asset returns, however, it might be wise for employees to demand government guarantees.

Broadly speaking, these results point to a significant role to be played by equity markets in Turkey in attracting workers to money purchase schemes. So, the legislation of the current bill is likely to promote the emergence and growth of a sizeable market for defined-contribution retirement plans to be offered by the private sector. Such a development, if it actually happens, will have significant consequences for Turkey – that go beyond its implications for the volume of transactions in the financial markets or macroeconomic balances of the country. Perhaps most importantly, the pension system to be set up will enable the employees to share in capital income. In the foreseeable future, returns to capital are likely to grow faster than returns to labour in most parts of the world, just as they did in the recent past, and this is even more likely to happen in a fast growing country like Turkey. Giving employees a chance to get their share of this growth in capital income will definitely help improve income distribution in Turkey, thereby contributing to increased welfare and stability in the country.

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NOTES

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Excluding such limited-distribution papers as Teksoz, Akmaz and Kenar (1998) and Teksoz (1999).

[2] See, Sayan and Kenc (1999) for an overlapping generations, general equilibrium investigation of the long-run effects of parametric pension reform in Turkey.

[3] The results in Sayan and Turhan-Sayan (2000) provide evidence that the parametric reform of 1999 is not likely to eliminate the pension deficit which makes up the largest part of social security imbalances.

[4] The letter describes the policies Turkish government plans to implement to secure the Fund's support in the context of the ongoing stabilization (disinflation) and structural adjustment program.

[5] See Kenc and Sayan (2001) for past and projected changes in the age composition of Turkish population and a comparative analysis of demographic transition in Turkey and the EU.

[6] We do not consider individualized pension plans managed by life insurance companies without the involvement of the employer here.

[7] When contributions to the PAYG system are collected through payroll taxes, they distort labor supply decisions and resource allocation, and might affect the competitiveness of the country in international markets. PAYG schemes may also discourage capital formation by reducing the incentives to save, whereas funded systems tend to increase savings and the demand for long-term assets like equities and bonds, thereby stimulating economic growth. See, Kenc and Perraudin (1997) for a dynamic programming simulation of distortionary effects of various pension rules and regulations on labor supply, and Huang, Imrohoroglu and Sargent (1997) for an overlapping generations, general equilibrium analysis of the issues involved in a transition from PAYG to funded schemes. Sayan and Kiraci (2001a) point out that transitional aspects are important even in the context of parametric reform introduced to rehabilitate a PAYG system, and discuss some of the implications of introducing pension reform by gradually changing system parameters over a transitional period, as opposed to changing them once-and-for-all.

[8] $\ddot{a}_{55}$ = 15.026 implies that an individual who would like to collect TL 1 a year as pension income after the

age of 55 until death must have accumulated TL 15.026 in contributions net of administrative costs during his working life.

[9] In adjusting nominal values for consumer price inflation, the "Cost of Living Index for Wage Earners" series published by the Istanbul Chamber of Commerce (ICC) was used, enabling all model results to represent purchasing power of an employee in today's money.