Pension Funds under Investments Constraints: An Assessment of the Opportunity Cost to the Greek Social Security System

Milonas, Nikolaos /T and Papachristou, George and Roupas, Theodor /A

University of Athens, Aristotle University of Thessaloniki, University of Patras

2010

Pension Funds under Investments Constraints:
An Assessment of the Opportunity Cost to the Greek Social Security System

by

Nikolaos T. Milonas
Dept. of Economics, University of Athens, 5 Stadiou Street, 105 62 Athens, Greece
e-mail: nmilonas@econ.uoa.gr

George A. Papachristou
Dept. of Economics, Aristotle University of Thessaloniki, 541 24 Thessaloniki,
Greece
e-mail: gpapahr@econ.auth.gr

Theodore A. Roupas
Dept. of Business Administration, University of Patras, 265 00 Rio, Greece
theod_roupas@yahoo.gr

THIRD DRAFT
April 22, 2009

Pension Funds under Investments Constraints:
An Assessment of the Opportunity Cost to the Greek Social Security System

Abstract

In this paper we study the opportunity loss of the Greek social security system in terms of risk and return, caused by the inflexible investment constraints under which Greek pension funds operated in the period 1958-2000. Using data on pension fund reserves as well as on money and capital market yields, we evaluate retrospectively the risks and returns of a more pro-investment fund reserve management by analyzing an indicative number of investment scenarios in local and international money and capital markets. In order to estimate local currency yields for international investment, we generate for the entire period – covering both a fixed and a partially floating exchange rates regime – a corresponding series of exchange rate variations based on the official rate fluctuations and inflation differentials. Our results suggest that in the 43-year period, there has been a significant opportunity loss in the system both in risk and returns: first, by excluding Greek bank deposits and Greek capital market securities that would have propped returns up at acceptable levels of risk and, second, by not allowing for some degree of international diversification that would have kept overall downside risk down. This opportunity loss could have alleviated, to some extent, the current imbalance of the system, had some of the restrictive investment rules been relaxed.

1**. Introduction**

Equity investment for and financial management of pension fund wealth, especially reserves, has been in the center of social security discussions, proposals and reforms for the last twenty years or so, worldwide as well as in Europe. Because of adverse demographics and a sluggish economy, a majority of governments have taken actions redesigning the system's parameters and liberalizing financial investment. Such actions aimed at restoring actuarial and financial imbalance affecting their social security systems.

The financial debacle of the sub-primes and the economic crisis that followed hit the world economy and impinged upon the issue of pension equity investment in two ways. First, negative growth rates and increasing unemployment has put pension finance under even greater strain and exacerbated their imbalance. Second, negative stock market returns had a drastic effect on affected pension reserves, at least for those funds that had chosen during the past decade to allow for a more pro-equity investment.

Adverse stock market developments have also had the effect of confirming the fears and suspicions of those who had opposed social security reforms in the first place. Paradoxically, the more the authorities were reluctant to liberalization and the longer the consultations between authorities and social groups, the greater the equity loss because of a 'latecomer effect'. Perhaps healthier social security systems could be expected to recover from the current downtrend in income and reserves once their economies begin to grow again and equity losses could be temporarily sustained. The same does not apply to weak and unbalanced systems like the Greek social security system that consecutively resisted serious reforms in terms of eventually matching inflows to outflows.

In what position would the Greek social security be, had it adopted a more pro-equity investment, in the right time and not in the last hour? In what position would it be, if the existent restrictions on pension reserves investment had receded in favor of a regulation allowing for a richer opportunity set? This is in our opinion the appropriate question one has to ask and not rely exclusively on the recent equity losses that are actually being recorded. The reason for addressing this particular question is because the older and stricter investment policy rules were imposed for most of the period since the system's creation and only recently had been abandoned. Even today, after some relaxation of the restrictions, investment in domestic equity, mutual funds and real estate account for a maximum of only 23% of total pension reserves.

The benefits of the system, if it were to allow for a more liberal investment policy on domestic money and capital market, have been recently studied by Milonas, Papachristou and Roupas (2007) who found that the returns to risks ratio would improve significantly, if reserves had been invested freely in the local money market and the Greek stock exchange. Yet, that study fell short of investigating the effect of diversification in foreign markets. The present paper aims to close this gap in the literature and offer policy recommendations regarding financial management in the Greek social security system. In particular, the objective of the present paper is to provide evidence of what would have been achieved by the system, had there been a more flexible investment policy that allowed investments in both local and international markets.

The effect of investing in equity and other riskier assets on the risks and perils of pension fund reserves has been studied by a number of authors [Munnel and Balduzzi (1998), Weller (2000) and the referenced articles therein, and Weller and

4

Wenger (2008)]. Empirical research offered a scientific argument to those who supported financial management liberalization and an increased number of European countries have reformed their social security systems lowering their restriction to equity investment.[1] Pension fund managers and social security systems that followed suit not only have they greatly benefited in the last 15 years from the stock market boom, but they also had time to built up strong capital gains that would help them to deal with the ensuing financial and economic crisis of the late 2000.[2]

Our argument must not be misunderstood. While we argue that risk exposure alone is not a panacea to the pressing structural problems of unreformed security systems, yet we accept that a reasonable risk exposure will mitigate, to some extent, the inefficiencies of the system, by achieving a higher return per unit of risk.

The paper is developed as follows. In Section 2, we describe the present state of the Greek social security system, its basic characteristics, the major reforms implemented so far and rules, regulation, restriction on pension investments as well as the portfolio composition of pension funds in the period 1958-2000. Section 3 provides a description of the data and sources, and the methodology of balanced bootstrapping used in creating annual yields scenarios for the period under study. In Section 4 we discuss the international finance issues in the 1958–2000 period and propose an homogenous measure of exchange rate variation in fixed as well as in floating exchange rates regimes. Empirical results are presented and discussed in Section 5, while summary and concluding comments are presented in a final Section.

---

[1] According to OECD Global Pension Statistics, in 2006 pension fund assets in selected OECD countries were allocated almost 50% of total investments to equities and investment funds such as private equity and hedge funds.
[2] Over the fifteen year period from 1994 and up to October 2008, the average annual pension fund returns for UK, US and Sweden were estimated to be 9.1%, 10.5% and 11.7%, respectively. Source: Pension Markets in Focus, December 2008, Issue 5, p.5, OECD.

2. The Greek Social Security System

All pension schemes irrespective of the mode of operation accumulate surpluses during the first few decades since their inception. Over time, though, pension liabilities mature, demographics might change and growth rates may not be able to sustain the funds needed. In such a case deficits may prevail over surpluses.[3] This is the trend that most, if not all, developed countries are in. Given that this trend will continue in the years to come, increased macroeconomic imbalances are bound to force governments to change the parameters of the social security systems.[4] This is especially true for the Euro zone countries that share the same currency and are required to keep their budget deficits and public debts to minimum set levels. As a result, the European Commission demands reforms in the social security systems so that no additional strains are added to the basic macroeconomic variables. In line to these demands, many European governments have introduced reforms or are in the process of reforming their social security systems.[5] The Greek social security system is one such example, especially because of its unique characteristics. For Greece to become competitive it is imperative that it must change the basic parameters to its social security system to make it viable again.[6]

---

[3] Pension funds, just like any economic entity, are subject to monetary risks. Their outlays increase over time and one thing that should be considered is the preservation of the purchase power of the capital paid as pension stipend.

[4] Barr (2000) recognizes the government as the key principal in reforming the pension system, irrespective of how the latter is run. He also argues that a necessary condition for a successful reform is an effective government.

[5] For example, see Koch and Thimann (1999) for a thorough analysis of needed reform for the Austrian social security system. Disney (2000) analyzed the difficulties run by OECD countries in their pension systems and examined various reform options been suggested. Holzmann et al (2003) presented the reform progress that has been made in European countries. Sakellaropoulos (2003) has presented the social policy issues surrounding the reform in the European pension systems, including the Greek pension system.

[6] A series of reforms in the last two decades in Greece illustrate the difficulty of bringing the Greek model of pension provision in line with the policy goals of the ''European social model'' [see Vlachantoni (2005)].

2.1 The Basic Characteristics of the Greek Social Security System

The Greek social security system was put in service in 1950 as the primary system to provide health and pension stipends to eligible members. The system was designed on a Pay-As-You-Go basis and, as a result, not all inflows were allocated to reserves. Since for the first three or so decades the system was not mature, the inflows surpassed the outflows and there was no pressure on government officials to establish an appropriate base for reserves. Instead, time after time the governments utilized most of the inflows to finance various state projects. The understanding was that the state will accommodate the on-coming deficits of the system when needed.

Besides being insufficient on an actuarial basis, reserves were restricted to certain types of investments, such as, mandatory deposits with the Bank of Greece, demand and time deposits, treasury bills and treasury bonds. With these restrictions the governments secured the financing for their own policies. However, this policy provided sub-optimal yields for the system's reserves. (More on Section 2.3)

Another characteristic of the system is that there were multiple social security providers resulting in complexity, fragmentation of the security coverage, inefficiency and inequalities across secured individuals.[7] According to the 2008 social budget data,[8] there are 50 different main and supplementary pension funds, and 133 organisations of broader social protection under the supervision of 6 Ministries.[9] It is worth noting that despite the approximately 20 main social security funds, 90% of the

---

[7] Sectorial fragmentation, lack of a central executive body and piece-meal supervision of social security organizations prevented the establishment of a common insurance perception, thus giving rise to inequalities among the funds of various trader and professional groups in terms of contributions and benefits (pension amount, one-off allowance, medical care, etc.).

[8] Social Budgets 1970-2008.

[9] The large number of pension funds leads to a high administrative cost. Social security funds employ approx. 1% of the labour force and spend 3% of the GDP annually, when the average social security fund staff expenses in OECD countries is estimated to be half of this amount versus total insurance protection expenses.

insured (4,040,870) and pensioners (2,282,480) in 2008 were covered by 3 funds, i.e. IKA (Social Insurance Institute) 46.3%, OAEE (Self-Employed Insurance Organisation) 14.1% and OGA (Agricultural Insurance Fund) 29.5%. It is only the remaining 10% of the population that is covered by the remaining 17 smaller funds. Note that the state secures all public sector employees through a separate fund.

When measuring pension fund assets per insured individual, an interesting characteristic emerges. There exist two types of pension funds, those with sufficient reserves and those funds with insufficient reserves. Furthermore, the funds with the most assets are not necessarily the funds with the most members. There are pension funds with large reserves that make them viable, despite all social security system inefficiencies. In contrast, there are other funds which will fail to meet their obligations after a month if contributions and grants are discontinued. The banking sector funds are listed among those with the highest reserves per insured member.[10] At the other extreme, IKA is among the funds with the poorest assets per insured, although it covers most of the insured people followed by OAEE, OGA etc. The Fund of Independent Professionals (OAEE) is the third biggest in the country in terms of members (860,000) but the tenth biggest in terms of assets value. The Consolidated Wage Earners' Auxiliary Pension Fund (ETEAM) is the second biggest in terms of members (1,700,000) but 23rd in terms of asset value.

Finally, one common characteristic of all pension fund organizations is the absence of professional asset management. The responsibility of investment decisions rests upon the Board of Directors whose members are various state officials and employee representatives and most of whom are not familiar with money and capital

---

[10] Such discrepancies are the result of better pay for members of rich funds, special taxes levied on the public on behalf of certain funds, generous employer or state contributions to certain funds and widespread tax and contribution evasion in other funds.

markets. The lack of professional asset management is another implicit cost to pension funds that contributed to earning low returns.

2.2 Recent Major Reforms in the Greek Social Security System

Evidence of an imbalance in the Greek pension system appeared as early as in the beginning of the 80's. The major pension organizations had begun facing large deficits growing rapidly in the following years. Deficits were increasing with such a rate that in the beginning of the 90's it was feared that the social security system would collapse.[11] Internal factors (large administrative costs, sub-optimal investments policies) along with external factors (economic growth rate, inflation, demographic developments, unemployment, etc.) had been blamed for the worsening situation in the system.

In 1990-92, when it was widely understood that the system was non-viable, three laws were enacted (Laws 1902/90, 1976/91 and 2084/92) in a considerable effort to curtail deficits and add rationalization to the social security system. The enacted measures addressed to both outflows (by decreasing the salary to pension ratio, changing the salary indexation, applying stricter criteria on benefits, unifying pension rights, etc.) as well as inflows (mainly increase in the contributions, etc.).

The changes resulted in a remarkable primary deficit decrease (30%) at real prices in 1991–93. According to OECD estimates, the total effect of the changes brought by Law 1902/90 amounted to 3 percentage points of the GDP in the first three years of implementation.[12] However, this positive trend was reversed after 1994 to the point that in 1999 the primary deficit approximated the 1989 level at real prices. This

---

[11]The increasing deficits were initially covered through borrowing from banks, later though subsidies were allocated from the ordinary budget.
[12] See OECD (1996).

return to the previous non-viable situation led to another reform on 2002. Law 3029/02 made additional state funding in the system compulsory, changed again the parameters of the system and introduced the second pillar of occupational pension funds. Yet, these changes were only minimal and the problem of social security system reform was put on the agenda immediately after.

In 2008 a new reform (Law 3655/08) took place with mostly administrative content and no immediate economic results since expected benefits were to accrue in the following years and through the gradual implementation of reforms. The new law forced the merging of the 133 existing social security organizations to only 13.[13] Also passed were new measures raising the retirement age, discouraging early retirement and providing incentives to prolong employment. The major aim of this regulatory change was to limit the fragmentation of the insurance system, achieve economies of scale, establish substantial control and supervision; overcome major administrative and organisational difficulties, and cut down on the vast administrative and operating costs.

Regarding the reserves of the merged insurance funds, the new enacted Law 3655/08 provided limited improvement since individual fund assets would remain separate and there would be a relevant independence. However, regarding the management of the reserves, it would be subject to uniform rules, that is, there would be single investment targets but returns on investment would be distributed pro rata to the merged funds. The asset returns that may be achieved by the 13 insurance organisations are estimated to be many times higher than the asset returns that would have been earned from the 133 individual funds.

---

[13] This occurred by merging and integrating into existing social security organisations. For instance, several major insurance funds, such as those of Hellenic Telecommunication Organization, Public Power Corporation, Banks, etc., were integrated into the largest insurance organization, IKA.

2.3 The Role of Fund Reserves, Investment Restrictions and Regulation

The policy adopted in 1950 opted to utilize pension cash reserves and other pension assets to attain general economic and development targets of the country. As a result, pension funds were forced to deposit their reserves with the Bank of Greece at an interest rate defined by the Ministry of Economy.[14] This regulation not only prevented the funds from managing their reserves at their discretion but also led to loss of income, as the rate on these deposits was usually set at very low levels compared to the existing rates on savings and time deposits.[15] In particular, the interest rate on the mandatory deposits at the Bank of Greece was fixed at 4% in the period 1950-1973. In the same period the savings interest rate was 7% - 9% while the consumer price index rose from 5.7% to 27.7%.[16]

It is thus understood that pension funds suffered significant loss of income, which in turn led to the creation of deficits, especially between 1972 and 1990 when there was a vast divergence between the mandatory deposit rate, the savings rate and the price index.

The magnitude of the opportunity loss to the pension reserves from the above investment restrictions can be seen graphically in Figure 1. The yields earned were set much lower compared to rates in savings and time deposits and treasury bills. Mandatory deposit rates were upward adjusted after 1973 but for most of the period

---

[14] The institutional framework forced pension organizations to deposit the largest part of their reserve funds with the Bank of Greece which managed these amount on their behalf. Timid emancipation steps were first taken in 2001. Today new reserve funds can be invested more flexibly (see below in this section). Old reserves are required to be invested under the old restrictive investment constraints.

[15] According to data of the Bank of Greece, the reserves of pension funds had returns much lower that the existent inflation rates over long periods of time. As a result their Net Asset Value had been significantly depreciated.

[16] Roupas (2003), p. 88.

were set again lower than the other rates. Only after 1994 when mandatory deposits were lifted, pension funds earned market rates in the instruments they invested.

Insert Figure 1 here

In Figure 2 there is graphical representation of the portfolio composition of the entire Greek social security pension fund reserves in accommodation of the imposed investment restrictions. For most of the years since the inception of the system mandatory deposits was the predominant portion of pension portfolios. Indeed, mandatory deposits with the Central Bank accounted for more than 75% of total reserves until 1984 leaving little room for bank deposits and even less room for acquiring Greek treasury bills. Investments in treasury bills have gradually increased since 1974 as percent of total reserves with corresponding decrease in mandatory deposits. Treasury bonds became an investment choice since 1987 just before bank deregulation. Equity was allowed in pension portfolios as early as 1975 and up to 10% of total reserves. Yet, equity investments did not materialize prior to 1991. During that year equity entered into pension portfolios slowly and today it makes up pension fund portfolios up to a maximum of 23% of total reserves. It should be mentioned that the 23% category, besides equity, includes investments in any kind of domestic mutual funds. Finally, none of the investments is allowed to be directed in foreign assets or foreign currency.

Insert Figure 2 here

To understand the significance of the opportunity loss imposed on pension funds, it should be stressed here that from 1950 to 1980 the system had not yet entered a maturity stage. As a consequence major reserve amounts had accumulated which had there been used efficiently, they could contribute to the financing of the deficits that had emerged later as a result of the economic crisis, the decrease in economic growth and the deterioration in the dependency ratio.

This policy worked against the interests of the social security system while it provided ample benefits to the Bank of Greece. The latter earned large commissions from pension funds as well as the interest differential set in its favour. Although the Bank of Greece supported all economic policies of the state and provided financing when needed thus producing social benefits, some of the benefits out of pension funds were funnelled to private interests since a number of its shares belong to private shareholders.

3. Data and Methodology

Data on pension funds finance are available from three different sources: the Central Bank, the National Statistical Service and the Ministry of Labor. Central Bank time-series covers the period from 1950 to 2000 for all pension funds and for all types of reserves' investment, with the exception of equity investment; the latter is taken from the Ministry of Labor time-series, starting as late as 1990, since investment in a restricted number of Greek stocks did not occur prior to that date. Data on the US dollar and German mark official exchange rates are stated as local currency units per one unit of foreign currency. Greek, US and German consumer price indices are end of year levels and along with currency rates are retrieved from the International Financial Statistics Website.

Simulated returns are generated by non parametric methods of bootstrapping.[17] A balanced sample of returns scenarios is made possible by selecting each time the first N=43 elements of a NxN vector of randomly permutated histories of returns. This method allows for every historical return to appear with equal probability and guarantees that simulated returns scenarios have mean and standard deviation equal to their sample counterpart.

The same method of balanced bootstrapping was one of the methods used to generate simulated returns in our previous study in Milonas et al. (2007) where international investment opportunities were left out. In order to allow for comparisons between our present results with those of our previous research we re-estimate the risk and return variables both with and without international investment.

Simulated stock return scenarios are plugged into the pension fund's basic accounting identity in order to evaluate the distribution of reserves at some terminal date under alternative investment strategies. These strategies are confined to the strict and constrained investment rules of the pension fund system. The basic accounting identity is defined in equation (1) :

$$V_{t+1} \equiv V_t \left[1 + \sum_i x_t^i r_{t+1}^i \right] + NCF_{t+1} \qquad (1)$$

where:

$V_{t(t+1)}$:   fund reserves at end of period t ($t+1$)

x_t^i :   percentage of total fund reserves invested on asset i at end of period t

r_{t+1}^i :   return on asset i in period $t+1$

NCF_{t+1} :   net cash flow of the fund in period $t+1$

---

[17] See Efron and Tibshirani (1993)

Allowing for different weights to be invested on assets i, we can come up with an alternative investment strategy $[\bar{x}_t^i]$ that will start at t=0 with the same original fund reserves and endowed with the respective net cash flows in every period as in the basic case. Asset weights are changed according to some defined scenarios and introduce the missing investment flexibility to the pension fund system. This alternative strategy that allows for the time evolution of fund reserves is given by equation (2):

$$\bar{V}_{t+1} \equiv \bar{V}_t \left[1 + \sum_i \bar{x}_t^i r_{t+1}^i \right] + NCF_{t+1} \tag{2}$$

with $\bar{V}_0 = V_0$

The original series of pension reserves, $[V_t]_{t=1,\dots,T}$, the original investment vector of weights in each asset i, $[x_t^i] \begin{subarray}{l} i=1,\dots,N \\ t=1,\dots,T \end{subarray}$, the return vector on all investments except stock and foreign currency investment, $[r_t^i] \begin{subarray}{l} i \neq s \\ t=1,\dots,T \end{subarray}$, the simulated stock and foreign currency return series $[r_t^s]_{t=1,\dots,T}$ and the alternative investment strategy vector, $[\bar{x}]$, under consideration were used to evaluate recursively the final value of reserves at terminal date T. We measure the effect of each alternative investment strategy as the average percentage difference of simulated over actual terminal value, i.e. $E(\Delta \bar{V}_T)/V_T$. We also measure the downside risk as the probability that the fund's simulated reserves might be equal to or lower than actual reserves, i.e. $\Pr(\bar{V}_T \leq V_T) = p$.

To get a better handling of risk, we calculate two *Value at Risk* measures at standard confidence levels[18] 95% and 99% defined as percentage differences of the

---

[18] The first measure is used in Riskmetrics of J.P.Morgan and the second measure is the Basel Committee rule [Jorion (2001, p.121)].

corresponding percentile reserves over actual terminal reserves, i.e., $\Delta \overline{V}_T^c / V_T$ where $\overline{V}_T^c$ such that $\Pr(\overline{V}_T \leq \overline{V}_T^c) = 1 - c$. The two *VaR* measures correspond to a required level of minimum reserves[19] as a protection against adverse stock market conditions. We also calculate a measure called *Beyond Value at Risk*[20], i.e. $\Delta \overline{V}_T^b / V_T$ where $\overline{V}_T^b$ is equal to the conditional expectation $E(\overline{V}_T \mid \overline{V}_T \leq \overline{V}_T^c)$. This VaR measure is appropriate for fat tailed return distributions.[21]

4. International Investment Yields under Fixed and Floating Rates Regimes

Technical rules imposed on Greek pension funds limited investment choices to mandatory and demand deposits, treasury bills and bonds and to a small extent to equity. The constrained choices are more severe since reserves could be invested only in domestic assets excluding deposits in foreign assets. In this section we describe the methodology being followed to reserves deposited in foreign treasury bonds to overcome the problem of a mixed exchange rate regime throughout the sample period.

Investing in international capital markets may improve pension fund finance in terms of higher returns and risk reducing diversification. However, international diversification of fund reserves introduces additional sources of risk, foreign exchange risk and sovereign-political risk. Although it is not impossible to limit the exposure to the latter by selecting stable and well developed capital markets, the former type of risk has always been a concern to the international investor. Multiple currencies instead of single currency investment may alleviate the exchange risk exposure of pension fund reserves.

---

[19] According to Jorion (2001, p. 384-5) this is the equivalent to "economic capital."
[20] Also known as Conditional Value at Risk or Mean Shortfall
[21] See Artzner et al. (1999)

In assessing the effect of introducing some degree of international diversification into Greek pension funds investment, it is necessary to take into account both the inception and the elimination of a number of exchange rates regimes. For example, during the 1950's and 1960's, a period when fund reserves were building up due to favorable Social Security demographics, the Greek foreign exchange market operated under a firm set of trade barriers and capital mobility restrictions and the Greek drachma to US dollar rate did not move at all in accordance to the country's commitments to the Breton-Woods agreements. However, during this period a parallel or 'black' market was usually created by those traders and investors trying to circumvent exchange market rulings.

On the other hand, an equally important part of our sample refers to the period following the act of the US to unilaterally revoke the dollar to gold conversion and the subsequent introduction of a floating exchange rates regime in 1973. Although some countries left their currencies float freely many others including Greece preserved their trade and capital mobility restrictions so that their official exchange rate variations serve their economic targets of growth, balance of payment and employment. The regime of free nonetheless pegged float was followed by a series of attempts to attain exchange rate stability in Europe by setting price limits around a fixed central parity, by gradually reducing those limits and by providing for the operation of European exchange rate intervention mechanism. Despite the currency stability sought this period exhibited important exchange rate variation either in terms of depreciation or appreciation, i.e. movements around central parity and within price limits, or in terms of devaluation or re-evaluation of the central parity itself.

Within this period under investigation with a mixture of exchange rate regimes there is one methodological question issue that arises: How one could backtest the

risk and returns of international investment as if exchange rates were moving freely when in fact were not, using variables that overcome this problem. In other words, how could one introduce currency variation in local currency returns of the international investment, when exchange rate were fixed for some period or supported by market restrictions over almost the entire period? In order to respond to this requirement, we undertake the task to re-construct the series of exchange rates that would prevail in free floating in order to restore external equilibrium conditional on the selection of an appropriate model of exchange rate determination.

Kouretas & Zarangas (1998) propose a solution to the similar, in our opinion, problem of explaining the variation of the parallel or 'black market' exchange rate, e_{pt}, as opposed to the official rate, e_{ot}, during periods of varying degrees of market restrictions. In setting up their model they assume two types of international arbitrageurs: financial arbitrageurs whose excess demand for foreign currency is equal to $k \cdot (e_{pt} - e_{ot})$ where k is their elasticity of currency demand, and goods arbitrageurs whose corresponding excess demand is equal to $\lambda \cdot (e_{pt} - PPP_t)$ where λ is the corresponding elasticity of currency demand, $PPP_t \equiv P_t - P_t^*$ the purchasing power parity (all variables are expressed in logarithms), and P(P*) is the domestic (foreign) price level. Taking differences we come up with the "true" variation of the exchange rate which is not other than the variation of the parallel market rate assuming unitary elasticities of demand and zero aggregate excess demand for currency:

$$\Delta e_{true} = \Delta e_o + (\pi - \pi^*) \tag{3}$$

where the last term denotes the inflation differential between home and abroad.

Following the aforementioned strategy we calculate a series of "true" exchange rate annual variations for the US dollar and the German mark. Official exchange rates are stated as local currency units per one unit of foreign currency and inflation differentials are based on the corresponding variation of consumer price indices, home and foreign. Original series are end of year levels retrieved from the International Financial Statistics Website and 'true' variation is expressed in percentage rates.

Time series variation of the 'true' US dollar rate (denoted DR/USD) and the German mark (denoted DR/DM) against the Greek drachma are depicted in Figure 3.

Insert Figure 3 here

Inspection of Figure 3 reveals the drastic devaluation of the drachma in 1950 and 1953, the depreciation that followed the Breton-Woods agreements debacle in 1973, the 1983 devaluation by the Papandreou government, and the two less dramatic currency crises of 1992 and 1997.

Local currency yields in US and German Treasury bonds are defined as:

$$Y_{USD}^{DR} = Y_{USD}^{DR} + \Delta e_{USD} \quad \text{and} \quad Y_{DM}^{DR} = Y_{DM}^{DR} + \Delta e_{DM}$$

where exchange rate variations are defined on the basis of the "true" rates.

Local currency yields in US and German Treasury bonds are depicted in Figure 4. Inspection of Figure 4 shows the high inflation, high interest and weak currency 1980's, the currency crises of 1992 and 1997. The yield on the Greek 12-month Treasury bill is included for the sake of comparison.

Insert Figure 4 here

19

5. Empirical Results

In this Section we present the risk and return of a number of alternative investment strategies that depart from the 'mandatory and demand deposits only' restriction imposed on the pension funds decision-makers during the larger part of the period under study.

In Table 1 we present the results for a 'stocks only' strategy. Historical 'mandatory and demand deposits' portfolios are replaced by a portfolio of $x\%$ riskless placements (equally divided in savings and time deposits with Greek banks and Greek Treasury bills and bonds) and a risky component (Greek equity) of $1-x\%$. Columns 2-6 refer to an equity component of $1-x\%$ from 0 to 40%. For example, the 9X1 investment vector of a 10% 'stocks only' strategy would be:

[0   0   0.225   0.225   0.225   0.225   0.10   0   0]'

where the first two zeros refer to the absence of a mandatory and demand deposit component, the next four 22.5% weights refer to a 90% riskless portfolio equally divided in two types of Bank deposits and two types of Treasury securities, the 10% weight is the Greek equity component, while the last two zeros indicate the absence of foreign currency in the pension fund's portfolio.

In Table 2 we present the results for a 'stocks and currency' strategy where historical 'mandatory and demand deposits' portfolios are replaced by a portfolio consisting of $x\%$ riskless portfolio, same as above, and a risky component of $1-x\%$ equally split between Greek equity and foreign currency (half in US Treasury bonds and half in German Treasury bonds). Columns 2-6 refer to a risky component of $1-x\%$ from 0 to 40%. This time, for example, the 9x1 investment vector of a 40% 'stocks and currency' strategy would be:

[0   0   0.15   0.15   0.15   0.15   0.20   0.10   0.10]'

where the first two zeros indicate again no mandatory or sight deposit component, the next four 15.0% weights refer to a 60% riskless portfolio equally divided again in two types of Bank deposits and two types of Treasury securities, the 20% weight is the Greek equity component, while the last two 10% weights indicate the percentage investment in foreign currency placed in US and German Treasury bonds. Investment weights in Greek equity and in the two foreign bonds sum to a 40% risky component.

Tables 1 and 2 reveal the stabilizing effect of international diversification in terms of probability and downside risk which, however, comes at a cost through an inferior return on pension reserves. In fact 'stocks only' strategies dominate (Table 1, line 1), at all levels of stock, 'stocks and currency' strategies (Table 2, line 1). On the other hand, 'stocks and currency' strategies dominate 'stocks only' strategies with respect to each and every measure of downside risk (Tables 1 and 2 lines 2 to 6), again at all level of stock.

Table 1: Risk and return on pension reserves (1958 - 2000) stocks only [1]					
stock %	0	0,10	0,20	0,30	0,40
Effect [2]	0,0543	0,1963	0,3771	0,6122	0,9345
Risk [3]		0,0288	0,0602	0,0848	0,0890
VaR.1 [4]		-0,0264	-0,0914	-0,1676	-0,2272
VaR.5 [4]		0,0173	-0,0135	-0,0534	-0,0857
bVaR.1 [5]		-0,0450	-0,1279	-0,2119	-0,2818
bVaR.5 [5]		-0,0095	-0,0633	-0,1259	-0,1723

Source: International Financial Statistics Website and our calculations

Notes:
[1] Stock returns are generated with the balanced bootstrap method described in the methodology section
[2] Simulated minus actual terminal reserves (%)
[3] Probability of simulated wealth falling below actual terminal reserves
[4] *VaR* at confidence levels of 99% and 95% over actual terminal reserves (%)
[5] Conditional *VaR* at 99% and 95% over actual terminal reserves (%)

Table 2: Risk and return on pension reserves (1958-2000) stocks & currency [1]

stock % &	currency	0,10	0,20	0,30	0,40
Effect [2]		0,1669	0,3003	0,4771	0,6947
Risk [3]		0	0,0012	0,0028	0,0034
VaR.1 [4]		0,0513	0,0575	0,0458	0,0540
VaR.5 [4]		0,0777	0,1031	0,1284	0,1664
bVaR.1 [5]		0,0413	0,0318	0,0111	0,0115
bVaR.5 [5]		0,0620	0,0734	0,0782	0,0995

Source: International Financial Statistics Website and our calculations

Notes:
[1] Stock returns are generated with the balanced bootstrap method described in the methodology section
[2] Simulated minus actual terminal reserves (%)
[3] Probability of simulated wealth falling below actual terminal reserves [4] VaR at confidence levels of 99% and 95% over actual terminal reserves (%)
[5] Conditional VaR at 99% and 95% over actual terminal reserves (%)

To examine further the risk return trade-off between 'stocks only' and 'stocks and currency' strategies, we construct Figures 5 and 6 for the 10% and 40% weight on stocks, respectively.

Insert Figure 5 here

Modes both in the 10% and almost probably in the 40% 'stocks only' distribution of returns dominate those of 'stocks and currency' corresponding strategies, indicating that, on the average, the first strategy offers a higher return vis-à-vis the second strategy. However, over the range of low or negative returns 10% and 40% 'stocks and currency' strategies are dominated by the distribution of 'stocks only' corresponding strategies. The graphical evidence provided by Figures 5 and 6 indicates that substituting foreign currency for stocks in the risky portfolio of a pension fund's reserves, would drastically reduce the fund's downside risk and would

consequently end up in a positive terminal excess return, maybe not maximal but definitely less volatile with respect to alternative investment strategies.

Insert Figure 6 here

6. Summary and Conclusions

In this paper we analyzed the Greek social security system to study the potential loss to it caused by the restrictive investment policy imposed on pension funds. The paper builds on the work of Milonas et al. (2006) and examines the effect of relaxing the investment restriction on the level of terminal reserves and the associated risk assuming that pension funds had the flexibility to invest not only in fixed investments but in equities as well as in foreign bonds.

The results of the paper signify the beneficial role of more diversified investments on the level of risk of reserves. Directing only 10% of reserves into equity investment enhances terminal reserves by 19.6%. This enhancement increases to 37.7%, 61.2%, and 93.5% of reserves when equity investment makes up 20%, 30%, and 40% of the reserves, respectively. As expected, this significant value enhancement in reserves comes with some risk which, however, remains at low and reasonable levels.

Furthermore, when reserves, besides equity, can be directed in foreign bonds as well, there is a great reduction in the risk to minimal levels even in the most risky case considered, that is, 40% of reserves equally allocated to Greek equities and foreign bonds.

In line to our expectations, the reduction of risk in reserves when part of the risky investment is allocated to foreign bonds is accompanied with lower value

enhancement to reserves compared with the strategy when stocks were the only risky element in the portfolio. Yet, our results illustrate that investment in foreign currency act as a limiting force to downside risk while adding significant value enhancement to reserves.

The results of the paper help us identify the magnitude of the opportunity cost to pension funds reserves when investment rules confines pension investments to domestic assets only and minimum exposure to equity investment.. Up to the adoption of euro in 2001, Greece used the drachma, a weak currency, and investing abroad would act as a hedge against repeated drachma devaluations, as our results imply. Nowadays, in the presence of globalization and in the case of Greece which shares the same currency with other Eurozone countries, it seems odd to prohibit pension funds from placing reserves into foreign assets in an era where, at the other extreme, other pension funds are allowed to invest only in foreign assets.[22] Furthermore, the results of the paper provide policy recommendation to country officials to shift investment rules to more flexible investment policy that recognizes the need to enhance return while getting the benefits of diversification. Such a policy shift is easier to be implemented compared to the needed reform on the pension fund system. In addition, because pension fund reserves are inadequate and the system is not viable yet, relaxing the investment constraints will give additional support to the system until the needed reforms are put to work.

---

[22] This is the case with the Norwegian Public Pension Fund. Source: Pension Funds in Focus, November issue 2007.

References

Artzner, P., F. Delbaen, J-M. Eber and D. Heath. 1999. Coherent Measures of Risk, *Mathematical Finance*, 9: 203-228.

Barr, N. 2000. Reforming Pensions: Myths, Truths, and Policy Choices. IMF Working Paper #139.

Disney, R. 2000. Crises in Public Pension Programmes in OECD: What are the Reform Options. *The Economic Journal*, 110: 1-23.

Efron, B. and R.J. Tibshirani. 1993. *An Introduction to the Bootstrap,* Chapman and Hall, New York.

Holzmann, R., L. MacKellar and M. Rutlowski. 2003. Accelerating the European Reform Agenda: Need, Progress and Conceptual Underpinnings. In *Pension Reforms in Europe: Process and Progress,* Ed. R. Holzmann, M. Orenstein and M. Rutlowski, 1-46, IBRD/World Bank, Washington D.C.

Jorion, P. 2001. *Value at Risk: The New Benchmark for Controlling Market Risk,* 2^{d} Edition, McGraw-Hill.

Koch, M. and Thimann. 1999. From Generosity to Sustainability: The Austrian Pension System and Options for its Reform. *Empirica* 26: 21-38.

Kouretas, G.P, and I.P. Zarangas. 1998. A cointegration analysis of the official and parallel foreign exchange markets for dollars in Greece. *International Journal of Finance and Economics* 3: 261-276.

Milonas, N.T., G. Papachristou and T. Roupas. 2007. Fund Management and its Effect in the Greek Social Security System. *Journal of Pension Economics and Finance*, 16 Nov 2007: 1-16. doi:10.1017/S1474747207002855.

Munnell, A. and P. Balduzzi. 1998. *Investing the Social Security Trust Funds in Equitie.* American Association of Retired Persons/Public Policy Institute.

OECD. 1996. Ageing in OECD Countries: A Critical Policy Challenge. Social Policy Studies No. 20, Paris.

Roupas, T. 2003. *The Greek Social Security System: Administration, Organization and Investment Management*, Ph.D. Dissertation Thesis, Department of Economics, University of Athens (in Greek).

Sakellaropoulos, T. 2003. *Social Policy Issues*, Vol. A, Dionikos Publishers. Athens.

Social Budgets, 1970-2008, Greek Ministry of Labour, Athens (in Greek).

Vlachantoni A. 2005. The Governance of Social Policy in the New Europe. ESPAnet Young Researchers Workshop, University of Bath, U.K, April 1-2.

Weller, C.E. 2000. Risky Business? Evaluating Market Risk of Equity Investment Proposals to Reform Social Security. *Journal of Policy Analysis and Management* 19: 263-273.

Weller, C.E. and J.B. Wenger. 2008. Prudent investors: the asset allocation of public pension plans. *Journal of Pension Economics and Finance*, doi: 10.1017/S1474747 20800396X.

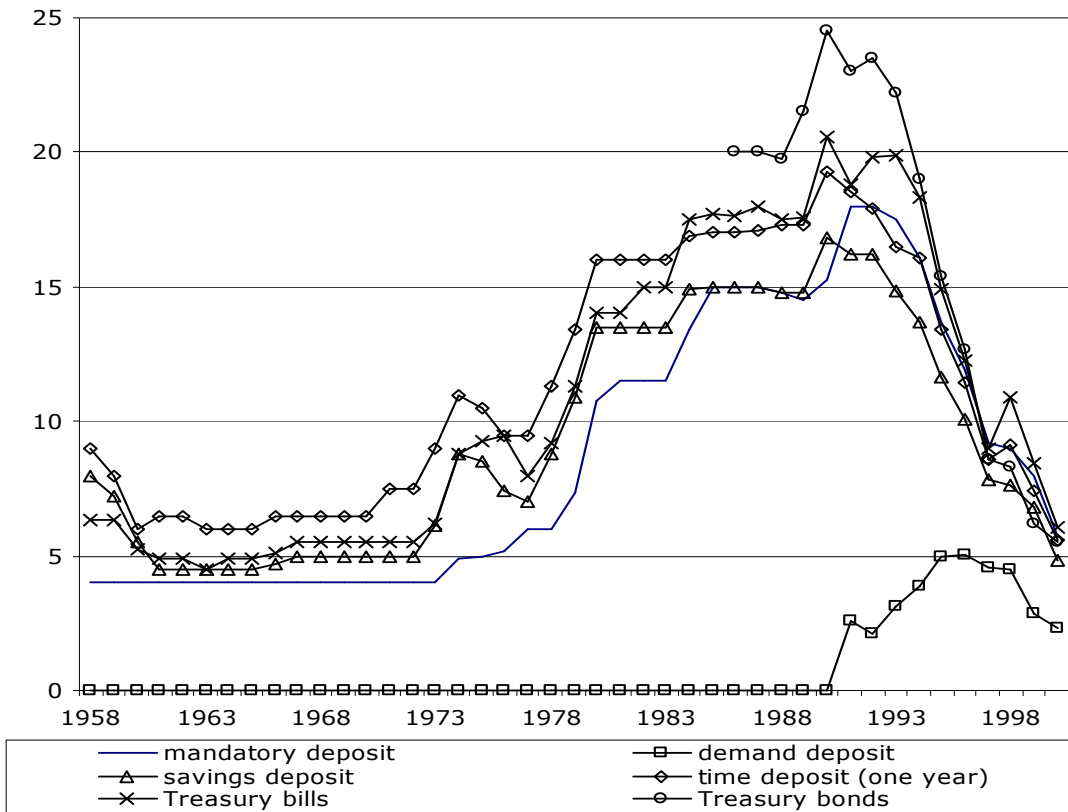Figure 1: Yields on Greek bank deposits and securities, 1958-2000

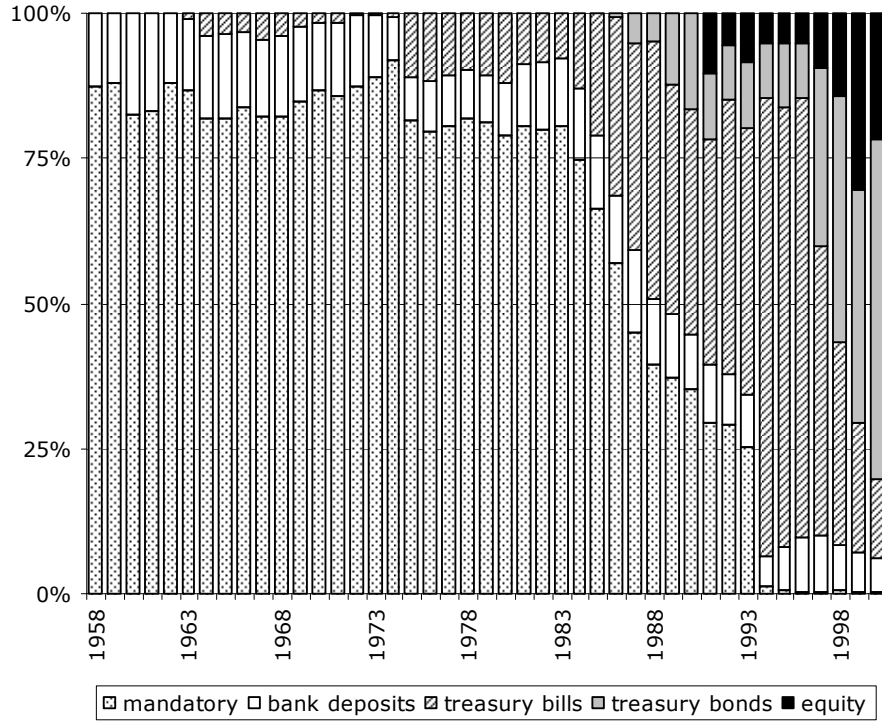Figure 2: Portfolio composition of Greek pension reserves, 1958-2000

Figure 3: 'True' exchange rate variations of US Dollar and German Mark, 1958-2000
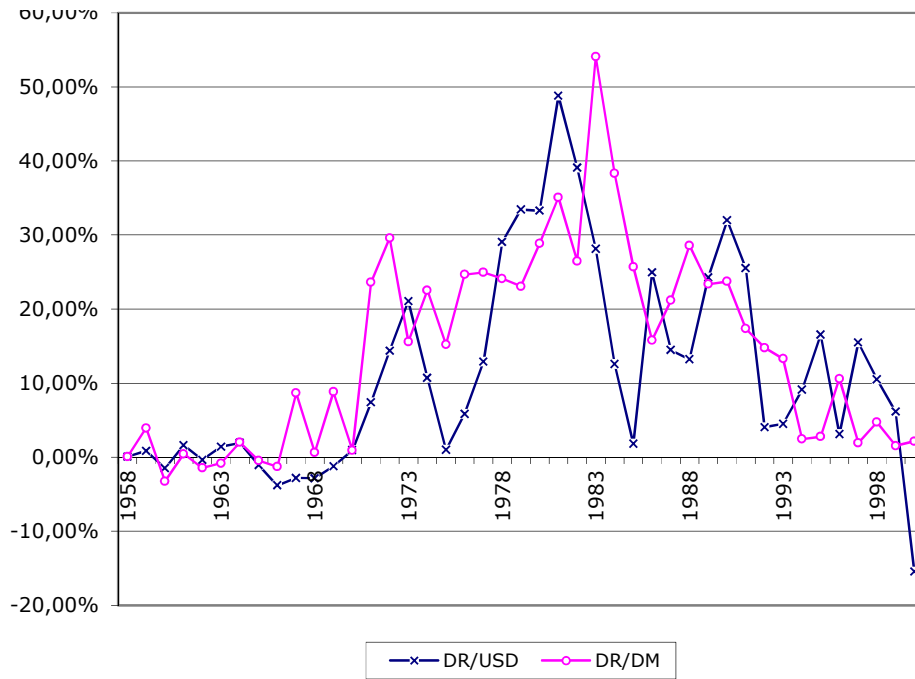
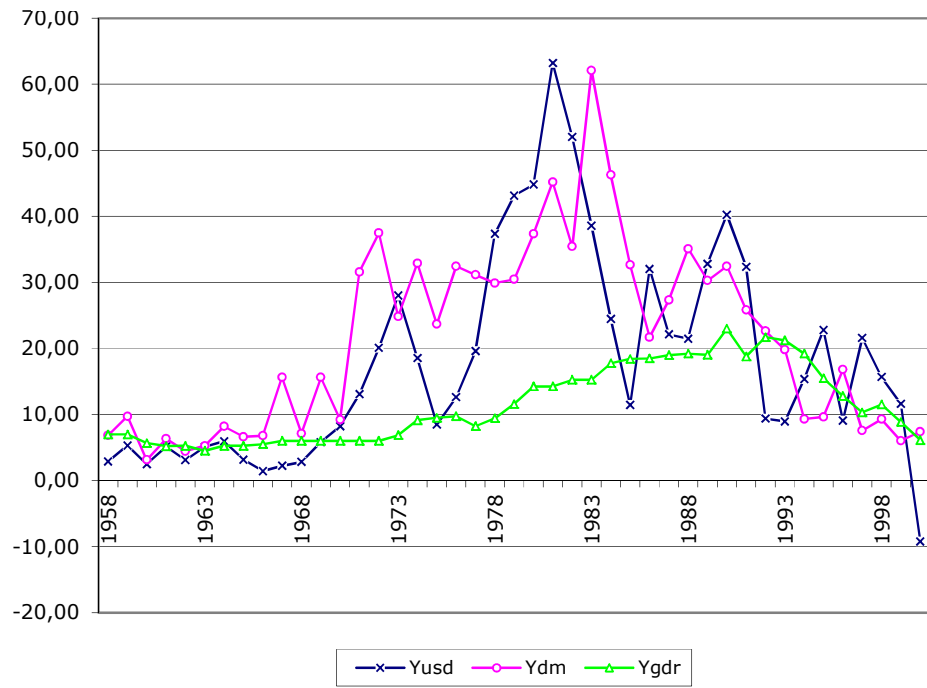Figure 4: Local currency yields of US and German Treasury bonds, 1958-2000

Figure 5: Distribution of reserves excess return (10% risky assets), 1958-2000
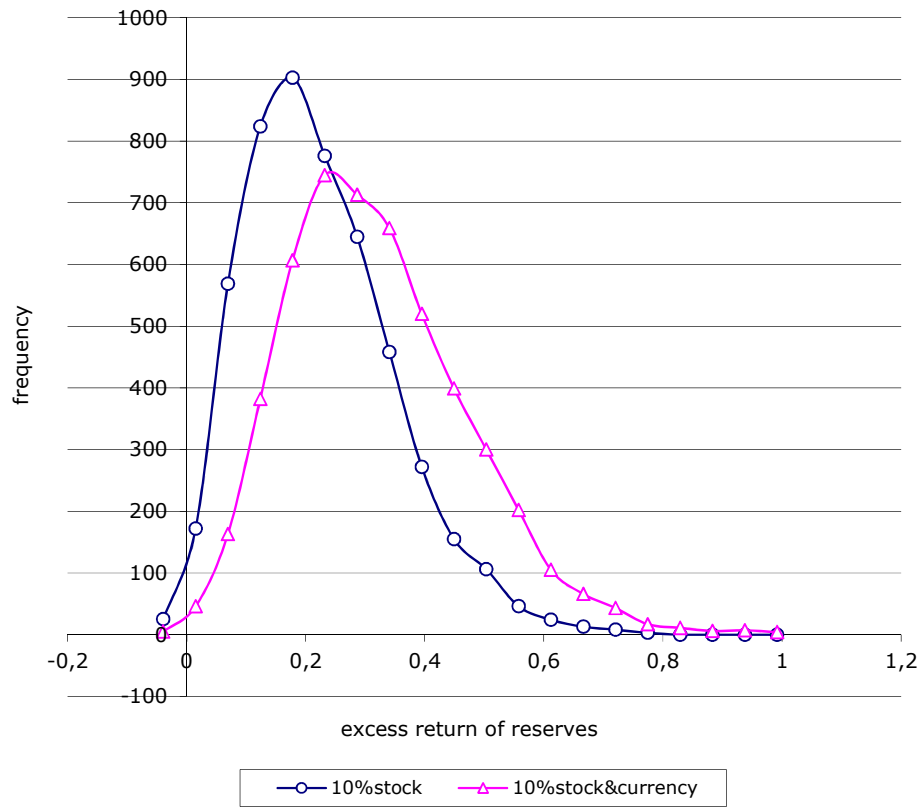
Figure 6: Distribution of reserves excess return (40% risky assets), 1958-2000