

**MASTER IN
FINANCE**

**MASTER'S FINAL WORK
DISSERTATION**

**THE ROLE OF PENSION RESERVE FUNDS IN PAY-AS-YOU-GO
PENSION SCHEMES FINANCIAL SUSTAINABILITY**

JOANA CRISTINA DOS SANTOS PATRÍCIO

OCTOBER - 2016

**MASTER IN
FINANCE**

**MASTER'S FINAL WORK
DISSERTATION**

**THE ROLE OF PENSION RESERVE FUNDS IN PAY-AS-YOU-GO
PENSION SCHEMES FINANCIAL SUSTAINABILITY**

JOANA CRISTINA DOS SANTOS PATRÍCIO

SUPERVISION:

MARIA TERESA MEDEIROS GARCIA

OCTOBER - 2016

Abstract

The present study aims to analyze the strategy followed by the Portuguese financial stabilization fund (FEFSS), along with investigating what would the situation be if a greater volume of transfers would have been performed or applied in alternative investments.

In the first place, the study investigates the substantial literature related to the importance of pension reserve funds in the financial sustainability of the pay-as-you-go systems, as well as the influence of its management on reaching this goal.

In order to proceed to the analysis of the performance of the Portuguese case, two different policies of stable transfers to the fund are contemplated. The simulation of the value of the fund coming from the application of these policies is then used to apply three different strategies of asset allocation. Two different time-frames are taken into account to perform the study: from 1989 to 2014 and from 1997 to 2014.

The final results show that the proposed investment strategies increase the value of the portfolio, allowing to fulfill between the years of 2010 and 2012 the goal set by law: covering two years of pension needs. Thus, applying the strategies considered would increase the contribution of the fund to the financial sustainability of the pay-as-you-go system.

Keywords: Public Pension Reserve Funds, FEFSS, Social Security

Acknowledgments

The Master thesis stands as a turning point in my journey, and I would like to thank all who participated on this path.

I would like to thank Professor Maria Teresa Medeiros Garcia for the help on deciding the field of study and the correct way to follow, as well as for her useful suggestions that helped improving my work.

Finally, I would like to thank my family and friends for all their support and motivation on this journey. A particular thank you to my parents and my sister, who are always there and without whom this would not be possible.

Table of Contents

1. Introduction	1
2. The role of public pension reserve funds in social security	4
2.1 The creation of public pension reserve funds	4
2.1.1. The example of FEFSS	5
2.2 Management of public pension reserve funds	10
2.3 The funding and performance of public pension reserve funds	11
2.4 Evidence from public pension reserve funds across the world	16
3. Simulation of the value of the fund	22
3.1 Selection of data and time frame	23
3.2 Selection of rates	24
3.3 Models	26
4. Results and Analysis	28
5. Conclusions, Limitations and Further Investigations	32
5.1 Conclusios	32
5.2 Limitations and Further Investigations	33
6. References	344
7. Appendix	400

Index of Figures

Figure 1 - Pensioners per active population in %	8
Figure 2 - Social security pensions: total and per type expenses in million euros	9
Figure 3 - Evolution of the total funding of the FEFSS in million euros	12
Figure 4 - FEFSS nominal and real rates of return.....	13
Figure 5 - Evolution FEFSS applying Model 1 vs Real Value in million euros	29
Figure 6 - Evolution FEFSS applying Model 2 vs Real Value in million euros	30
Figure 7 - Evolution FEFSS applying Model 3 vs Real Value in million euros	31

Index of Tables

Table I - FEFSS Portfolio Distribution.....	15
Table II - Public Pension Reserve Funds in Selected OECD Countries (2014).....	17
Table III - Nominal/Real Rates of Returns of PPRF in Selected OECD Countries (2014).....	19
Table IV - Model's Output (in euros).....	28

Index of Appendix

Appendix 1 - Synthetic Fertility Index.....	400
Appendix 2 - Active Population per Pensioner	411
Appendix 3 - Average year pension of the Social Security System	422
Appendix 4 - Total Amount Received from the FEFSS.....	433

Acronyms

FEFSS – *Fundo de Estabilização da Segurança Social*

GPIF – Government Pension Investment Fund

IGFSS – *Instituto de Gestão de Fundos de Capitalização da Segurança Social*

OECD – Organization for Economic Co-Operation and Development

PAYG – Pay-as-you-go

SPRF - Sovereign Pension Reserve Funds

SSRF - Social Security Reserve Funds

1. Introduction

Portuguese social security system lays on protecting workers and their families when in situations of lack of job, unavoidable unemployment and lack of capacity to work, death and privation of enough means to survive, as stated in Law 28/84¹. A system of pay-as-you-go (PAYG) was first established between two groups, the one currently working and the one currently receiving (Hemming, 1998). In this system, the goal of reducing old-age poverty is reached by using the benefits coming from contributors, while preventing costs of pensions from erasing (OECD, 2013; Silva, Calado & Garcia, 2004). Financial sustainability has increased over the last years, mainly due to measures such as increasing the retirement age, decreasing options for early retirement, changing the way benefits are calculated, and the creation of reserve funds (Garcia, 2004; OECD, 2015a).

The establishment of partially prefunded systems by setting up or developing public pension reserve funds is a strategy followed by many countries, being the ultimate owner the government (Yermo, 2008). Considerable literature supports that the good performance of public pension reserve funds depends on their management, as across different reserve funds it is common to denote political interference as a common trigger for poor returns (Iglesias & Palacios, 2000; Impavido, 2002; Garcia, 2004; Palacios, 2002; Vittas, Impavido & O'Connor, 2008; Yermo, 2008), thus a good governance policy is needed, and a path to the elimination of political influence has to be covered.

The Portuguese situation is one useful example to study how the creation of a public reserve fund came to improve social security's financial sustainability in the long term and how it can avoid structural problems emerging from the demographical, economic

¹ Lei n.º. 28/84 de 14 de Agosto

and political challenges we face today. The creation of the reserve fund will therefore be considered, taking into account its past performance and expectations for the future, as so as the way it is managed and how this can affect future outcomes. Other countries experience is also important to take into account, in order to understand the worldwide most common practices of management and how these different funds perform (Impavido, 2002; Palacios, 2002; Yermo, 2008) .

Considering that different management options are available for public pension reserve funds, the current situation of the Portuguese pension reserve fund is questioned by the application of different scenarios. The goal of this work will be applying this different scenarios and simulate what the value of the portfolio would be if the amount transferred to the fund each year would have been different, and if this amount would have been applied in a different portfolio. The simulations performed in this work led us to believe that the system could have now a much greater stability, if it had been fortified sooner with greater amounts transferred into the fund and if the strategy of investment would have been different simultaneously. Thus, the contribution of this study lays in analysing different funding possibilities for the Portuguese pension reserve fund and identifying which investment allocation strategies would have been more successful. Further investigation is also important to be made, considering a wider range of asset allocation possibilities and the application of the simulation to future values.

The work is divided in the following sections: Chapter 2 explains the need to create public pension reserve funds to strengthen social security, giving the example of FEFSS² in a first moment, and being followed by a study of the importance of good management

² *Fundo de Estabilização Financeira da Segurança Social*

principles. In the same chapter, the performance and funding of public pension reserve funds is analysed, giving once more the example of FEFSS and strengthening the analysis with evidence from a selected group of OECD countries. Chapter 3 explains the simulation to be performed, how the data was selected, the scenarios to be considered, and the models that are going to be applied. The outputs are also considered in this chapter, and an analysis of them is made. Chapter 5 explains the main conclusions of the work performed, as well as the limitations and the possible future works to be performed in order to enlarge the understanding of the topic.

2. The role of public pension reserve funds in social security

2.1 The creation of public pension reserve funds

The PAYG allows to receive benefits in a more punctual way, not having to wait for a whole generation to produce them and accumulate (Hemming, 1998). Laibson, Repetto & Tobacman (1998) also suggest that a mandatory system like PAYG allows to prevent myopic behaviour from individuals, as the majority of people follow instantaneous gratification not saving for the future. At the beginning of the establishment of this system there is an equilibrium, as the population is young and the system is immature allowing for the benefits of the system to excel, the first generation of the PAYG is favoured with low costs and large positive transfers, receiving money they did not saved in previous times (Moffitt, 1984; Hemming, 1998). The downside of PAYG emerges when there is a maturation of the system, where the following generations are negatively affected by the loss of what could have been possible life savings, by an increase of contribution rates, to insure higher benefits, and by more incentives to evade, as early retirement and high benefit rates (Cooley & Soares, 1999; The World Bank, 1994). Feldstein (1974) shows that in such a system there can be a reduction of savings from 30 to 50 per cent due to lack of incentives to save. Research done by Ehrlich & Kim (2005) went further, by studying 57 countries in the period of 1960 to 1992, and found that the PAYG system has an impact in lowering fertility rates worldwide, in addition to decreasing private savings and economic growth. Nonetheless, there is some controversy about this topic, as more studies were done where the historical evidence did not support the hypothesis of social security reducing private savings (Lesnoy & Leimer, 1985).

In the last decades, the problems of the system coming to its maturation were intensified by a disequilibrium between the population currently contributing and the

population currently dependable, due to the low fertility rate that is not sufficient to replace the current contributing population, and the increasing life expectancy leading to a higher need for resources (Bloom, Boersch-Supan, McGee & Seike, 2011; Garcia, 2005). The increase of the financial difficulties of the PAYG system has intensified the interest on alternative programmes that might pass through funding pensions as a complement to PAYG systems, along with a development of an insurance business, helping the system to meet its redistributive objectives and financial solvency (Vittas, 1995). Moreover, the evolution of pension systems across the world and the increasing believes that an alternative to the PAYG would be needed came to give a great importance to partially prefunded systems, in which the government creates reserve funds guaranteeing partially the financial sustainability of the pension systems in a short time range (Yermo, 2008). Furthermore, the World Bank (1994) gives as a recommendation the existence of a system composed by one public managed PAYG pillar and a private managed and fully funded one, reinforced with a voluntary pillar to give additional protection if wanted by the contributor. The European Commission (2010), on its turn, recommends adapting each system and future reform to the economy, demography and society of the country in question, combining therefore adequacy with sustainability.

2.1.1. The example of FEFSS

In Portugal a system of three pillars exists. The first pillar is based on the solidarity principle, with a universal based regime and is mandatory for all private, public, and self-employed workers. The second pillar is a voluntary regime with a complementary characteristic. It is formed by a public capitalization regime and complementary regimes of individual or collective nature. Finally, the third pillar is also complementary, and it is constituted by individual plans of retirement.

In order to finance social security, a pay-as-you-go distribution system was first created, where current obligations are covered by current contributions (Garcia, 2014a). The need to prefund the pay-as-you-go system was acknowledged with the creation of the social security Financial Stabilisation Fund (FEFSS) in 1989³, a reserve fund in a capitalization scheme, managed by a public institution named IGFSS⁴. At the time of creation it was defined that the main revenue for the fund would be the contribution surplus of the social security. The Law of 2000⁵ came to add rules to the financing of the FEFSS, as it stated that the reserve fund would additionally receive between two and four per cent of the workers contributions, until the target of accumulating enough to ensure at least two years of pension was achieved. Additionally, trying to improve the sustainability of the system, the Law 32/2002⁶ introduced new restrictions to the calculation of the pensions, having as target incentivising workers to stay longer on the work force. Silva et al. (2004) presented a simulation of the future performance of the assets of the fund, concluding that the fund would reach its peak in 2012, after being first mobilised the year before, and would be depleted between 2025 and 2026. On the long term this suggested that strengthening measures would be needed to allow the system's financial sustainability to last longer than estimated. In fact, the growing importance of further measures was considered in the social security Law of 2007⁷, being this one the law currently followed. The previously presented law introduces a sustainability factor in order to consider the aging population problem and increase the long-term sustainability of the system, being this factor clearly added to the calculation of the pensions in May

³ *Decreto-Lei n.º 259/89 de 14 de Agosto*

⁴ *Instituto de Gestão de Fundos de Capitalização da Segurança Social (IGFSS)*

⁵ *Lei n.º 17/2000 de 8 de Agosto*

⁶ *Decreto-Lei n.º. 35/2002 de 19 de Fevereiro*

⁷ *Lei n.º. 4/2007 de 16 de Janeiro*

2007⁸. The system prevailing in Portugal, was considered financially sustainable due to reforms performed in the previous years (Garcia & Lopes, 2009).

Considering all the changes performed until now, the FEFSS accumulated at 31st of December 2014 13.504 million EUR, or 16.395 million USD⁹, enough to guarantee 114,80% of one year pension needs (IGFSS, 2014), meaning that the goal of covering two years of pensions is not yet reached, however the fund is going in that direction reaffirming the success of its performance. Nonetheless, the fund main characteristics should be analysed and its weaknesses should be considered (Garcia, 2014a).

Initially an analysis of the present demographical situation is important to be made, as it is one of the main drivers of public pension reserve funds creation and incentive to succeed as it helps off-set some of the main consequences of the demographic aging problems (Garcia, 2004; Impavido, 2002; ISSA, 2013; OECD, 2013; OECD, 2015a; Silva et al., 2004; The World Bank, 1994; Vittas et al., 2008; Yermo, 2008). The current retirement ages for both men and women who entered the labour force at the age of 20 is 66 years, and it is expected to remain so as assessed by OECD (2015).

The present generational problem can be analysed also in appendix 1, where it is shown the synthetic fertility index, representing the average number of child born per women in fertile age (between 15 and 49 years old). In order to guarantee the renovation of the generation, the number had to be on average 2.1, value that has not been registered since 1981 and from which the index has moved away. Bloom et al. (2011) enhances the declining fertility as global problem, especially when accompanied by an increased

⁸ *Decreto-Lei nº. 187/2007*

⁹ Conversion rate on 31 December 2014, Source: from European Central Bank

longevity of people's life, as it represents a decrease in the work force that constitutes a crucial factor to economic prosperity.

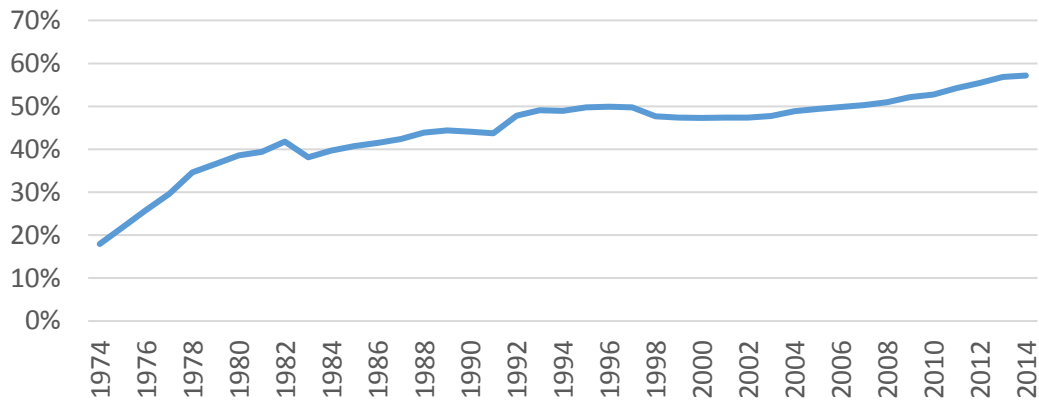


Figure 1 - Pensioners per active population in % (Source: PORDATA)

An analysis of the past performance of the work force can be done by looking at Figure 1, which shows the ratio between pensioners and active population, enhancing the increasing disequilibrium existing between contributors and beneficiaries in the last years. Bloom et al. (2011) shows that Portugal in 2011 was in the top of the selected countries with the highest shares of population aged more than 60, being predicted to be in the second place of this ranking in 2050, only after Japan. In this way, Silva et al. (2004) projections of a rising in the pensioners numbers are confirmed, supported also by appendix 2 that displays the pressure that the system is subjected to now and its increase in the future.

Joana Patrício, Master in Finance
 The role of pension reserve funds in PAYG financial sustainability

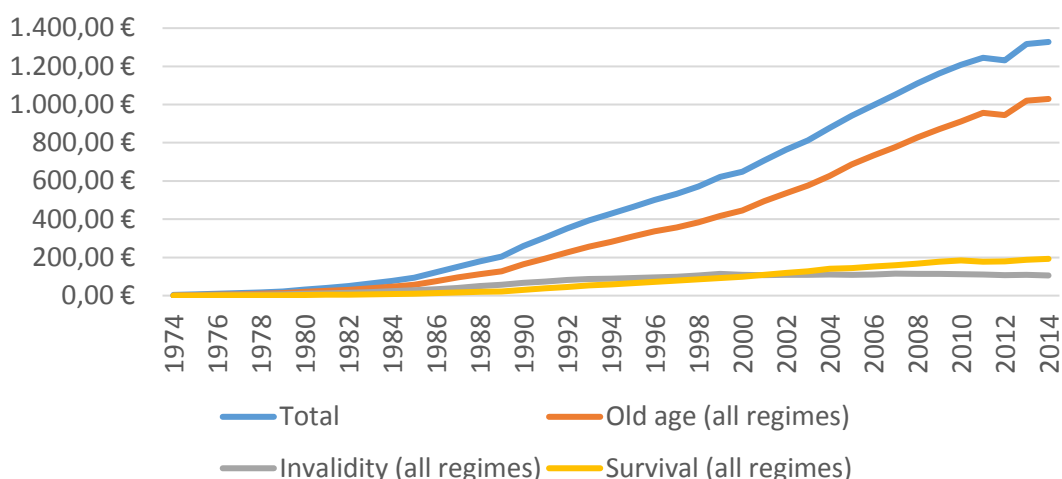


Figure 2 - Social security Pensions: total and per type expenses in million euros
 (Data Source: IGFSS/MSESS, Source: PORDATA)

Expenses with pensions can be seen in Figure 2, being possible to conclude that the expenses with pensions follow a rising tendency, but at a lower rate in the recent years. The main driver for the increase in total pensions was the old age pension, reaffirming the demographic problem. As an exception there is the year of 2012, when the amount of euros spent decreased, reflecting a reduction of payments of old age and invalidity pensions, increasing only survival ones. This was justified by the suspension of the Christmas and holidays subsidies to part of the population from the welfare system, and due to the changes arising from the fiscal restraints applied previously. A similar behaviour can naturally be noticed in the average pension shown in appendix 3, where we can observe a general increase on the average euros spent per pensioner, with the same exception of 2012.

Considering the current demographic situation and the predictions made by authors as Silva et al. (2004), measures should be taken to assure the sustainability of the system. Some authors defend the adoption of measures as the indexation of the normal retirement

age to life expectancy (Diamond, 1996), higher contribution rates, lower benefits, later retirement ages and policies that promote savings in order to improve the national output (Barr & Diamond, 2009). Additionally, the decreasing values of output expected in the future, arising from the decrease in the active population seen before, combined with the rising expenses, show that the existence of the reserve fund can be of extreme importance to avoid higher taxes to ensure the level of benefits in the long run (Lane, 2001).

2.2 Management of public pension reserve funds

The management of the reserve funds is of crucial importance to guarantee the fulfilment of its creation goals (Iglesias & Palacios, 2000; Impavido, 2002; Garcia, 2004; Palacios, 2002; Vittas, 1995; Yermo, 2008). Being a public reserve fund does not imply it will have a public management, as the management may be designated to private firms, or to private managers, while the control is kept to the government by the creation of restrictions and investment options (Iglesias & Palacios, 2000).

There are considerable amounts of risks associated to public pension funds, as investment risk arising from the exposure to financial markets, the surplus risk associated with defined benefits plans and the equilibrium between assets and liabilities, among other risks as political interference (Garcia, 2004). It is of main importance to be sure that there is no political interference that reduces the efficiency of the funds (Palacios, 2002; Yermo, 2008). Political influence is most common associated with the usage of pension reserves as debt financing for the government and the pursuit of social and economic political targets, often generating lower investment returns than alternative investments, leading to a poorer performance that could be avoided by a good management with low political influence over investment decisions (Iglesias & Palacios, 2000; Palacios, 2002).

Thus, governance affects performance in the sense that the absence of good governance leads to poorer investment policies (Impavido, 2002). Good governance is the ability to isolate fund management and political influence, while having a high level of transparency and public accountability (Vittas et al., 2008). Yermo (2008) advances the increase of the expertise in the government boards and augmented constraints on the discretionary interventions by the government as two important enhancements to improve fund's governance. Palacios (2002) highlights measures already followed by five studied countries of the OECD, including the selection of the boards independently of the new government by using detailed criteria, high reporting and disclosure tools that would increase the transparency of the conduct of the board members and less strict limits on the investment on foreign assets.

2.3 The funding and performance of public pension reserve funds

Funding, as performance, is influenced by public plan governance (Yang & Mitchell, 2005). It is not enough to establish the fund and finance it in an irregular rhythm, indeed according to Yermo (2007) minimum funding standards should be kept to ensure that in the future the assets of a pension plan will match the accrued liabilities. Hess & Impavido (2003) defend that the pressure existing to improve local economy affects performance negatively, supporting the previously explained need to focus on good governance and the limitation of political interference. Chaney, Copley & Stone (2002) managed to provide statistical evidence of pension funding being negatively affected by fiscal distress and by the existence of budget balance requirements.

Joana Patrício, Master in Finance
 The role of pension reserve funds in PAYG financial sustainability

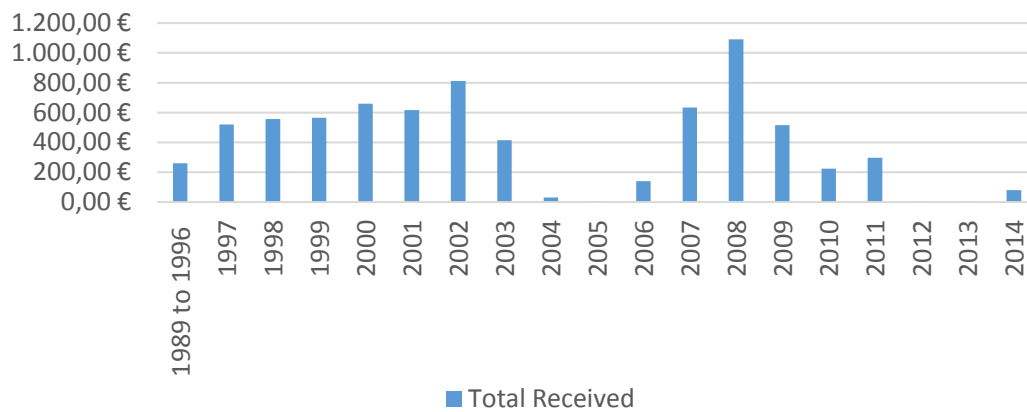


Figure 3 - Evolution of the total funding of the FEFSS in million euros

(Source: FEFSS - Relatório e Contas 2014)

The historical funding of the FEFSS represented in figure 3 and its accumulated value in appendix 4, show that the evolution of the appropriations is not constant over time, and in some years no transfers were made. Research done by Palacios & Whitehouse (2006) has found that on comparing public sector pensions to private ones, the first ones tend to be more generous on the benefits while also having lower funding levels and higher per member liabilities. According to Ponds, Severinson & Yermo (2011) reforms on public pension funds are being made by several countries to lessen these benefits, it is the case of Portugal, Finland, France, Germany, Italy and Sweden, while growing costs of public sector pension liabilities are being registered, reason why underfunding should be taken into account. Although underfunding might be risky, Ponds et al. (2011) defends that funding surplus might increase benefits and in the long run increase funding costs, leading again to underfunding. Additionally, it is considered by the same author that too much prefunding can lead to an investment in domestic government bonds, which means circularity in government funding and so it represents not much added value.

Considering now the performance, strategic asset allocation is needed, in order to have good rates of returns. Figure 4 illustrates the evolution of the nominal and real rates of return since the creation of FEFSS until 2014. Garcia (2014a) considers as a possible explanation for the low real rate of return values in 2002 and 2011 the stock markets crash of 2000-2002 and 2008, together with the lack of defined benchmarks by the management for the rates of return performance analysis.

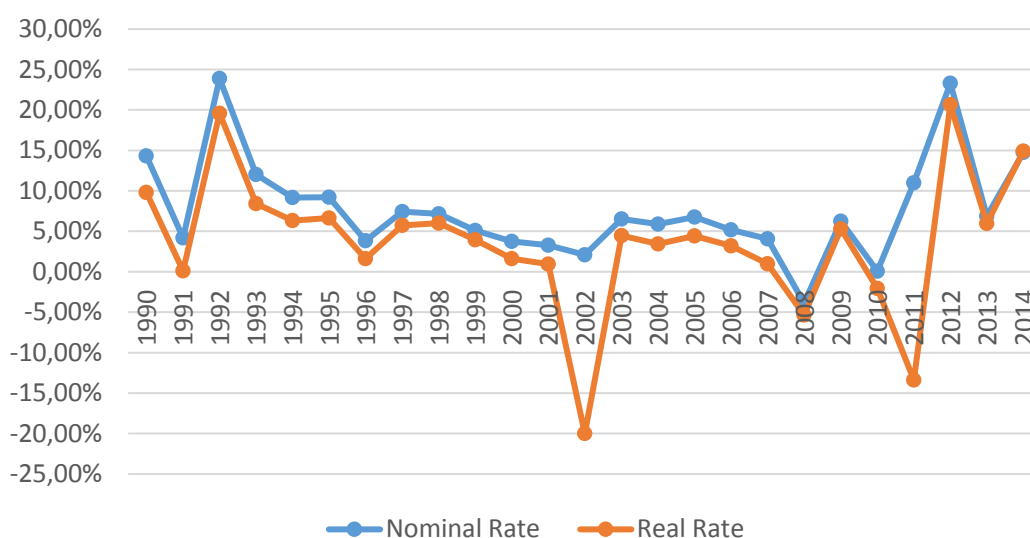


Figure 4 - FEFSS nominal and real rates of return
 (Source: FEFSS - Relatório e Contas 2014)

Furthermore, the lack of transparency and the political interference that the fund may suffer are factors that can be limiting the good performance (Iglesias & Palacios 2000; Palacios, 2002; Yermo, 2008). An example of this situation is the change of the Board of Directors at the Statutory Audit Entity according to the government selected, fact that should be under further investigations (Garcia, 2014b). Along with the previous threat, there is literature supporting that the usage of the FEFSS to buy until 90% of public debt represents a possible error of management as investments should be made according to

profitability, safety, liquidity and a diversified asset allocation (ISSA, 2013; OECD, 2009; Tribunal de Contas, 2015).

Considering the asset allocation, on one side investing in low return assets provides inadequate rates of returns to finance future pension necessities, on the other excessive risk may also have negative outcomes in unfavourable market circumstances, thus a good design is needed for the fund scheme to outperform the single PAYG performance (Davis, 1998). The distribution of the FEFSS investment from 1998 to 2014 can be seen in Table I. Public debt represented the major investment in all the years, consisting the majority on Portuguese bonds. On its turn, shares represented in most years the second major investment of the portfolio, invested in stocks in the case of European companies, and through indexes and futures in the remaining ones. A beginning of diversification was sought by having low market shares in a wide number of European companies, as so as indexes and futures, although it has decline in the latest years with an increased investment in public debt. Despite the recommendations to diversify the portfolio seen above, the increasing investment in bonds that has been made is described by Blake (2000) as a possible consequence of a mature fund, by justifying that commonly immature and fast growing funds might opt for an aggressive investment policy investing in equities with cash flows having a long duration, while more mature funds choose passive investment polices as fixed-income bonds that will be maturing at the same time as pension liabilities granting liquidity to the system. Diamond (1996) suggests that a bigger investment in private bonds and equity should be made, as social security expenses are simple to predict and the existence of a large trust fund reduces the need for liquidity, and so reducing the need to pay a premium for liquidity when investing.

Table I

FEFSS Portfolio Distribution

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Public Debt	73.2%	73.6%	56.5%	51.5%	51.5%	52.3%	53.7%	50.5%	50.3%	50.5%	55.9%	50.6%	53.2%	50.7%	54.7%	57.9%	75.1%
Securites																	
Other Bonds	7.7%	14.4%	23.7%	30.1%	30.1%	22.5%	20.6%	17.7%	19.8%	19.6%	21.5%	27.3%	18.4%	11.9%	15.7%	9.0%	1.5%
Trust Units	1.4%	3.8%	4.0%	6.7%	1.6%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Shares	0.2%	1.3%	4.7%	7.2%	6.8%	9.4%	13.5%	24.2%	20.8%	20.7%	16.6%	17.1%	23.2%	16.3%	13.4%	15.6%	10.9%
Real Estate	0.3%	0.5%	0.9%	0.7%	1.6%	1.4%	1.8%	3.0%	3.6%	3.2%	3.0%	2.6%	2.2%	2.3%	1.8%	1.5%	1.2%
Deposits	17.3%	7.4%	10.3%	3.6%	7.2%	11.2%	7.1%	1.6%	2.2%	2.9%	1.1%	0.1%	0.8%	17.3%	13.4%	15.5%	11.3%
Strategic Reserve	0.0%	0.0%	0.0%	0.0%	2.9%	3.1%	3.2%	3.0%	3.3%	3.2%	2.0%	2.3%	2.2%	1.5%	1.0%	0.6%	0.2%
Provisions and Tax Receivables	0.0%	-1.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Source: IGFSS and FEFSS Annual Reports (1998 to 2014)

2.4 Evidence from public pension reserve funds across the world

Comparison with other countries is needed to better understand the behaviour of FEFSS and its management. Palacios (2002) considered a group of five countries, Canada, Ireland, Japan, New Zealand and Sweden. Yermo (2008) enlarged the sample to 15 selected OECD countries, adding to the above mentioned countries United States, Norway, South Korea, Spain, France, Australia, Portugal, Mexico, Poland and Denmark. Impavido (2002) selected a broader group of countries, being able to analyse funds in both developed and development countries. Iglesias & Palacios (2000) made an analysis that had an additional focus on different types of prefunding and public and private funds. In the present work, only an analysis of public reserve funds in developed countries will be considered, as it is important to collect comparable data, gathering both sovereign pension reserve funds and social security reserve funds from OECD countries. The group includes 14 funds from different countries in a similar approach to Yermo's (2008), being now added Belgium, while Ireland and Denmark are discarded. On December 22nd 2014 Ireland made the transition of all assets and liabilities from the National Pensions Reserve Fund to Ireland Strategic Investment Fund, whose goal is now to support economic activity and employment in the country. Denmark's mandatory pension schemes, that include the supplementary earning-related pension scheme (ATP) and the Special pension savings scheme (SP) were also disregarded, as they are included by OECD in private pension funds.

Table II presents the chosen funds, which can be of two types: Social security Reserve Funds (SSRFs) that belong to the social security system, being financed essentially by surpluses of employee and contributions of current pay-outs, and Sovereign Pension Reserve Funds (SPRFs) that are established by the government and separated from the

Joana Patrício, Master in Finance
The role of pension reserve funds in PAYG financial sustainability

social security system, being their inflows transfers that come directly from the government (Blundell-Wignall, Hu & Yermo, 2008).

Table II

Public Pension Reserve Funds in Selected OECD Countries (2014)

Country	Name	Type of fund	Year of establishment	Total Invested Assets	
				EUR millions	% of GDP
Australia	Future Fund	SPRF	2006	73.804	6,8%
Belgium	Zilverfonds	SPRF	2001	20.757	5,2%
Canada	Canada Pension Plan Investment Board	SSRF	1997	169.517	12,1%
France	AGIRC-ARRCO	SSRF	n.d.	57.741	2,7%
Japan	Government Pension Investment Fund	SSRF	2006	935.641	28,1%
Korea	National Pension Service	SSRF	1988	352.049	31,6%
Mexico	IMSS Reserve Fund	SSRF	n.d.	1.318	0,1%
New Zealand	Superannuation Fund	SPRF	2001	17.710	11,5%
Norway	Government Pension Fund Global	SPRF	2001	22.569	6,5%
Poland	Demographic Reserve Fund	SPRF	2002	4.201	1,0%
Portugal	Financial Stabilization Fund	SSRF	1989	13.509	7,8%
Spain	Social security Reserve Fund	SSRF	1997	41.597	3,9%
Sweden	National Pension Funds (AP1-AP4 and AP6)	SPRF	2000	126.191	30,3%
United States	Social security Trust Fund	SSRF	1940	2.297.711	16,1%

Source: OECD Annual Survey of Large Pension Funds and Public Pension Reserve Funds 2015
Note: Original data in USD, value in euros calculated by applying the rate on 31st December 2014, Source: European Central Bank

Portugal's funds is among the biggest public pension reserve funds, being the United States Social Security Trust Fund the world's biggest public fund with 2.297.711 million euros in 2014, and Japan's Government Pension Investment Fund the second, with 935.641 million euros in 2014. Regarding the GDP, the importance of the Portuguese fund is also reflected, as we can see the weight was of 7,8% in 2014, when the world's biggest funds had a weight of 16,1% and 28,1%, United States and Japan respectively.

The distinct values of the funds in the year of 2014 can be reflection of the transfers made since the creation of the funds and of the rate of returns coming from the application of the portfolio.

Concerning first the transfers, they can be very different depending on the country. Portugal has an irregular transfer policy depending on political decisions, as seen beforehand. Impavido & Vittas (2008) studied the transfers of Norway, Canada and New Zealand, giving comparative examples that help understand the global behaviour of funds on this topic. Considering first Norway, it indexed the revenues to the petroleum activities, being the transfers constituted in part of the net oil revenues. Canada on its turn receives all the transfers made to the Canada Pension Plan that are not used to pay current pensions, retaining also the benefits from the operations of the plan. Finally, the New Zealand fund, similarly to the Portuguese one, receives mainly the annual government contribution varying from year to year and depending on the financial objectives of the fund. As a conclusion, the different methods followed result on divergent portfolio values existing some characteristics that stand out, as the fact that all funds are younger and funded at a higher level than the Portuguese one, being Canada's the biggest.

Addressing secondly the rates of return, Yermo (2008) refers that some reserve funds have defined objectives as is the case of Canada's Canada Pension Plan Investment Board and Japan's Government Pension Investment Fund. Table III shows the nominal and real rates of returns of public pension reserve funds from 14 previously selected OECD countries. In the table a computed 5 years annualized rate is also presented.

Joana Patrício, Master in Finance
The role of pension reserve funds in PAYG financial sustainability

Table III

Nominal/Real Rates of Returns of PPRF in Selected OECD Countries (2014)

Country	Name	Nominal						Real					
		2010	2011	2012	2013	2014	5-year annualized	2010	2011	2012	2013	2014	5-year annualized
Australia	Future Fund	9,5%	1,6%	12,8%	17,2%	13,2%	10,7%	6,6%	-1,4%	10,4%	14,1%	11,3%	8,1%
Belgium	Zilverfonds	4,3%	4,3%	4,2%	4,0%	3,4%	4,1%	1,2%	0,8%	2,0%	3,0%	3,8%	2,1%
Canada	CPPIB (1)	8,9%	5,3%	9,7%	13,5%	15,6%	10,5%	6,4%	2,9%	8,8%	12,1%	13,9%	8,7%
France	AGIRC (2)	3,4%	-1,4%	10,2%	5,9%	5,0%	4,6%	1,6%	-3,8%	8,7%	5,2%	5,0%	3,2%
	ARRCO (2)	3,1%	-2,4%	11,6%	6,7%	6,4%	5,0%	1,3%	-4,8%	10,1%	6,0%	6,3%	3,7%
Japan	GPIF (3)	0,4%	-1,9%	8,7%	17,1%	9,2%	6,5%	0,8%	-1,7%	8,8%	15,2%	6,7%	5,8%
Korea	NPS (4)	10,4%	2,3%	7,0%	4,2%	5,3%	5,8%	7,1%	-1,8%	5,5%	3,0%	4,4%	3,6%
Mexico	IMSS (5)	6,6%	5,0%	4,3%	4,6%	4,7%	5,0%	2,1%	1,1%	0,7%	0,6%	0,6%	1,0%
New Zealand	Super-annuation Fund	15,1%	1,2%	19,2%	26,1%	13,9%	14,8%	10,6%	-0,7%	18,1%	24,1%	13,0%	12,7%
Norway	GPPF (6)	15,3%	-3,9%	12,2%	15,6%	10,6%	9,7%	12,2%	-4,1%	10,6%	13,3%	8,4%	7,9%
Poland	FRD (7)	6,6%	1,8%	10,2%	3,0%	4,3%	5,1%	3,4%	-2,7%	7,7%	2,3%	5,2%	3,1%
Portugal	FEFSS (8)	0,1%	-11,0%	23,3%	6,9%	14,7%	6,1%	-2,4%	-14,1%	21,0%	6,7%	15,2%	4,5%
Spain	SSRFS (9)	-1,8%	6,0%	4,9%	9,1%	11,9%	5,9%	-4,7%	3,6%	2,0%	8,9%	13,0%	4,4%
	AP 1 (10)	10,3%	-1,9%	11,3%	11,2%	14,6%	8,9%	7,8%	-4,1%	11,4%	11,0%	15,0%	8,0%
	AP 2 (10)	11,2%	-2,1%	13,3%	12,7%	13,1%	9,5%	8,7%	-4,3%	13,4%	12,5%	13,5%	8,5%
Sweden	AP 3 (10)	9,0%	-2,5%	10,7%	14,1%	13,7%	8,8%	6,5%	-4,7%	10,8%	13,9%	14,1%	7,9%
	AP 4 (10)	10,9%	0,7%	11,2%	16,4%	15,7%	10,5%	8,4%	-2,9%	11,3%	16,2%	16,1%	9,6%
	AP 6 (10)	9,4%	-6,9%	9,2%	-	-	-	6,9%	-9,0%	9,3%	-	-	-
United States	SSTF (11)	4,6%	4,4%	4,1%	3,8%	3,6%	4,1%	3,1%	1,4%	2,3%	2,3%	2,8%	2,4%
Average		7,2%	-0,1%	10,4%	10,7%	9,9%	7,5%	4,6%	-2,6%	9,1%	9,5%	9,4%	5,8%

Source: OECD Annual Survey of Large Pension Funds and Public Pension Reserve Funds 2015
Notes: (1) Canada Pension Plan Investment Board, (2) General Association of Management Pension Funds, (3) Government Pension Investment Fund, (4) National Pension Services, (5) Mexican Social Security Institute, (6) Government Pension Fund Global, (7) Demographic Reserve Fund, (8) Financial Stabilization Fund, (9) Social Security Reserve Fund Spain, (10) Swedish National Pension Funds, (11) Social Security Trust Fund.

Considering Yermo's (2008) examples once more, Canada's government established as a goal having a 4,2% real rate of return, based on the yields on long term government bonds and a premium of 2,3% for equities. This goal has been reached in the majority of

the 5 years presented in Table III, with the exception of 2011. In Japan's fund the goal was to reach a long-term rate of return that allowed to have a stable ratio of reserves to annual public expenditures. The latest performance goals were set in 2014, stating an annual nominal return rate of return of 4,2%, representing more 0,1% than the previous target, being still one of the smallest targets among its peers. Taking into account Table III, the goal has been reached mainly due to the last three years, reflecting a change from the bad results in the years of the crisis. When comparing FEFSS performance with other funds present in Table III, we can see it is below the 5,8% average 5-year annualized real rate of return. One thing that could help improve its management and performance could be setting benchmarks similarly to what the countries given as an example do, as FEFSS has no goal defined and so a clear assessment measure of investment performance regarding rates of returns does not exist (Garcia, 2014a).

A further analysis of the asset allocation elaborated by OECD (2015b) gives us a wide perspective of the trends in different countries. The study concludes that the perspective of a high investment in bonds is supported by several countries, as is the case of Belgium, Spain, and the United States. Poland follows the same strategy, while also investing on listed equity. Mexico has a divided investment strategy, allocating its assets mainly on fixed income and listed equity. Norway invests on both, however listed equity has the highest share of investment, having the category of cash and deposits relevance too, but in a lower amount compared to the two previous categories. Canada and Sweden divide the higher shares of investment on fixed income and listed equity, followed by private equity in the first country and land and buildings in the second. Finally, Australia has the more evenly distributed fund, being the one of the selected countries with lowest amount of the portfolio invested in fixed income. The highest investment for this country was on

listed equity, followed by hedge funds, cash and deposits, fixed income, private equity, unlisted infrastructure investment and finally lands and buildings.

OECD (2015b) also calculated the historical average asset allocation of selected public pension reserve funds from 2010 to 2014, showing a trend for seeking alternative investments to fixed income exposure. Possible alternatives go from equities, to hedge funds, commodities and other risky investments (Trianti, 2015). The case of Japan is an example of changing investment policies, as in October 2014 alternative asset allocations were proposed to be included in the portfolio allocation in order to respond now to increasing interest rates, contrasting with previous expectations of deflation (OECD, 2014). Stewart & Yermo (2010) suggested that an investment in long-term assets, improving the diversification of the fund, would be a good action to improve the performance of the Japanese fund, supporting Diamond (1996) previously explained suggestion of avoiding the payment of liquidity premiums when the fund does not have immediate needs for capital. Following the same theory, starting from October 31st 2014 GPIF's asset allocation policy was changed, along with the internal control, the risk management capabilities and the human resource management that were reinforced. GPIF's previous allocation of 60% in domestic bonds was reduce to only 35% and the investment on short-term assets was alienated, while the investment on domestic and international stocks increased by 13% each, increasing also the investment in international bonds by 4%.

3. Simulation of the value of the fund

Taking into account the considerable importance of the fund in the social security financial sustainability previously reviewed, it makes sense to consider it should receive significant transfers in order to increase its value. However, this is not being verified, as we have seen before. The law of 2007 currently in practice foresees the occurrence of bad economic years, which justifies legally the small amount, or even nonexistence, of the transfers to the fund that should come from between two and four per cent of the contributions of employed workers and positive balances of social security and revenues from real estate and other investments. Nevertheless, in the majority of the years, transfers were indeed made, as can be seen in the Figure 1 presented before.

Regardless of the previous governmental decisions considering transfers, it is interesting to determine what the value of the fund would be if these transfers were made regularly in the past years, with different asset allocations. This paper now approaches an important consideration, what if the transfers to the fund would have been greater and invested differently? We will now study the fund we might have today if the management had been different, in order to prevent the same choices in the future if they reveal to be a contributor to a not so good as possible performance of the fund in the long run.

Additionally, we want to determine when the goal of covering two years needs of pensions would be covered if the alterations were made, for the year 2014. The value to be achieved can be calculated as presented below:

$$(1) \quad \text{Target Value (in million EUR)} = \frac{\text{Value of the Fund}_{\text{Year } t} \times 100\%}{\% \text{ Covered by the Fund}_{\text{Year } t}} \times 2$$

The values taken from the IGFSS report of 2014 were considered, where 13.504 million euros represented enough to guarantee 114,80% of one year's needs. This led to

the establishment of the value of 23.526 million euros as a target value which would guarantee the fulfilling of the initial goal of the FEFSS.

3.1 Selection of data and time frame

FEFSS has an existence starting on 1989, however IGFSS started its operations in 1977. Some organizations as OECD, see OECD (2015b), consider the returns of FEFSS starting from the existence of its management fund. The consideration of a bigger time range than the fund's lifetime would be of some importance to this study, giving the possible amount that could have been saved if the fund would have been created sooner and if greater amounts would have been transferred each year. Additionally, the available data for contributions of employees started in 1977, being possible to obtain the information needed to compute the values to be transferred. However, the rates to be applied further in the work consider the yield of Portuguese bonds and the yields from PSI 20 which are not available from that time, as the first has the last available data in *Banco de Portugal* historical information only since 1994 and the second has the last available information from *Reuters* since 1996. For this reason, two simulations will be made, starting on 1989 for the first simulation and on 1997 for the others. The starting point at 1997 matches the available information in FEFSS and IGFSS reports, which is only detailed after 1996, being just presented an amount of 259.486.439, 81 euros accumulated since the creation until the end of that year. This amount will be then consider as the starting amount when the year of 1997 is taken as a starting point.

The initial values of each year will take into account the details in the laws that today regulates the transfers to the fund. Law 259/89 was the first to regulate the revenues of the FEFSS, stating that any of the surplus of the social security could be transferred to the fund by decision of the ministers in charge. Article 91 from the Law 4/2007 came to add

an important new source of revenue, where the money to be entering into the fund was to be considered between 2% and 4% of the total contributions received from employed workers by social security each year. For this reason two different scenarios were taken into account, in the following propositions.

Proposition 1: The amount transferred consists on a stable yearly transfer of 2% of employed workers contribution to social security, and of the direct transfer of the difference between total revenues and total expenses of the social security balance.

Proposition 2: The amount transferred consists on a stable yearly transfer of 4% of employed workers contribution to social security, and of the direct transfer of the difference between total revenues and total expenses of the social security balance.

3.2 Selection of rates

After the years of study and the inputs of the fund are defined, the rate of capitalization to apply to the existent amount of money has to be set. At this point several analysis of what is done in other countries have been made in order to see alternative strategies. From this point, four different capitalization options (CO) were considered.

The first option is to consider the real rates of return the fund has been having since its creation in 1989. The effect of the value of money is already taken into account, by considering a rate of return that already excludes inflation rates.

CO 1: The rate of capitalization is to be considered the average real rate of return of FEFSS from the beginning of its creation (1989) to the latest available data (2014).

In order to better compare the results from the application of different rates, the average real rate of return will be applied too, this time from 1997 to 2014. This options disregards the previous years, working only with accumulation until 1996.

CO 2: The rate of capitalization is to be considered the average real rate of return of FEFSS since the beginning of the fund and is to be applied to the years between 1997 to the latest available data (2014).

However, as the rate of 2,92% of return calculated as the average return since the creation of the fund may not be applicable to portfolios with a higher volume and a different time range, alternative measures were analysed. For this reason, the performance of portfolios composed differently was applied. The previous study of the Belgic, Spanish and US portfolios showed a total investment in bonds, mainly national ones. In order to reflect the consequences in the Portuguese public reserve fund if this strategy was also followed, 100% investment in Portuguese bonds was considered, meaning that the portfolio would have imitated the behaviour of Portuguese 10-years bond yields.

CO 3: The rate of capitalization is to be considered the yield of Portuguese 10-year bonds for each year, starting from 1997 to 2014.

On the other hand, Japan and Poland are following a different strategy, complementing the investment in national bonds with an amount of the portfolio invested in listed equity. Thus, a mixed investment on Portuguese 10-year bonds and equity was considered. The particular amount of a 60% investment on bonds follows the previous GIPF's strategy, being the remaining 40% invested in stocks, using as a benchmark for the equity investment the PSI 20 index.

CO 4: The rate of capitalization is to be considered as an investment of 60% on Portuguese bonds and 40% on equity, reflecting PSI 20 historical yields, for each year starting from 1997 to 2014.

3.3 Models

The capitalization options were applied to the different propositions according to the following models.

Model 1

$$(2) \quad V_t = (Trfi_t + V_{t-1}) \times (1 + r_{FEFSS})$$

Where t represents the year ($t = 1989, \dots, 2014$ and $t = 1997, \dots, 2014$); V_t represents the total value of the fund at the end of period t , $Trfi_t$ is the value transferred at time t deriving from the application of Proposition i ($i = 1, 2$); V_{t-1} is the calculated value for the year before t ; r_{FEFSS} is the real rate of return deriving from the application of Capitalization Option 1 and 2.

Model 2

$$(3) \quad V_t = (Trfi_t + V_{t-1}) \times (1 + r_{Portuguese Bonds})$$

Where t represents the year ($t = 1997, \dots, 2014$); V_t represents the total value of the fund at the end of period t , $Trfi_t$ is the value transferred at time t deriving from the application of Proposition i ($i = 1, 2$); V_{t-1} is the calculated value for the year before t ; $r_{Portuguese Bonds}$ is the real rate of return deriving from the application of Capitalization Option 3 at year t .

Model 3

$$(4) \quad V_t = (Trfi_t + V_{t-1}) \times [0.6(1 + r_\alpha) + 0.4(1 + r_\beta)]$$

Joana Patrício, Master in Finance
The role of pension reserve funds in PAYG financial sustainability

Where t represents the year where ($t = 1997, \dots, 2014$), remaining the other common variables the same. The variables r_α and r_β derive from Capitalization Option 4, representing the first one the real rate of return of the Portuguese bonds at year t , while r_β is the real rate of return of PSI 20 at year t .

4. Results and Analysis

The final values attained consist on estimations of the possible value of the portfolio, if different decisions have been made as explained previously. In Table 3 the application of Propositions 1 and 2 to the four different capitalization methods are presented.

Table IV

Model's Output (in euros)

Proposition	P1	P2
Model 1 (CO1)	35.948.058.386,18	36.628.914.220,09
Model 1 (CO2)	30.121.066.755,67	30.609.936.886,74
Model 2 (CO3)	40.229.288.551,46	40.893.567.540,53
Model 3 (CO4)	29.391.102.848,09	30.690.421.041,53

Source: Calculations done by the author

As can be seen in Table IV, values are between 29.391 and 40.894 million euros approximately, what represents a considerable increase from the present value of FEFSS and the completion of the goal of creating of the fund: covering two years of pensions needs. As expected, the results from the application of P1 are always lower than the ones from P2 as the transfers to be considered are smaller. Indeed, both results were expected as an increase in the transfers would naturally increase the final output.

In Figure 5 the yearly outputs from the application of Model 1 are presented, considering both CO1 and CO2, as so as the real evolution of the FEFSS during the years of existence. There is a great increase of the portfolio value in the model compared to real values, for CO1 since 2001 and 2002, for P1 and P2 respectively, and for CO2 since 2005. The goal of covering two years of pensions needs is fulfilled in 2010 for CO1 and in 2012 for CO2, showing that if transfers have been made in a greater value the main target would have already been met.

Joana Patrício, Master in Finance
 The role of pension reserve funds in PAYG financial sustainability

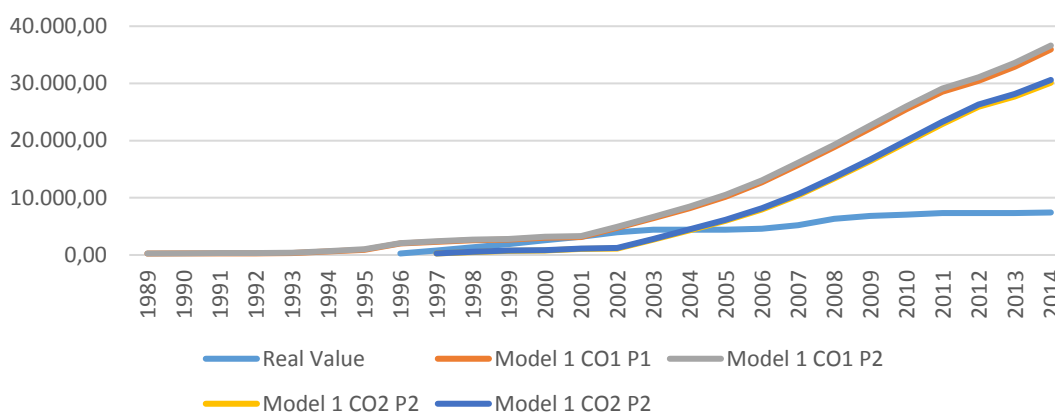


Figure 5 - Evolution FEFSS applying Model 1 vs Real Value in million euros

(Source: Calculations done by the author)

In more detail, if the practices of higher transfers as proposed in P1 and P2 were followed since the creation of the fund, maintaining the proportional allocation of assets, as suggested in CO1, the value of FEFSS would be between 2.6 and 3.1 times bigger than the present one, representing in P1 and P2 a coverage of 20,73% and 21,12% of 2014 GDP respectively, in opposition to the 7,79% verified today. The outcome from the application of the average real rate of return of FEFSS since its creation to transfers from 1997 to 2014 was naturally inferior to the previous one, as the initial accumulated transfers from 1989 to 1996 that the fund already had were very low. Notwithstanding, the final value was close to the one achieved in CO1, being the difference of around 6.000 million euros, representing 17,37% and 17,65% of the GDP in 2014. However, the results from CO2 are not directly comparable to the others, as a different time frame is being used with less seven years having naturally less time to accumulate funds and to capitalize them.

Joana Patrício, Master in Finance
 The role of pension reserve funds in PAYG financial sustainability

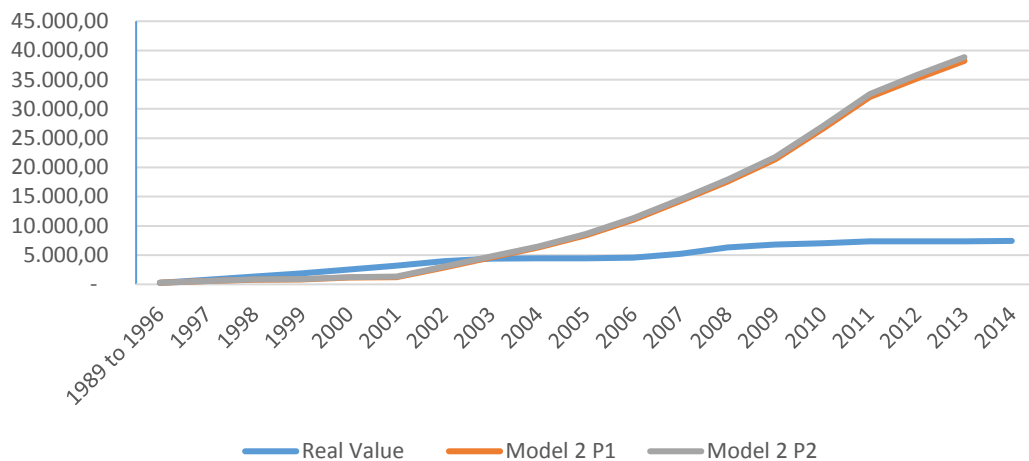


Figure 6 - Evolution FEFS applying Model 2 vs Real Value in million euros

(Source: Calculations done by the author)

Figure 6 represents the evolution of the portfolio if Model 2 considerations were applied. As in the previous model, the value of the portfolio increases significantly over time, especially after the year of 2004. The fund would have reached the targeted 23.526 million euros in 2010 if one of the two conditions of Model 2 have been applied, and in 2014 would have represented more than 3.4 times the yearly pension needs.

The highest result was achieved here, with the application of the fund to the portfolio composed exclusively of Portuguese bonds, reaching values of more than 40.200 million euros. The high yields paid by Portuguese bonds, especially in the period of 2011/2012, may help explain this situation, since the maximum value of the rate was of 10,56% and the minimum 2,53%.

Joana Patrício, Master in Finance
 The role of pension reserve funds in PAYG financial sustainability

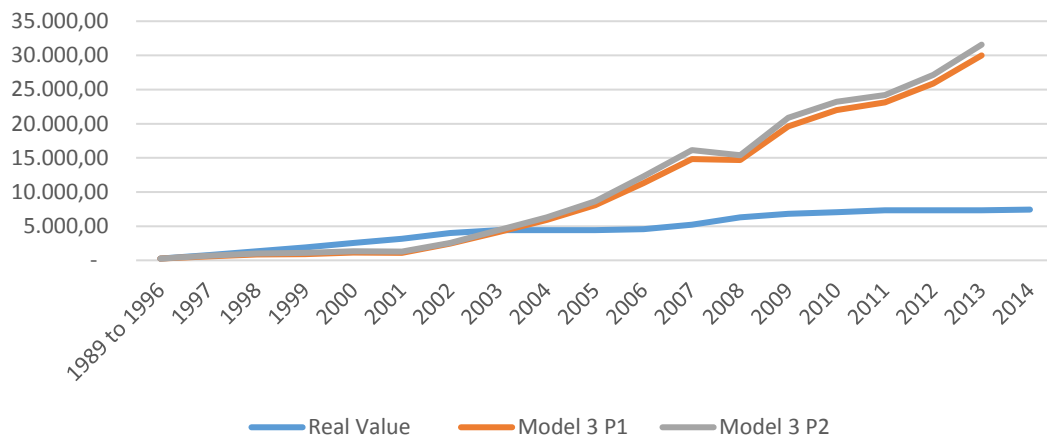


Figure 7 - Evolution FEFSS applying Model 3 vs Real Value in million euros

(Source: Calculations done by the author)

The last portfolio was the one with the lowest amount accumulated, mainly due to the bad performance of the index selected, as the PSI 20 reached negative values of -51, 29% and maximums of 71,06%, being during this period highly volatile. However the goal of covering two years of pension needs was covered in the year of 2011 and in 2012, and it covered the yearly pension needs by 2,5 times, being on both consideration very close to Model 1 performance considering CO2 specifically.

Regarding all the different simulations, the application of CO1 in Model 1 would be expected to have accumulated the greater amount, as it accumulated for a longer time. In the year of 1997 it had in the portfolio an amount around 2.300 million euros in P1 and 2.400 in P2, due to the accumulation and return of the portfolio since 1989. This value can be compared to the initial value of 267 million euros considered as the starting point for all the other simulations, noticing Model 1 applying CO1 was surpassed by Model 2 in the year of 2010.

5. Conclusions, Limitations and Further Investigations

5.1 Conclusions

The creation of pension reserve funds is important to guarantee the sustainability of the social security in the long term (Garcia, 2014). These funds are subject to different management challenges and performance outcomes around the world, existing considerable literature giving advice on how to manage them (Iglesias & Palacios, 2000, Impavido, 2000, Palacios 2002, Vittas et. Al., 2008, Yermo, 2008). The present work studied the importance of the creation of FEFSS in Portugal, and how the fund has been managed until 2014. The need for the FEFSS is mainly supported by the increase in the weight of the pensioners over the active population (Bloom et. Al, 2011, Garcia, 2005). Along the work it was studied that the existence of the fund makes a difference if it is well managed (Iglesias & Palacios, 2000, Garcia, 2004, Palacios, 2002, Yermo, 2008), being a good governance needed (Impavido, 2002), as so as a good investment policy (Garcia, 2014a). However, it is not commonly accepted the way the portfolio should be funded or invested. Concerning funding, Yermo (2008) defends minimum standard requirements should be kept to guarantee the financial sustainability of the PAYG system. When it comes to the asset allocation of the portfolio, Davis (1998) suggests a balance between lower and higher risk investments. In Portugal the funding of FEFSS has been irregular, and in order to evaluate what could be the situation if different decisions have been made, different ways of funding FEFSS were considered, with more stable and valuable transfers being made each year. Different applications of the portfolio were also taken into account, as so as two distinct time frames. Naturally, all defend the same principle: if the transfers were made more regularly and in greater amounts, the fund would have a considerable higher value now. The difference between all the models and

its corresponding capitalization options, lays on the changeable values of the portfolio and on how fast the goal of covering two years of pensions needs is reached. Interesting results were obtained when it came to the conclusion that a single investment in Portuguese bonds would have been a good choice, and a mixed investment in both Portuguese bonds and PSI 20 would have represented the worst outcome. However, all models applied achieve the goal of covering two years of pension needs, and managed to do so between the years of 2010 and 2012, showing that greater transfers constant over time would have been rewarded in this gap of time, contributing to a greater financial sustainability of the pay-as-you-go system.

5.2 Limitations and Further Investigations

Possible limitations of the work can be the fact that only 2% and 4% rates of transfers were calculated, together with the consideration of the total positive amount of the surplus being transferred to the fund, what can have a low probability of happening in the future. Additionally, the portfolios selected to simulate the return of the fund were simple, and more complex ones should be tested, having a wider selection of assets and markets.

The conclusions resulting from the application of different investment strategies are however relatively simple to obtain since historical data is being used. Investigations of optimal future portfolios to confirm that the outputs present in the work can be repeated in the future would be interesting. Finally, the lack of information considering historical data did not allow to investigate the value of the portfolio in a longer period of time. Considering the existence of the portfolio before 1989 would be interesting in order to discover what would be the situation today if transfers were made for a longer time, and how fast would the goal of covering two years pension needs be reached.

6. References

Barr, N. & Diamond, P. (2009). Reforming pensions: principles, analytical errors and policy directions. *International Social Security review* 62(2), 5–29.

Blake, D. (2000). *Financial System Requirements for Successful Pension Reform*. London: The Pensions Institute, Birkbeck College, Discussion Paper PI-9906.

Bloom, D. E., Boersch-Supan, A., McGee, P., & Seike, A. (2011). *Population Aging: Facts, Challenges, and Responses. Program on the Global Demography of Aging*. Harvard, Program on the Global Demography of Aging, Working Paper Series 71.

Blundell-Wignall, A., Hu, Y.-W. & Yermo, J. (2008). *Sovereign Wealth and Pension Fund Issues*. OECD Working Papers on Insurance and Private Pensions 14.

Chaney, B. A., Copley, P. A. & Stone, M. S. (2002). The effect of fiscal stress and balanced budget requirements on the funding and measurement of state pension obligations. *Journal of Accounting and Public Policy* 21, 287–313.

Cooley, T. F. & Soares, J. (1999). A Positive Theory of Social security Based on Reputation. *The Journal of Political Economy* 107(1), 135–160.

Davis, E. P. (1998). *Investment of Mandatory Funded Pension Schemes*. London: The Pensions Institute, Birkbeck College, Discussion Paper PI-9908.

Diamond, P.A. (1996). Proposals to Restructure Social security. *The Journal of Economic Perspectives*, 10(3), 67–88.

Ehrlich, I. & Kim, J. (2005). *Social security, Demographic Trends, and Economic Growth: Theory and Evidence from the International Experience*. NBER Working Paper 11121.

European Commission (2010). *Joint Report on Pensions: Progress and key challenges in the delivery of adequate and sustainable pensions in Europe*. European Economy Occasional Papers 71.

Feldstein, M. (1974). Social security, Induced Retirement, and Aggregate Capital Accumulation. *The Journal of Political Economy* 82(5), 905–926.

Garcia, M.T.M. (2004). An analysis of pension funds in Portugal. *Pensions: An International Journal* 9(3), 227–245.

Garcia, M.T.M. (2014a). An Appraisal of Public Pension Reserve Funds Management - Evidence From Portugal. *Mediterranean Journal of Social Sciences* 5(23), 333–341.

Garcia, M.T.M. (2005). Individual responsibility for the adequacy of retirement income. *Pensions: An International Journal* 11(3), 192–199.

Garcia, M.T.M. (2014b). Management of Pension Funds: the Case of Portugal. *International Journal of Latest Trends in Finance & Economic Sciences* 4(4), 792–802.

Garcia, M.T.M. & Lopes, E.G. (2009). The macroeconomic impact of reforming a PAYG system: The Portuguese case. *International Social Security Review* 62(1), 1–23.

Hemming, R. (1998). *Should Public Pensions be Funded?* The International Monetary Fund Working Paper 98/35.

Hess, D. & Impavido, G. (2003). *Governance of Public Pension Funds : Lessons from Corporate Governance and International Evidence*. The World Bank Policy Research Working Paper Series 3110.

IGFSS (2014). *FEFSS - Fundo de Estabilização Financeira da Segurança Social Relatório e contas 2014*. Porto: IGFSS.

Iglesias, A. & Palacios, R.J. (2000). *Managing Public Pension Reserves, Part I: Evidence from the International Experience*. Social Protection Discussion Paper 21311(0003).

Impavido, G. (2002). *On the Governance of Public Pension Fund Management*. The World Bank Policy Research Working Paper 2878.

Impavido, G. & Vittas, D. (2008). Improving the Investment Performance of Public Pension Funds : Lessons for the Social Insurance Fund of Cyprus from the Experience of Four OECD Countries. *Cyprus Economic Policy Review* 2(2), 3–35.

ISSA (2013). *ISSA Guidelines on Investment of Social security Funds*. Geneva: ISSA.

Laibson, D.I., Repetto, A. & Tobacman, J. (1998). Self-Control and Saving for Retirement. *Brookings Papers on Economic Activity* 29(1), 91–196.

Lane, P.R. (2001). The National Pensions Reserve Fund: Pitfalls and Opportunities. *Trinity Economics Papers* 20017.

Lesnoy, S.D. & Leimer, D.R. (1985). Social security and Private Saving: Theory and Historical Evidence. *Social security Bulletin* 48(1), 14-30.

Moffitt, R. (1984). Trends in Social security Wealth by Cohort. In: Moon, M., ed., (1984) *Economic Transfers in the United States*. Chicago: University of Chicago Press, 327-358. Available at: <http://www.nber.org/chapters/c8812>.

OECD (2015b). *Annual Survey of Large Pension Funds and Public Pension Reserve Funds: Report on pension funds' long-term investments 2015*. Paris: OECD.

OECD (2014). *Annual Survey of Large Pension Funds and Public Pension Reserve Funds: Report on pension funds' long-term investments 2014*. Paris: OECD.

OECD (2009). *OECD Guidelines for pension fund governance*. Paris: OECD.

OECD (2013). *Pensions at a Glance 2013: OECD and G20 Indicators*. Paris: OECD Publishing. Available from: http://dx.doi.org/10.1787/pension_glance-2013-en.

OECD (2015a). *Pensions at a Glance 2015: OECD and G20 Indicators*. Paris: OECD Publishing. Available from: http://dx.doi.org/10.1787/pension_glance-2013-en.

Palacios, R. & Whitehouse, E. (2006). *Civil-service Pension Schemes Around the World*. Social Protection Discussion Paper 0602.

Palacios, R.J. (2002). *Managing Public Pension Reserves, Part II: Lessons from Five Recent OECD Initiatives*. Social Protection Discussion Paper Series 0219.

Ponds, E., Severinson, C. & Yermo, J. (2011). *Funding in Public Sector Pension Plans: International Evidence*. OECD Working Papers on Finance, Insurance and Private Pensions 8, OECD Publishing.

Silva, C.M.P., Calado, J.P.T. & Garcia, M.T.M. (2004). The Financial Sustainability of the Portuguese Social security System. *The Geneva Papers on Risk and Insurance* 29(3), 417–439.

Stewart, F. & Yermo, J. (2010). *Options to Improve the Governance and Investment of Japan's Government Pension Investment Fund*. OECD Working Papers on Finance, Insurance and Private Pensions 6, OECD Publishing.

The World Bank (1994). *Adverting the old age crisis: policies to protect the old and promote growth*. New York: The World Bank.

Trianti, N. (2015). Portfolio Management in Public Pension Reserve Funds. *Estudios de Economía Aplicada* 33(3), 985–1008.

Tribunal de Contas (2015). *Parecer sobre a Conta Geral do Estado de 2014*

[online]. Lisbon: Tribunal de Contas. Available from:

http://www.eca.europa.eu/Lists/ECADocuments/POSITIONPAPER_2011/POSITIONPAPER_2011_PT.pdf.

Vittas, D. (1995). *Sequencing Social security, Pension, and Insurance Reform*. The World Bank Policy Research Working Paper 1551.

Vittas, D., Impavido, G. & O'Connor, R. (2008). *Upgrading the Investment Policy Framework of Public Pension Funds*. The World Bank Policy Research Working Paper 4499.

Yang, T. & Mitchell, O.S. (2005). *Public Pension Governance, Funding, and Performance: A Longitudinal Appraisal*. Pension Research Council Working Paper WP 2005-2, 157–178.

Yermo, J. (2008). *Governance and Investment of Public Pension Reserve Funds in Selected OECD Countries*. OECD Working Papers on Insurance and Private Pensions 15, OECD Publishing.

Yermo, J. (2007). *Reforming the Valuation and Funding of Pension Promises*. OECD Working Papers on Insurance and Private Pensions 13, OECD Publishing.

Legislative

Diário da República (D.R.). Assembleia da República - Lei n.º 17/2000, I Série - A 182 (8-8-2000) 3813-3825.

Diário da República (D.R.). Decreto-Lei n.º 35/2002, I Série - A 42 (19-2-2002) 1355-1359.

Joana Patrício, Master in Finance
The role of pension reserve funds in PAYG financial sustainability

Diário da República (D.R.). Lei n.º 4/2007, I Série 11 (16-1-2007) 345-356.

Diário da República (D.R.). Ministério do Emprego e da Segurança Social - Decreto-Lei n.º 259/89, I Série 186 (14-8-1989) 3277-3279.

Diário da República (D.R.). Ministério do Trabalho e da Segurança Social – Decreto-Lei n.º 187/2007, I Série 90 (10-5-2007) 3100-3116.

7. Appendix

Years	Synthetic Fertility Index
1970	3.00
1971	2.99
1972	2.85
1973	2.76
1974	2.69
1975	2.75
1976	2.81
1977	2.68
1978	2.45
1979	2.31
1980	2.25
1981	2.13
1982	2.08
1983	1.96
1984	1.91
1985	1.73
1986	1.67
1987	1.63
1988	1.62
1989	1.58
1990	1.57
1991	1.56
1992	1.54
1993	1.52
1994	1.45
1995	1.41
1996	1.45
1997	1.47
1998	1.48
1999	1.51
2000	1.55
2001	1.45
2002	1.47
2003	1.44
2004	1.41
2005	1.42
2006	1.38
2007	1.35
2008	1.40
2009	1.35
2010	1.39
2011	1.35
2012	1.28
2013	1.21
2014	1.23

Appendix 1 - Synthetic Fertility Index (Data Source: INE - Indicadores Demográficos, Source: PORDATA)

Joana Patrício, Master in Finance
The role of pension reserve funds in PAYG financial sustainability

Years	Active Population	Social security Total Pensioners	Ratio Active/Pensioner
1974	3 910 100	701 561	5.57
1975	3 933 100	861 705	4.56
1976	4 072 200	1 051 836	3.87
1977	4 124 300	1 221 856	3.38
1978	4 142 700	1 433 079	2.89
1979	4 239 000	1 550 651	2.73
1980	4 293 200	1 656 147	2.59
1981	4 367 200	1 719 685	2.54
1982	4 306 600	1 797 692	2.40
1983	4 840 400	1 846 744	2.62
1984	4 783 900	1 898 085	2.52
1985	4 767 000	1 940 896	2.46
1986	4 767 800	1 977 355	2.41
1987	4 808 100	2 037 334	2.36
1988	4 851 700	2 126 623	2.28
1989	4 907 900	2 177 872	2.25
1990	4 991 000	2 202 255	2.27
1991	5 101 600	2 230 326	2.29
1992	4 737 200	2 266 641	2.09
1993	4 715 100	2 314 662	2.04
1994	4 773 000	2 336 414	2.04
1995	4 754 300	2 364 250	2.01
1996	4 788 800	2 390 004	2.00
1997	4 854 500	2 414 790	2.01
1998	5 100 100	2 431 571	2.10
1999	5 151 400	2 440 771	2.11
2000	5 247 300	2 480 268	2.12
2001	5 342 400	2 528 926	2.11
2002	5 414 300	2 563 966	2.11
2003	5 433 800	2 593 494	2.10
2004	5 421 400	2 649 886	2.05
2005	5 461 400	2 696 957	2.03
2006	5 499 600	2 738 781	2.01
2007	5 533 100	2 782 756	1.99
2008	5 534 600	2 817 837	1.96
2009	5 486 100	2 859 260	1.92
2010	5 489 700	2 896 065	1.90
2011	5 428 300	2 943 645	1.84
2012	5 382 600	2 981 635	1.81
2013	5 284 600	3 001 520	1.76
2014	5 225 600	2 987 182	1.75

Appendix 2 - Active Population per Pensioner (Source Data: INE - Inquérito ao Emprego, IGFSS/MSESS until 1998 and ISS/MSESS from 1999, Source: PORDATA)

Joana Patrício, Master in Finance
 The role of pension reserve funds in PAYG financial sustainability

Years	Total Pension per Year
1970	38.6
1971	38.3
1972	45.1
1973	40.0
1974	53.4
1975	67.7
1976	86.0
1977	101.8
1978	114.3
1979	135.9
1980	193.3
1981	236.1
1982	281.4
1983	340.7
1984	404.6
1985	484.3
1986	614.2
1987	740.1
1988	843.7
1989	939.1
1990	1 180.2
1991	1 364.6
1992	1 548.1
1993	1 701.4
1994	1 833.3
1995	1 962.0
1996	2 096.3
1997	2 204.7
1998	2 350.8
1999	2 547.8
2000	2 616.2
2001	2 795.6
2002	2 979.2
2003	3 129.9
2004	3 310.2
2005	3 489.0
2006	3 637.9
2007	3 780.7
2008	3 940.2
2009	4 064.6
2010	4 170.5
2011	4 226.4
2012	4 130.0
2013	4 384.8
2014	4 444.9

Appendix 3 - Average year pension of the Social security System (Data source: IGFSS/MSESS until 1998 and ISS/MSESS from 1999, Source: PORDATA)

Joana Patrício, Master in Finance
The role of pension reserve funds in PAYG financial sustainability

Year	Real Estate Disposition	Transfers	Total Received	Accumulated
1989 to 1996			259 486 439,81	259 486 439.81
1997	20 402 064.55	498 797 897.07	519 199 961.62	778 686 401.43
1998	2 865 184.58	553 665 665.74	556 530 850.32	1 335 217 251.75
1999	10 868 492.90	553 665 665.75	564 534 158.65	1 899 751 410.40
2000	9 389 350.81	650 105 246.35	659 494 597.16	2 559 246 007.56
2001	4 694 704.74	611 853 433.22	616 548 137.96	3 175 794 145.52
2002	4 660 069.76	807 931 560.70	812 591 630.46	3 988 385 775.98
2003	22 500 537.39	392 655 010.00	415 155 547.39	4 403 541 323.37
2004	-	30 215 872.38	30 215 872.38	4 433 757 195.75
2005	-	6 101 099.47	6 101 099.47	4 439 858 295.22
2006	20 275 026.00	120 349 270.00	140 624 296.00	4 580 482 591.22
2007	15 925 883.64	618 028 530.72	633 954 414.36	5 214 437 005.58
2008	13 763 066.59	1 078 115 722.54	1 091 878 789.13	6 306 315 794.71
2009	3 814 031.37	512 181 731.72	515 995 763.09	6 822 311 557.80
2010	23 484 568.50	200 000 000.00	223 484 568.50	7 045 796 126.30
2011	4 022 141.25	293 007 652.06	297 029 793.31	7 342 825 919.61
2012	2 769 951.06	-	2 769 951.06	7 345 595 870.67
2013	3 433 812.79	-	3 433 812.79	7 349 029 683.46
Total	162 868 885.93	6 926 674 357.72	7 089 543 243.65	7 349 029 683.46

Appendix 4 - Total Amount Received from the FEFSS (Source: FEFSS - Relatório e Contas 2013)