



Factors influencing sustainability of the Public Pension System in Portugal: a perspective of certified accountants

Master degree in Corporate Finance

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Leiria, March 2025



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Master's thesis carried out under the guidance of Doctor Cristina Isabel Branco de Sá, Professor at the School of Technology and Management of the Polytechnic Institute of Leiria and Doctor Tânia Cristina Simões de Matos dos Santos, Professor at the School of Education and Social Sciences of the Polytechnic Institute of Leiria.

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Dedication

O primeiro agradecimento, não podia deixar de ser para as minhas orientadoras, à Doutora Cristina Isabel Branco de Sá, Professora da Escola Superior de Tecnologia e Gestão do Instituto Politécnico de Leiria e à Doutora Tânia Cristina Simões de Matos dos Santos, Professora da Escola Superior de Educação e Ciências Sociais do Instituto Politécnico de Leiria, gratidão pela vossa ajuda, pelas críticas construtivas, que me desafiaram a pensar, pelo rigor demonstrado, pelo apoio ao longo deste percurso e mais importante pelos ensinamentos valiosos que me foram transmitindo.

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Um grande bem-haja a todos!

Resumo

A presente dissertação tem como principal objetivo perceber quais os fatores que, na perspetiva dos contabilistas certificados mais influenciam a sustentabilidade do sistema público de pensões em Portugal, nomeadamente demográficos, sociais, macroeconómicos, financeiros e às políticas governativas destinadas a fazer face à redução do rendimento na idade da reforma. Tal posiciona-se como significativo, já que os contabilistas certificados com a sua experiência e formação em contabilidade, finanças e gestão de riscos, são os profissionais a serem consultados, para assegurar que se implementem boas práticas financeiras e operacionais que favoreçam a sustentabilidade do sistema público de pensões a longo prazo.

A temática da sustentabilidade financeira do sistema público de pensões em Portugal tem sido amplamente debatida e assume particular importância face à evolução demográfica e o actual contexto económico, causando pressão sobre o financiamento do sistema, cujo objectivo é garantir prestações em substituição dos rendimentos auferidos em determinadas contingências, funcionando em sistema de repartição. De modo a melhorar a compreensão deste tema, iremos analisar a evolução do sistema público de pensões em Portugal, cuja história se confunde com a história evolutiva da Segurança Social, as principais características e as reformas mais recentes. Analisaremos também a pensão de velhice no seu propósito.

Adotaremos uma metodologia de análise quantitativa, recorrendo à construção de quatro modelos de regressão linear para determinar quais os fatores que mais influenciam o sistema público de pensões em Portugal, na perspetiva dos contabilistas certificados, concluindo que são os fatores financeiros. A variável fatores financeiros é composta por: financiamento da SS via orçamento do Estado, contribuições das entidades empregadoras, contribuições dos trabalhadores e capitalização individual, sendo este o conjunto de variáveis que mais influência positivamente a sustentabilidade do sistema publico de pensões em Portugal. Os efeitos demográficos migratórios, o fator de sustentabilidade aplicado às reformas antecipadas (corte aplicado) e a taxa de crescimento real dos salários, são as variáveis que se destacam nos quatro modelos.

Palavras-chave: Sustentabilidade, sistema de pensões, segurança social, fatores financeiros, contabilistas certificados.

Abstract

The main objective of this dissertation is to understand which factors, from the perspective of certified accountants, most influence the sustainability of the public pension system in Portugal, namely demographic, social, macroeconomic, financial and government policies aimed at addressing the reduction in income at retirement age. This is positioned as significant, since certified accountants, with their experience and training in accounting, finance and risk management, are the professionals to be consulted to ensure that good financial and operational practices are implemented that favour the sustainability of the public pension system in the long term.

The topic of financial sustainability of the public pension system in Portugal has been widely debated and assumes particular importance given demographic evolution and the current economic context, causing pressure on the financing of the system, whose objective is to guarantee benefits, in replacement of income earned, in the event of certain contingencies, operating in a retribution system. To improve understanding of this topic, we will analyse the evolution of the public pension system in Portugal, whose history is intertwined with the evolutionary history of Social Security, the main characteristics and the most recent reforms. We will also analyse the old-age pension in its purpose.

We will adopt a quantitative analysis methodology, using the construction of four linear regression models to determine which factors most influence the public pension system in Portugal, concluding that it is the financial factors that, from the perspective of certified accountants, most influence the public pension system in Portugal. The variable financial factors made up of SS financing through the State budget, employers contributions, workers contributions and individual capitalisation, are the set of variables that most positive influence on the sustainability of the public pension system in Portugal. The demographic migratory effects, the sustainability factor applied to early retirements (cut applied) and the real wage growth rate are the variables that stand out in the four models.

Keywords: Sustainability, pension system, social security, financial factors, certified accountants.

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List of Abbreviations and Acronyms

ALE	Average life expectancy
AP	Ageing population
CA	Certified accountants
CASI	Certified accountants sustainability index
CECC	Count of the entire contributory career
CPI	Consumer price index
DFSI	Demographic factors sustainability index
EC	Employer contributions
EGR	Employment growth rate
EU	Europe Union
FSF	Financial factors
GDP	Gross domestic product
GDPGR	Gross domestic product growth rate
GRF	General retirement fund
IC	Individual capitalisation
ILO	International labour organization
ILRA	Increase in legal retirement age
IMF	International monetary fund
INE	Instituto Nacional Estadística
ME	Migration effects
MFFSI	Macroeconomic and financial factors sustainability index
MP	Minimum pension
OECD	Organization for economic co-operation and development
PAYG	Pay-as-you-go
PGR	Productivity growth rate
PPS	Public pension system
RAUR	Review of the annual update rule
RER	Restriction of early retirements
RIR	Real inflation rate
RWGR	Real wage growth rate
SBF	State budget financing
SFCA	Sustainability factor (applied cut)
SFGPSI	Social factors and government policies sustainability index
SFI	Synthetic fertility index
SS	Social security
SSI	Social support index
SSFsf	Social security financial stabilisation fund
UB	Unemployment benefits
UGR	Unemployment growth rate
WC	Workers contributions

1. Introduction

1.1. Framework

The social security (SS) is the institution in Portugal that aims to guarantee the fundamental rights and equal opportunities of citizens, as well as to promote the well-being and social cohesion of all Portuguese citizens and foreigners who work or reside on Portuguese territory. It is divided into three systems: the citizenship social protection system, the welfare system and the complementary system.

The citizenship social protection system is part of the SS system, whose objective is to guarantee the right to a minimum subsistence to citizens in situations of economic difficulties. It operates through three subsystems: the social action subsystem, the solidarity subsystem and the family protection subsystem, that are financed by transfers from the State budget and tax revenues. The welfare system is the contributory component of SS, which aims to guarantee benefits in replacement of income earned in the event of certain contingencies. It is made up of the pay-as-you-go system (PAYG) which is divided into: mandatory regime and voluntary regime. The complementary SS system comprises three different schemes: the public scheme of capitalisation of voluntary individual membership, the organisation and management of which is the responsibility of the State, the complementary collective initiative scheme of an optional institution and the complementary scheme of optional individual initiative.

When the book *Livro Branco da Segurança Social* was published in 1998, Comissão do Livro Branco da Segurança Social, (1998), the first predictions of financial difficulties for the SS after 2020 emerged and the sustainability of the public pension system (PPS) was called into question and has been the subject of debate in national and European political circles. This debate gained new momentum after the 2008 crisis and the fiscal adjustment process that began in 2011.

While some authors still believe in the sustainability of the PPS in Portugal, others consider the PPS to be unsustainable, and this issue is a point of contention in the Portuguese political arena. In Portugal, as in other countries, the financial sustainability of the PPS depends on the coexistence of three major factors: demographic (working population currently contributing and pensioners receiving benefits), governmental (tax policy and social factors) and economic (economic development and the ability of taxpayers to honor their contractual commitments). Within this generality of factors, we have chosen to broaden and detail these two groups, governmental and economic, in

order to provide a richer and more precise analysis, while maintaining the demographic group. The governmental group now includes social factors in addition to government policies, since both have influence on the sustainability of the PPS and the economic group was subdivided into two categories: one for macroeconomic factors, which refer to the general performance of the economy and another for financial factors, which focus on more specific issues of the pension system.

We highlight demographic factors, which directly affect the working population that contributes to the pension system and the relationship between workers and pensioners. This relationship is central, as the sustainability of PPS depends on the number of workers who contribute and the number of pensioners. These demographic factors are seen as a subcategory of a broader demographic analysis, in which we include the synthetic fertility index, average life expectancy, ageing population and migration effects.

Government policies can range from decisions on taxation to the implementation of public policies aimed at social well-being and economic sustainability, in this context, refers to government policies and social factors, which are fundamental in determining how resources are distributed and how the SS system is sustained over time. The analysis was taken to a deeper level by defining government policies as the new measures aimed at addressing the reduction of retirement income. These measures include: counting the entire contributory career to calculate the old-age pension, applying restrictions on early retirement with introduction of the sustainability factor (cut applied) which is indexed to the average life expectancy indicator, reviewing of the annual update rule, with indexation of old-age pensions linked to the average real GDP growth and the CPI, and increase in the legal retirement age, as social factors were considered attribution of minimum pension and unemployment benefits.

Economic growth is crucial to ensure that the country has sufficient resources to support old-age pensions and other social benefits. These factors also take into account economic resilience in the face of crises and changes in the global environment. We have chosen to subdivide them into macroeconomic factors and financial factors. Macroeconomic factors are fundamental to assessing a country's economic health and have significant impacts on the sustainability of the PPS, which is why we chose to analyse the GDP growth rate, the employment growth rate, the productivity growth rate, the real wage growth rate, the real inflation rate and the unemployment growth rate. The financial factors we have defined are based on the funding of the pension system in Portugal, which is provided by different sources, each with specific characteristics that

influence the financial sustainability of the system. Funding is provided by the State budget, employers contributions, workers contributions and individual capitalisation.

1.2.Objectives

This Master's thesis aims to explore which factors most influence the sustainability of public pension system in Portugal, from the perspective of certified accountants (CA). The sustainability of the public pension system in Portugal is a complex issue, shaped by several economic, demographic, social and institutional factors that certified accountants with their expertise, can offer a unique perspective on these dynamics. We seek to do this through a questionnaire that aims to explore the perception of certified accountants on the impact they attribute to demographic, social, government policies, macroeconomic and financial factors, on the sustainability of the public pension system.

We will adopt a quantitative methodology, which involves the research design, sample definition, data collection, statistical analysis and finally the interpretation of the results. Through a questionnaire developed for the certified accountants, on which factors most influence the sustainability of the public pension system in Portugal.

The sustainability of the public pension system in Portugal is influenced by various factors. Based on the literature review, we considered demographic factors such as synthetic fertility index (SFI), average life expectancy (ALE), ageing population (AP) and migration effects (ME). For social factors we took into account the unemployment benefits (UB) and minimum pension (MP) and for government policies we consider the variables: count of the entire contributory career (CECC), sustainability factor (applied cut) (SFAC), restriction of early retirements (RER), review of the annual update rule (RAUR) and increase in the legal retirement age (ILRA). Macroeconomic factors, considered are gross domestic product growth rate (GDPGR), employment growth rate (EGR), productivity growth rate (PGR), real wage growth rate (RAGR), real inflation rate (RIR), unemployment growth rate (UGR). Finally financial factors include State budget financing (SBF), employers contributions (EC), workers contributions (WR) and individual capitalisation (IC).

Therefore, the research question derived from this dissertation will be: from the perspective of certified accountants, what are the factors that most influence sustainability of the public pension system in Portugal? This study constitutes a contribution to the debate currently focused on demographic issues and directs the discussion to other variables, such as macroeconomic and financial factors and also government policies that may affect the sustainability of the public pension system.

1.3. Structure

This master's thesis includes in this first chapter, a brief introduction and the description of the investigation objectives.

The second chapter provides an overview of the public pension system in Portugal, outlining its main characteristics, recent reforms, the purpose of old-age pensions and eligibility criteria.

Chapter three contains literature review, and the various multifaceted and wide-ranging factors that influence the functioning and effectiveness of the public pension system. These factors are: demographic, social, government policies including new measures aimed at addressing the reduction of retirement income, macroeconomic and financial factors.

In fourth chapter, we present the investigation methodology and research hypothesis, in order to assess the perceptions of CA regarding the factors that most influence the sustainability of the PPS, using multiple linear regression models for analysis.

In fifth chapter, the results obtained are presented, starting with a descriptive statistic, an analysis of the demonstration between the variables, the results obtained through the linear regression models developed, on which we analysed their variance, the tests of the coefficients, the coefficients of determination and also the verification of compliance with the assumptions underlying the linear regression models. Chapter five ends with validation of hypothesis test.

The six chapter summarizes the conclusions drawn from the research, the results of empirical study and future investigations.

2. Public pension system in Portugal

We begin chapter two with a theoretical framework of the PPS in Portugal, referring to its structure, sources of financing and government policies that we consider relevant¹.

This chapter is divided into four parts: the first part is devoted to the evolution and major features as well recent reforms of the system and the second part: purpose of the old-age pension and eligibility criteria.

2.1. Evolution and major features

The first steps of social assistance in Portugal date back to the founding of the nationality, with efforts by monarchs and religious orders to protect those in need. The first *Santa Casa da Misericórdia* appeared in Lisbon in 1498 as a result of the special intervention of Queen Leonor with the full support of King Manuel I. It would become a pillar of private medical care and social action, while the *Casa Pia* in Lisbon, in the 18th century, marked the beginning of public assistance. After the establishment of the Republic, recognition of the role of the State in providing assistance progressed slowly until the 1940s. However, as social needs have become more complex, state involvement has become more significant coordinate with *Santa Casa da Misericórdia*, a long-standing social solidarity institution in Portugal.

Workers associations in the 19th century encouraged the growth of mutual aid associations, which offered medical assistance and disability benefits. However, protection was insufficient, especially with regard to old-age, which led to the creation of retirement funds. In 1919, five legislative diplomas represented the first attempt at a compulsory social insurance system for low-income workers, providing for a Compulsory Social Insurance Institute, but this legislation was not implemented due to the lack of political conditions. It was only in 1935 that were established the bases for a mandatory SS system, covering workers in various areas and offering benefits for illness, disability and old-age, administered by union pension funds. This first structured SS system had a very limited scope of action. The agricultural and fishing sector now has specific social protection system.

¹ Source: oficial web page of Social Securiry – <https://www.seg-social.pt/evolucao-do-sistema-de-seguranca-social>

In 1962, a reform was carried out through, that resulted in several changes. The financial balance regime of SS institutions changed from strict capitalisation system, where contributions made by workers were saved and accumulated for their individual future pensions, to a mitigated capitalisation system. Under this new system, the focus shifted to a more collective form of financing with a greater reliance on a PAYG system where the funds collected from current workers were used to pay for the pensions of current pensioners, which allowed the improvement of existing benefits and the extension of protection to maternity and family responsibilities. The reform aimed to cover a greater number of workers in the social protection system, and this included the introduction of independent workers (freelancers, independent professionals, traders, among others) in their various forms. To bring SS institutions closer to workers and their families, the territorial base became predominantly regional, with the exception of disability, old-age and death, which were covered by the *Fundo Nacional de Previdência Complementar*.

A new national institution, *Fundo Nacional de Seguro de Doenças Profissionais*, was created, integrating the risk of occupational diseases into the system. With the internationalisation of the system, the *Caixa Central de Segurança Social dos Trabalhadores Migrantes* began to operate, connecting Portuguese SS institutions with their counterparts abroad. Furthermore, the work accident protection regime was reformulated, maintaining the employer's direct responsibility and the obligation to transfer this responsibility to insurance companies.

Between 1970 and the introduction of the first legal framework in 1984, Lei de Bases n.º 28/84 da Assembleia da República, (1984), decisive measures were implemented for social protection, especially aimed at the rural population, with the creation of the agricultural workers pension scheme, a transitional scheme focused on offering pensions to agricultural workers in vulnerable situations due to disability or old-age, who are not covered by *Casas do Povo* nor are beneficiaries of union pension funds. These achievements were fundamental for the construction of the SS system that would emerge after April 25th of 1974, based on the constitutional right to social protection. Unemployment benefits were introduced, and new benefits were created for pensioners, including the Christmas bonus.

In 1977, the scope of the social pension was expanded. Originally, the social pension was intended only for a very restricted group of people, generally in situations of extreme need and without other sources of income, social pension was fundamental to the creation of the minimum social protection scheme, which guaranteed health and SS

benefits to all citizens, regardless of employment relationships or contributions, according to Despacho Normativo n.º 59/77, de 23 de fevereiro, (1977).

From 1977 to 1983, the non-contributory scheme, replaced the minimum scheme, limiting access to benefits to the most disadvantaged citizens based on verification of their resources. Among the main reforms during this period, we highlight the approval of the regime for displaced persons, Despacho Normativo n.º 152/77, de 21 de junho, (1977), the inclusion of domestic workers in the general SS regime, Decreto Regulamentar n.º 43/82, de 22 de julho, (1982), the voluntary SS regime, Decreto-Lei n.º 368/82, de 10 de setembro, (1982), the creation of the regime for independent workers, Decreto-Lei n.º 8/82, de 18 de novembro, (1982) and reformulation of the social protection system for rural workers, Decreto-Lei n.º 251/83, de 11 de junho, (1983). Finally, a new legal regime of contributions was implemented to ensure greater rigour in payment and settlement of debts, Decreto-Lei n.º 103/80, de 9 de Maio, (1980).

In 1984, the first legal framework on SS was approved Lei de Bases n.º 28/84 da Assembleia da República, (1984), aiming at the protection of workers and their families in situations of incapacity for work, unemployment and death, as well as offering compensation for family burdens and protecting people with insufficient means of subsistence. The law gave rise to specific regulations, such as unemployment benefits, linked to the duration and amount of contributions, and work lost, and a social unemployment benefit for workers with shorter contribution careers. The problem of youth unemployment and long-term unemployment is a focus in Europe, leading the SS to implement support measures, such as exemption from contributions for employers who hire young people and long-term unemployment beneficiaries, also hiring disabled people are entitled to a reduction in contributions, Decreto-Lei n.º 299/86, de 11 de setembro, (1986).

Funding for the general scheme is guaranteed by the SS budget, which comes from contributions from workers and employers, while the non-contributory scheme and social action are supported by state transfers. The single social tax, in force since 1986, establishes contributions of 11% for workers and 24% for employers. In addition, complementary occupational schemes are regulated, Decreto-Lei n.º 140-D, de 14 de junho, (1986).

The 90s of the 20th century were marked by four fundamental diplomas, all published on September 3, 1993, which defined the structure of the SS system, Decreto-Lei n.º 326/93, Decreto-Lei n.º 327/93, Decreto-Lei n.º 328/93 and Decreto-Lei n.º 329/93, (1993). Reintroduced the disaggregation of the global contribution rate, specifying the

value of the rate for each eventuality. The right to SS was guaranteed to members of statutory schemes and managing partners, while the regime for self-employed workers was reformulated, they now have coverage equivalent to that of employees, with two benefit schemes: one mandatory for maternity, disability, old-age and death and another optional for illness and family expenses. New ways of financing pensions were defined, with the introduction of adjustments that aimed to increase the viability and sustainability of the PPS, especially in the face of fiscal and demographic challenges. As part of the non-contributory system, the guaranteed minimum income was created, which includes a cash benefit and a social integration programme, Decreto-Lei n.º 196/97, de 31 de julho, (1997). Measures were established to support workers in older age groups, increasing the duration of unemployment benefits and introducing partial unemployment benefit. Several reforms were also implemented in the area of pensions, including the creation of the 14th month's pension, Portaria n.º 470/90, de 23 de junho, (1990) and the regulation of pre-retirement for workers aged 55 and over, Decreto-Lei n.º 261/91, de 25 de julho, (1991).

The legal regime for invalidity and old-age pensions is undergoing significant reform. One of the main points is the enshrinement of equal treatment between men and women, standardising the age of access to the old-age pension to 65, with a transitional period of six years due to women's longer life expectancy and the existence of shorter careers, Decreto-Lei n.º 329/93, de 25 de setembro, (1993). The guarantee period for old-age pensions has changed from 10 to 15 years, while the period for invalidity pensions is maintained (3 years). The formula for calculating pensions has also been revised, taking into account the 10 best years of contributions in the last 15, so that the reference remuneration better reflects the last period of the professional career.

There was also a reform of the legal framework for the creation of pension funds, with the creation of the Social Security Financial Stabilisation Fund (SSFSF), Decreto-Lei n.º 115/98, de 4 de maio, (1998), aimed at financial stabilisation and the management of capitalised assets. In addition, the legal system for setting up pension funds was reformed and, regarding SS contributions, the overall rate was set at 34.75%, distributed between the employer (23.75%) and the employee (11%).

Between 2000 and 2002, with the second legal framework, Lei n.º 17/2000, de 8 de agosto, (2000), everyone's right to SS was renewed, with the effectiveness and efficiency of its management and financial sustainability. Although the designations have changed, the objectives and composition of the system, as well as the personal and material universe of benefits, have not undergone major changes.

2.2.Recent reforms

Since the beginning of 2000 and following the publication of the *Livro Branco da Segurança Social* in 1998, which predicted financial difficulties for SS after 2020 (*Comissão do Livro Branco da Segurança Social, 1998*), the sustainability of PPS in Portugal has been the subject of debate in the national and European political arena and among several authors (Ferreira et al., 2016). This debate gained new momentum following the 2008 crisis and the fiscal adjustment process initiated in 2011, and in particular an International Monetary Fund (IMF) report on how to reform public sector spending in Portugal (IMF, 2013).

Like other European countries, although with some delay, the old-age pension system in Portugal became progressively universal and financed by a PAYG scheme during the 1960s and 1970s (Cunha et al., 2009). In the 1970s, this was extended to agricultural workers, self-employed people and housewives. However, in the mid-1970s, Portugal still had a very low degree of social protection coverage (including pensions). From 1974 onward, the social protection system expanded considerably, with Portugal being one of the European countries where social expenditure grew the most between 1980 and 2014. This increase was due, not only to policies to expand social protection, especially in the 1980s and 1990s, but also to the natural maturation of the pension system (increase in the number of pensioners and retirement of workers with higher wages and longer contributory careers) (Lagoa & Barradas, 2019).

In the 2000s, the first measures were taken to contain spending on pensions. In 2002, the new SS legal framework changed reference wages to the calculation of the pension, which since 1994 were the wages of the best 10 years of the last 15. The change was in the sense that pensions began to depend on the wages of the entire contributory career, which had negative effects on the value of new pensions. The legal framework provided for convergence between MP and the national minimum wage, continuing an objective present since 1998. This law opened the possibility of pension ceiling, something that was never regulated and applied until 2007 reform. From 2006 onward, the convergence between the General Retirement Fund for public Employees (denominated *Caixa Geral Aposentações*) rules and those of the SS, continuing the path that started in 1993.

The new public employees funds began to be integrated into SS and the GRF became a closed system. The CRF was a public scheme, for State workers, established and managed by the government through the PAYG system.

This subsystem includes public servants and agent's administrative subscribers registered until December 31, 2005, the date from which the system was closed² for the registration of new subscribers according to legislation Decreto-Lei n.º 229/2005, Ministério das Finanças e da Administração Pública, (2005). In 2006, the convergence of the GRF rules with those of SS began, meaning that the GRF presents a considerable structural deficit covered by the State budget.

The most striking reform was that of 2007, whose emblematic measure was the introduction of the sustainability factor. Other notable changes include the acceleration of implementation of the calculation formula for the entire contributory career, change in the indexation rule for pensions, introduction of maximum ceilings on reforms and promotion of active ageing.

Following EU guidelines and with the aim of ensuring sustainability system's financial situation in the face of adverse demographic developments, the value of the old-age pension began to depend on the average life expectancy at age 65 – a sustainability factor. To understand the operation of this factor, let us take into account that the pension is calculated according to the following formula:

$$\text{Pension} = \text{Reference income} * \text{Accrual rate} * \text{Sustainability factor}$$

The reference income is the average income during the revalued discount years using the inflation rate. The accrual rate is 2% for each year of contribution with 20 or fewer years of contribution. Over 20 years of age, the rate varies between 2% and 2.3%, being lower for taxpayers with higher income. The calculation of the sustainability factor is given by the quotient between the average life expectancy at 65 years of age verified on 31/12/2000 and the average life expectancy, also at 65 years of age, verified in the year before the start of the old-age pension.

As can be seen from the formula, the old-age pension is calculated as a fixed percentage (but adjustable depending on the sustainability factor) of the reference income – this is a defined benefit system.

The increase in average life expectancy at the time of retirement reduces the value of new old-age pensions, both SS and GRF, but does not affect the value of those already

² From January 1, 2006, the GRF became a closed system and stopped receiving new subscribers.

in payment. There was a transition period for the application of the new rules and, in addition, the individuals could choose to work longer beyond the age of 65 (the legal retirement age at the time) so as not to be penalised by the increase in average life expectancy.

A second measure of the 2007 reform was the acceleration of the consideration of the entire contributory career for the calculation of the old-age pension, continuing what had already been started in 2002. A transitional regime was foreseen to protect workers registered before 2001.

Thirdly, the reforms made changed the way in which pension payments were indexed, which were no longer solely related to inflation but also began to be associated with economic growth. When real GDP growth is less than 2%, only pensions smaller than 1.5 Social Support Index (SSI) are updated to the inflation rate, while the others see their purchasing power decrease. Additionally, the indexation of MP is no longer made to the net national minimum wage, it now takes SSI into account.

Fourthly, the 2007 restructuring introduced measures to promote active ageing, subsidising the pension of workers who retire after 65 years of age through a monthly rate. On the contrary, the anticipation of the reform date suffered an additional penalty.

Fifthly, a maximum ceiling was introduced for the highest pensions (equal to 12 SSI), but this does not apply to pensions that are calculated based on earnings over the entire contributory career. Finally, a public system of real capitalisation in individual accounts was established, financed by workers' contributions and voluntary membership.

The 2007 reform significantly reduced public expenditure on SS and GRF, with a reduction of 0.9 p.p. in 2020 and a projected reduction of 4 p.p. in 2060, according to Cunha et al. (2009), more than half of this reduction is explained by the introduction of the sustainability factor.

The counterpart to the improvement in the financial balance of the PPS was the reduction in the value of new pensions. As a result of the application of the sustainability factor and the use of remuneration from the entire contributory career, pensioners now have a lower replacement rate. This reduction frustrated people's expectations and particularly affected pensioners with lower income (any reduction in an already low pension is significant), leading Mendes (2011, as cited by Lagoa & Barradas, 2019) to argue that lower income should not be subject to the application of the sustainability factor.

The application of the sustainability factor reduces the value of the pension, whose update over time won't necessarily follow inflation, depending on the economic growth that occurs each year. Taking into account the recent growth figures in Portugal, the requirement that real GDP growth be greater than 2% for pensions between 1.5 SSI and 6 SSI to keep up with inflation is considerably high, leading to proposals that update reference should be 2% nominal GDP growth.³

Minimum pensions, as the SSI began to be used as a reference⁴, grew less than the national minimum wage from 2007 onward, according to Moreira, (2019). The same author states that this occurred, despite one of the main objectives of the PPS, having become about reducing poverty among the elderly, rather than maintaining income equivalent to the last wage. In fact, an element that may have contributed to the lower growth in MP was the solidarity supplement for the elderly, introduced in 2005 to reduce poverty among the elderly. More recently, several measures were taken to accelerate the convergence between the GRF and SS, namely the increase in the single social tax of public employees from 10% to 11%, in 2011, and the increase in the State's contribution rate from 15% to 23.75%, in 2013 and 2014.

In 2013 there was a relevant change in the sustainability factor, with gains in average life expectancy at age 65 now being compared with the year 2000 and not with 2006, which made this factor more penalising. On the other hand, the legal retirement age was set at 66 years in 2014 and became linked to average life expectancy. The sustainability factor is now only applied in the case of early retirement.

The only countries that have chosen to radically reform their existing pension systems are: Italy, the United Kingdom and Sweden. Portugal, along with other European countries, continues to conform to parametric reforms that have improved its sustainability promptly.

2.3.Purpose of old-age pensions

Pensions serve several purposes (Brown, 2008), such as providing a replacement income at retirement age. They also provide security by reducing poverty, covering risk

³ Pension increases for 2024 are: - Pensions up to 2 SSI (inclusive): increase of 6%; Pensions between 2 and 6 SSI: increase of 5.65%; Pensions between 6 and 12 SSI: increase of 5%

⁴ Also in 2024, SSI will increase by 6%, from 480.43 euros to 509.26 euros.

and illness, protecting spouses and children in the event of the beneficiary's death (Barr, 2012).

Social security in Portugal, according to Ferrera (1996) fits in a social model from South European countries. This model is characterised by a social protection system that provides a minimum safety net for those who are excluded from the labour market, such as the unemployed, precarious workers or people on low incomes. The emphasis is therefore on basic protection, rather than extensive and universal coverage. Universal access to health services, inspired by the Beveridge⁵ model, was implemented in Portugal in 1979 and aims to ensure that all citizens, regardless of their economic status, have access to health care. Joining private SS or health schemes is not particularly common in Portugal (Lagoa & Barradas, 2019). The SS system is the institution in Portugal that aims to guarantee the fundamental rights and equal opportunities of citizens (Egorov, 2016), as well as to promote the well-being and social cohesion of all Portuguese citizens or foreigners who work or reside on Portuguese territory. It is divided into three systems: the citizenship social protection system, the SS system and the complementary system, as defined in Lei de Bases n.º 4/2007 da Assembleia da República, (2007). In turn, the SS system is divided into three basic pillars: the social protection and citizenship system, the complementary system and the welfare system, on which the approach of this study falls (includes old-age pensions and unemployment), although divided into three pillars that include: public old-age pensions, occupational pensions and individual private pensions.

The citizenship social protection system is the pillar that aims to guarantee the right to a minimum subsistence to citizens in situations of economic hardship, to prevent and eradicate poverty situations, social exclusion, disability and dependency. It comprises three subsystems, the social action subsystem, the solidarity subsystem and the family protection subsystem, which are financed by transfers from the State budget and by tax revenues, see organisational chart in [Appendice 1](#).

⁵ Beveridge system appeared in 1942 in England, was uniform and universal and made up of five pillars: needs, illness, ignorance, lack and unemployment.

The complementary system is an alternative to the mandatory contribution system, composed of three different schemes: the public scheme of capitalisation of voluntary individual adherence, whose organisation and management is the State's responsibility, with the primary purpose of providing benefits complementary to those provided by SS, the complementary collective initiative scheme of an optional employer fund or professional groups for the benefit of their employees and the complementary scheme of the optional individual initiative, implemented through pension plans, life insurance, capitalisation insurance and mutual. Unfortunately, in Portugal, supplementary private pension systems have never had a large scale, always covering a percentage of less than 5% of the active population (Bravo, 2021).

Based on the concept of professional solidarity⁶, the welfare system is the contributory part of SS that aims to guarantee, cash benefits that replace income from work lost due to the occurrence of legally defined eventualities such as unemployment, illness, or pension for old-age (Perreira et al., 2023). It consists of the PAYG system, which is separated into three parts: the mandatory regime, which covers salaried workers, self-employed people, and those registered in legal schemes, see organisational chart in [Appendice 2](#), the special regime which includes workers of specific professional groups and the voluntary regime, which includes voluntary social insurance and voluntary contribution payment. The pension system is an insurance and a means of transferring income to the retirement period, but it is also an instrument to reduce poverty and inequality (Lagoa & Barradas, 2019). In view of rapid ageing and the need to implement measures that guarantee the sustainability of the PPS, political decision-makers have changed the rules for accessing old-age pension.

According to Lagoa & Barradas (2019), Moreira (2019) and Murteira (2020) in 2002, old-age pension began to be calculated based on remuneration of the entire contributory career and in 2007 was introduced the sustainability factor (Garcia, 2017) linked to the average life expectancy. According to Portaria n.º 292/2022 de 9 Dezembro, (2022), “the normal age for access to the old-age varies depending on the average life expectancy at 65 years of age, verified between the second and third year before the start of the pension”. Therefore, the normal age for accessing the old-age pension under the general SS regime in 2024, is 66 years and 4 months. In an attempt to value workers with a long

⁶According to Art. 63.º da Constituição da República Portuguesa (1976).

contributory career, Decreto-Lei n.º 73/2018, 9 de agosto, (2018), was published, which defines new rules for early retirement without penalties in the value of old-age pension for workers aged 60, with 46 or more years of deductions and who began to pay at a very young age, that is, aged 16 or younger, and extends the special regime of early access to the old-age pension for beneficiaries of the general SS regime and the convergent social protection regime.

The right⁷ to SS is usually taken for granted (Razavi, 2022), being the result of public policies that attempted to solve the failures of the market, families and societies in the face of various social risks. In fact, until the 1990s, the assumption of these rights was considered a great achievement made available to the most disadvantaged, based on a system of co-responsibility for social risks and obtaining collective financing for the said system.

However, the costs of maintaining the SS have become unaffordable, according to the report of the European Commission, national expenditure on social protection since 2000 has reached 25% of GDP, with expenditure on pensions absorbing 50% of the aforementioned amount. It was (this) the essential factor for Portugal to be classified as a high-risk country in terms of the sustainability of public finances (European Commission, 2010). In view of these conditions, national policies are beginning to be adopted in order to guarantee the sustainability of PPS. Active ageing (Foster, 2012) and measures that make it difficult to anticipate retirement are prioritised.

One of the measures involved, the changes in calculation of the old-age pension, which previously considered only the best 10 years contributions (of the last 15) and now includes the entire contributory career. Pereira et al., (2014, as cited by Lagoa & Barradas, 2019) states that for a viable and sustainable system in the long-term, adjustments will be necessary, including an increase in the tax burden, also an increase in the retirement age, changing the attribution rules and the calculation of the respective benefit, reducing the value of old-age pension to guarantee intergenerational equity,

⁷ The right to social security is enshrined in international human rights instruments, with articles 22 and 25 of the Universal Declaration of Human Rights.

otherwise, the future of younger and future generations is already mortgaged (Silva & Ribeiro, 2017).

In 2012, the European Commission prepared the White Paper called “*An agenda for adequate, safe and sustainable pensions*” (European Commission, 2012), which defines some objectives that should be achieved by 2020, including adjustments of old-age pension to the evolution of average life expectancy and an increase in the regulatory pension age, bringing it successively closer to 70 years.

2.4. Eligibility criteria and general calculation formulas

The old-age pension is a monthly amount paid to citizens that achieve retirement age, 66 years and 4 months in 2024, and it is intended for wage replacement. Beneficiaries of the old-age pension are: employees, self-employed, members of statutory schemes and beneficiaries of voluntary social insurance.

The specific terms and eligibility requirements for the old-age pension are: full compliance with the age criteria and at least 40 years of contributions, see Table 2-1.

Table 2-1 Eligibility conditions for old-age pension

Contributive Career (years)	Personal retirement age	What happens if I start pension early?
Less than 40	66 years and 4 months	It can't, unless it meets the requirements of the Long Term Unemployment Anticipation Scheme or a Special Anticipation Scheme for exhausting Professions.
40		
41	66 years	Will have a pension calculated under the flexibilization anticipation regime, with a penalty for each month of anticipation in relation to the personal retirement age.
42	65 years and 8 months	
43	65 years and 4 months	
44	65 years	
45	64 years and 8 months	
46	64 years and 4 months	if you started to contribute before the age of 17, you may have a pension calculated under the scheme for very long contributory careers, with no penalty from the age of 60 onwards.
47	64 years	
48	63 years and 8 months	you may have a pension calculated under the scheme for very long contributory careers, with no penalty from the age of 60 onwards.
49	63 years and 4 months	
50	63 years	
51	62 years and 8 months	

Source: Adapted from Seguranga Social (2024), organized by the author.

The contribution period is an essential concept in the context of the SS system, referring to the time during which the worker makes contributions to the SS system, whether obligatory (when the worker is employed or self-employed and registered in the system) or voluntarily, to guarantee rights to future benefits, such as retirement, disability pension, survivor's pension, among others. The main objective of the contribution period

is to ensure that the worker is entitled to social benefits, such as retirement, due to the contributions made during the period of their professional activity.

In Portugal, to be entitled to the minimum pension, a worker must have at least 15 years of contribution period, and to be able to retire without any penalty, it is necessary to have 40 years of contribution period. In addition to the contribution period, the value of contributions made throughout a career directly affects the value of the benefits that a worker will receive. The underlying logic is that the longer the contribution period is, greater the value of the old-age pension. In some specific cases, the contribution period may be temporarily interrupted, without this affecting access to future benefits, such as maternity/paternity leave, unpaid leave or involuntary unemployment and temporary incapacity for work (illness).

The contribution period is crucial for ensuring sustainability of the PPS, by making contributions throughout their professional life, workers not only secure their future rights, but also contribute to the financing of current old-age pensions.

In the majority of cases, calculated old-age pension over 66 years and 4 months won't be penalised, but in certain specific cases, recourse to the rules for setting the old-age pension access and anticipation through flexibility that were in force on 31 December 2018, can result in a higher old-age pension, even if penalties are applied, including the sustainability factor, and in accordance with the principle of more favourable treatment provided by the law, this will be the old-age pension that will be granted. From this age onward, there is no penalty on the old-age pension, without prejudice to what is guaranteed above. To determine the entire contributory career, not only the contribution periods under the general scheme are taken into account, but also periods of maternity/paternity leave/military service (double bill) and periods with discounts for other schemes.

To calculate the amount of the bonus, increase and exceptions, and how to calculate the old-age pension with bonus increase⁸, see Table 2-2, the number of months is multiplied

⁸ Bonuses: Applying for an old-age pension after reaching the personal retirement age, the bonus will be apply from the month following the month in which personal retirement age is reached, up to a maximum of 70 years old.

by the bonus rate, which in turn depends on the number of years of deductions you have at the time you start receiving your old-age pension.

Table 2-2 Bonus increase for old-age pension

Beneficiary situation		Monthly Bonus Rate (percentage)
Age	Contributive Career (years)	
Years above personal age or normal age for accessing the old-age pension	15 to 24	0.33
	25 to 34	0.5
	35 to 39	0.65
	Over 40	1

Source: Adapted from Segurança Social (2024), organized by the author.

Exceptions exist for individuals with a contribution career of more than 40 years, where the minimum age may be reduced without penalty. However, the normal age of access to old-age pension remains at 65 for the beneficiary who is legally prevented from continuing to work beyond this age. In these cases, they must present a certificate issued by the employer, the service provider or the beneficiary of the activity performed (as the case may be), proving that they have done the same activity for at least the five calendar years immediately preceding the year in which the old-age pension begins. Professions of difficult or arduous nature⁹ are eligible for and may require an early retirement pension, subject to the specific conditions of age and contributory career established for each activity. There must also be a guarantee period.

Calculating the old-age pension is a complex process that takes into account several factors, including the worker's income throughout their career and the length of their contribution period. The formula takes into account the value of contributions, average income, number of years of contributions, among other factors. We present the main components of this formula for calculating old-age pensions for beneficiaries registered before December 2001, and whose old-age pensions are awarded after January 2017, in which the value of the old-age pension is made up of two parts, one calculated based on the 10 best years of the last 15 years of discounts and another based on all years of discounts in the contributory career, up to a limit of 40 years.

⁹ Miners, seamen, professional fishermen, air traffic controllers, dancers, Madeiran port workers and embroiderers, quarry workers.

The value of the pension is equal to $\frac{P1 \times C3 + P2 \times C4}{C}$, where P1 is pension calculated based on the 10 best years of the last 15 years of discounts, P2 is pension calculated based on all years of contributions from your contributory career, up to a limit of 40 years, C3 is the number of years of discounts completed by December 31, 2001, C4 is the number of years of discounts completed as of January 1, 2002 and C is the number of years of discounts (see how years are counted towards the term of guarantee).¹⁰

P1 is calculated according the formula $P1 = RR \times Global\ Formation\ Tax \times n$, where RR is reference remuneration is the basis for calculating the pension and is calculated by

$RR = \frac{TR_{10}}{140}$, where TR is the total remuneration of the 10 years in which we earned the most, of the last 15 years of discounts, n is number of years of discounts (minimum 15 and maximum 40). Beneficiaries registered with SS from January 1, 2002, the pension is calculated based on all years of contributions from your contributory career, up to up to a limit of 40 years (if we have more than 40 years of discounts, the 40 best years count).

$RR = \frac{TR}{n \times 14}$, where RR is reference remuneration; TR is total remuneration for the entire career, up to a limit of 40 years and n is the number of years of discounts (minimum 15 and maximum 40). If we have less than 10 years of discounts, the reference remuneration is equal to the total of registered remuneration divided by 14 x the number of years of corresponding deductions. P2 is calculated as the pension of beneficiaries enrolled as of January 1, 2002.

¹⁰ In C, C1, C2, C3 and C4 all years of the contributory career are considered, even if exceed 40 years of age; P1 can only be greater than 12 x SSI (in 2024, 6,111.12 €) if: P2 is greater than P1 or P1 is greater than P2 and both greater than 12 x SSI in this case, the pension is equal to P2.

3. Literature Review

We begin chapter three with a theoretical framework of the PPS in Portugal, referring to factors that might influence it, sources of financing and government policies that we consider relevant for understanding the topic, with the definition of the concept of sustainability based on the literature.

This chapter is divided into two parts: the first where we present the concepts of sustainability and the sustainability perspective of the PPS and a second part where we include an explanation of the factors that influence the sustainability of the PPS, identifying the structural weaknesses that contributed to the current problem and the measures implemented so far to reinforce it.

3.1. Public pension system - perspective of its sustainability

The concept of sustainability arises from “the need to ensure that development meets the needs of the present without compromising the ability of future generations to meet their own needs, thus ensuring a balance between economic growth, environmental preservation, and social well-being”, (United Nations, 1987, p. 37). From this we can identify the three pillars on which the concept of sustainability is based, economic growth, social and environment care. This concept, which integrates these three spheres: economic, social and environmental care, into the values and results of a company, became known as the *Triple Bottom Line* created by Elkington (1994) as presented in the study by Calazans et al. (2024).

In Portugal, as in other European countries, the financial sustainability of the PPS depends on the coexistence of three factors Cichon et al. (2004): demographic (active population currently contributing to pensioners receiving benefits), government policies (social factors) and economic (economic development and the ability of taxpayers to honour their contractual commitments).

While some authors like Garcia and Rocha da Silva (2019) also Whitehouse and Campos (2013) still believe in the sustainability of PPS in Portugal fulfilling certain conditions, others consider the PPS unsustainable (Bravo, 2021; Bravo & Marques, 2016; Garcia & Lopes, 2009; da Silva et al., 2004). According to Institute of Public Policy – Lisbon (2019), this topic is a point of disagreement in the Portuguese political arena.

Based on the various concepts of sustainability and with indicators already created to measure it, in the *Triple Bottom Line*, such Dow Jones Sustainability Index, in USA 1999,

FTSE4Good Global Index in England 2001, Corporate Sustainability Index in Brazil 2005 and SRI-KEHATI Index in Indonesia 2009, we tried to clarify and individualize as much as possible the variables presented in the social and economic aspects under analysis in this work (Cristófaló et al., 2016). To achieve this, were created five distinct groups: demographic factors, social factors and government policies (Rotschedl, 2015), macroeconomic factors and financial factors, with the first three making up the social part of our analysis, and the last two the economic part. This division arises from the literature review and the subdivision of internally or externally controllable factors by the State. In demographic terms, the State can effectively exercise some control over the fertility rate and migratory effects, as we will see further on, having no control, over average life expectancy and population ageing. In social terms, the State is able to exercise control over UB and the allocation of MP. In terms of government policies, they are just that, a public expenditure control mechanism that State can control and change in the future to make a sustainable PPS. As for macroeconomic and financial factors, they were chosen as they are targeted of practically all literature on the subject, despite the absence of control on the macroeconomic, but intern control on the financial factors.

The cross-national perspective provided in this chapter illustrates the significant differences in the difficulties encountered by EU nations in securing the financial sustainability of the PPS and preserving the adequacy of pension payments. The reality is that there is no one-size-fits-all solution for these diverse situations, particularly considering the differing effects of recent financial, economic, and fiscal crises, as well as the varying challenges posed by ageing population.

Most EU national governments nevertheless confront a shared challenge in the foreseeable future as they seek a combination of economic and social measures that will not only enhance a lasting recovery from the crisis (Martin, 2015) and safeguard against the risks of a recession relapse but also guarantee enduring financial sustainability in public budgets vis-à-vis demographic changes. Achieving the delicate balance between current and future economic and social policy issues, necessitates both the political will, to make difficult policy decisions and the political dexterity to persuade the public that sacrificing in the present is essential for the sustainability of future welfare systems in the EU. Regarding fiscal policy challenges, an evident inference is that several EU countries need to implement budget consolidations in order to establish lasting sustainability in their public finance frameworks. The issue at hand is not whether to engage in consolidation, but rather the timing of such efforts and strategies to control the size of the welfare state while upholding its fundamental social goals.

A consensus has emerged among EU countries in favour of implementing "austerity now", it is crucial for countries to be ready to implement corrective expansionary measures should this strategy jeopardize economic recovery. The key challenges faced by labour market policies include the need for activation and enhanced reintegration of demographic groups known to have low employment opportunities, such as mothers, older workers, and individuals with disabilities (Martin, 2015). "Undoubtedly, a longer and less disruptive working career will promote both financial and social sustainability of public pension systems" (Zaidi, 2012, p. 18).

A more effective approach to promoting longer career behaviours and leveraging gains in life expectancy for longer careers, remains to be discovered. Once again, the challenge lies in finding methods to compensate mothers for their childcare duties without disrupting their motivation to re-enter the job market, improve financial literacy to encourage increased work and savings for reform, how we can promote a more positive attitude among employers towards hiring and retaining older workers, ensuring changes to health and safety conditions in the workplace, European Commission (2020).

Each country will need to devise a suitable labour market policy package to address these issues. Regarding pension policy implications, EU nations must persist in limiting early retirement options and increasing the retirement age in line with changes in life expectancy. This should be done despite the current low youth employment rates and overall low labour demand in the European economy. In light of the financial market breakdown, the appropriateness of transitioning towards private funding for the 2nd pillar is now less clear. Alternatively, are parametric adjustments to the public PAYG system adequate? What regulations are necessary at the national and European levels, particularly considering lessons from the financial crisis? What straightforward policies can be implemented to address poverty in old-age without stigmatizing older individuals in need? Is increasing social minimum pension levels to match the national poverty line a viable solution? How can a balance be struck between encouraging work and savings without compromising the provision of a social safety net through a social pension? There are more questions than answers, and these matters are best addressed through national policymaking, drawing upon experiences from other countries (Zaidi, 2012).

While acknowledging the unique strategies of each country, it is imperative to establish processes founded on robust economic, financial, and fiscal principles. This will help to prevent recurrence of the 2008-2009 financial crises and the ensuing ripple effects. Furthermore, it is crucial to ensure that, the pension components of all packages are carefully designed and implemented, taking into account valuable insights gained from

the 2008 crisis. Therefore, throughout the entire process, each nation has sought a resolution adapted to its unique economic conditions, considering its historical and current pension strategies, and appropriate to the pace of population ageing, taking into account the expectations of its citizens regarding the nature and extent of social well-being. A comprehensive assessment of basic principles is imperative to assess the impact of policy reforms on economic stimulation, fiscal consolidation and pension income adequacy for future pensioners. It is important to determine how these reforms may affect pension sustainability and identify potential strategies to improve both the sustainability and adequacy of pension income. Population ageing is a predominant trend in all countries, although the speed and impact of this phenomenon, as well as the policy reforms introduced and their anticipated long-term ramifications, vary.

Despite the common problems of nations, the extent and specifics of these challenges differ. It will be up to each country to implement measures that align with its unique cultural heritage and practices. However, the common challenges faced by multiple nations suggest an opportunity for mutual learning, while also emphasizing the importance of personalized approaches that consider unique national contexts. The sustainability of the PPS and concerns about future pension returns highlight the importance of improving the quality and independence of evidence used to identify challenges and make policy decisions at national level. The greater the amount of reliable comparative evidence that we can introduce into this discussion as an established basis for deliberation on future actions, the simpler it will be to develop policy measures and convince the public of the need for and implications of change.

In cyclical terms, the post-2008 economic crisis caused significant losses to the SS system, which until 2008 was balanced, the significant reduction in GDP and wage growth and the increase in unemployment to historically high levels deteriorated the system's financial situation (Garcia & Rocha da Silva, 2019). In addition to income growth, the way it is distributed between workers and holders of other production factors is relevant to the sustainability of old-age pensions.

The assessment of the old-age pension scheme is based on two fundamental pillars: pension serves purpose of providing replacement income at retirement age and also maintaining financial sustainability of the scheme (Outlioua & Fazouane, 2023).

The first, aims to protect the elderly population from the risk of poverty, while the second aims to guarantee the long-term existence of pension schemes that provide this protection.

The sustainability of the PPS depends on taking into account the need to adapt the level of pensions to the needs of the elderly population, ensuring the sustainability of the entire system, both are closely linked and the success of one is strongly correlated with the success from the other (Outlioua & Fazouane, 2023). Through literature review, we were able to identify the factors that most influence the sustainability of the PPS, therefore, we believe it is essential to clarify the concept of sustainability. The well-founded study of the sustainability of the PPS requires a strong consolidation of the concept, so that government decisions can be regulated by reliable guidelines. The subsequent question that arises is: what makes the PPS sustainable, that is, a PPS that is financially, socially and economically viable in the long term, while fulfilling its purpose of providing adequate income to pensioners. It can be stated that sustainability in this context involves ensuring that the system can continue to provide benefits to future generations without compromising its financial stability, the fairness of distribution/retribution or the economy as a whole.

Linked to the drop in the weight of wages in national income we find economic globalization, which has increased commercial transactions and foreign direct investment with different effects on countries and sectors of activity. This scenario leads countries to adopt tax reforms with the aim of preserving their competitiveness in the global market. Instead of excessively burdening wages or labour policies, the reforms seek to transfer the burden of taxation to assets or productive factors that are less susceptible to international mobility, that said governments try to avoid policies that could lead companies to relocate their operations to countries with lower costs, also seeking to ensure a more stable tax base.

According to the International Labour Organization, (2002), many countries have reduced employer contributions to SS in an attempt to intervene directly in the cost of labour. However, the same study highlights that it is not certain that the contributions for SS affect the global wage cost determined by the market, probably only influencing its division between what the worker takes home in the present and in retirement.

The concept of sustainability is not always consensual, being the starting point for its analysis the framework of Samuelson (1958), expanded by Aaron (1966), and presented by (D'Addio & Whitehouse, 2012), simply, what the authors demonstrate is that, in a PAYG system, the fiscally sustainable rate of return is the sum of GDP growth and employment growth, which is also the perspective of Amaral, (2007) in his conference presentation and can be more or less exigent: A demanding concept is one that qualifies a SS system as sustainable if it can provide decent and non-decreasing pensions to the

elderly without increasing the effort of active generations in relation to GDP or increasing public debt. A weaker concept of sustainability would admit an increase in the effort required of active generations, while always refusing an increase in public debt. According to the author Amaral, (2007) the most exigence concept will serve to outline the PPS supported by *strong sustainability* without overloading active generation. Considering r_t is the average pension in year t, P_t is the number of pensioners, L is the employment, Y_t is the GDP and m_t is the part of the annual GDP destined to finance PPS, (Amaral, 2007) derives the equilibrium condition common to both concepts of sustainability, *strong and weak*. In order to ensure it, m will need to be constant:

$$r_t P_t = m_t Y_t$$

He obtained equation below by dividing both members by L (employment) and calculated the growth rates, with π being the average labour productivity:

$$\frac{\Delta r}{r} + \frac{\Delta\left(\frac{P}{L}\right)}{\left(\frac{P}{L}\right)} = \frac{\Delta\pi}{\pi} \text{ }^{11}$$

Due to the structural challenges facing the PPS, constant rule changes and government measures that have reduced pensioners incomes during the recent economic crisis, there is a crisis of confidence in the pension system, in particular in its ability to guarantee the payment of future old-age pensions (Whitehouse & Campos, 2013). In this context, workers have less incentive to contribute into the system, increasing legal and illegal contributory leakage (Pereira et al., 2014). The challenges facing the pension system have led to reforms to ensure its financial sustainability, which, however, cause a reduction in the replacement rate and benefit ratio. Based on Amaral (2007), macroeconomic sustainability condition, strong sustainability, is guaranteed whenever the productivity growth rate equals the average pension growth rate (which is at most non-negative) and the growth rate in the number of pensioners relative to the number of individuals working. If the productivity growth rate cannot balance these two parts, the system becomes unsustainable from a strong sustainability perspective, but it can be sustainable from a weak sustainability perspective, since the increase in the effort of

¹¹ (not writing the t indexes for simplicity).

active generations (m), when necessary, it balances both parties and is a reasonable increase accepted by society.

In the absence of the previous assumptions, the PPS becomes unsustainable, and it is up to each country to analyse the macroeconomic conditions of sustainability that most contribute to the unsustainability of the PPS. It should be noted that a strong sustainability of the PPS is the most desirable, but the assumptions are ambitious in any unfavourable economic and demographic context. Thus, the fight for PPS sustainability is much more realistic from the point of view of *weak sustainability*.

Another problem that has affected the PPS in Portugal is related to some management deficiencies. In the past, the anticipation of reforms had harmful effects on the sustainability of the PPS, particularly in a context in which people will live longer (Moreira, 2019). This phenomenon is only understandable when early retirement (Lagoa & Barradas, 2019) is the only alternative to unemployment (Garcia & Rocha da Silva, 2019).

3.2.Factors influencing sustainability of public pension system

We present factors that most influence the sustainability of the PPS derived from the literature review.

3.2.1.Demographic factors

Demographic factors deal with the dynamic aspects of populations changes and interrelationships between basic demographic variables – synthetic fertility index (SFI), average life expectancy (ALE), ageing population (AP) and migration effects (ME).

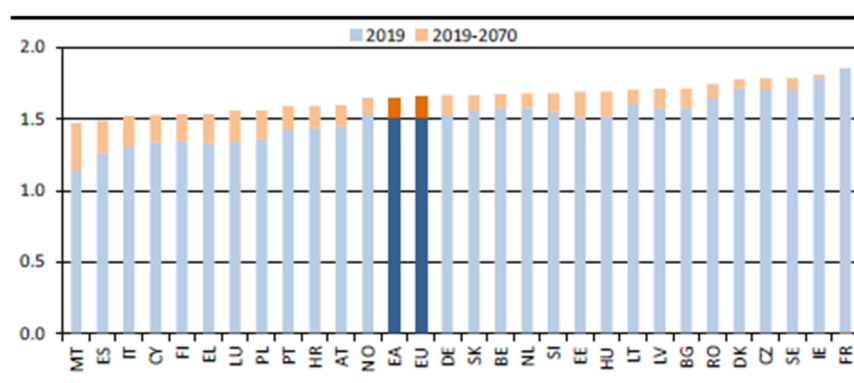
Throughout the literature review, authors like Barr & Diamond (2009), Garcia & Lopes (2009) and da Silva et al. (2004), consider that demographic factors SFI, ALE and AP have the greater impact on the sustainability of the PPS, exception made for the author Garcia & Rocha da Silva (2019), who state that “ageing has an almost insignificant impact in the long-run, when compared with unemployment and productivity”. (p.1).

As for migrations effects, Alves et al. (2019) and Cyrek & Fura (2019) both agree that emigration causes a negative impact on the sustainability of the PPS and immigration had a positive impact in Portugal, meeting certain requirements (Santos & Fabían, 2012). Demographic factors are not immutable, as they can change, especially the SFI, if there are favourable economic, social and cultural changes. According to Instituto Nacional de Estatística (INE), the SFI measures the average number of live children born per woman

of childbearing age (15-49 years), assuming that women would be subject to the fertility rates observed at the time. It is the sum of the fertility rates by age, by year or by five-year groups, between 15 and 49 years of age, observed in a given period (usually a calendar year).

Many researchers have demonstrated that greater life expectancy and lower fertility rates (Pinheiro, 2020) will have significant impact on the sustainability of pension schemes in the coming years, (Barr & Diamond, 2009; Nerlich & Schroth, 2018; da Silva et al., 2004). Thus, encouraging birth rates, through appropriate government policies such as, support for family planning, extended maternity leave with job security, family allowance, etc. is one of the main measures adopted by countries to deal with the impacts of ageing. The SFI has more tangible effects on the sustainability of pension systems than financial macroeconomic factors, according to a study carried out by Verbič & Spruk, (2014, as quoted by Outlioua & Fazouane, 2023), covering 33 countries with information from the period of 1998–2008. Bongaarts, (2014) using data from the seven largest countries of OECD show that the increase in SFI has a positive impact on the sustainability of the PPS, showing that an increase in the SFI rate of 0.1 child per woman will reduce pension scheme expenses by 4% in 2050 (OECD, 2019). European Union (2021) as shown in Figure 3-1, projects an increase in the fertility rate between 2019 and 2070 in almost all EU Member States, rising by 0.13 points to 1.55.

Figure 3-1 Fertility rates projection



Source: European Commission. (2021). *The 2021 Ageing Report: Economic and budgetary projections for the EU Member States (2019–2070)* (p. 19). Publications Office of the European Union.

<https://op.europa.eu/en/publication-detail/-/publication/8b1015a6-ead6-11eb-93a8-01aa75ed71a1/language-en>

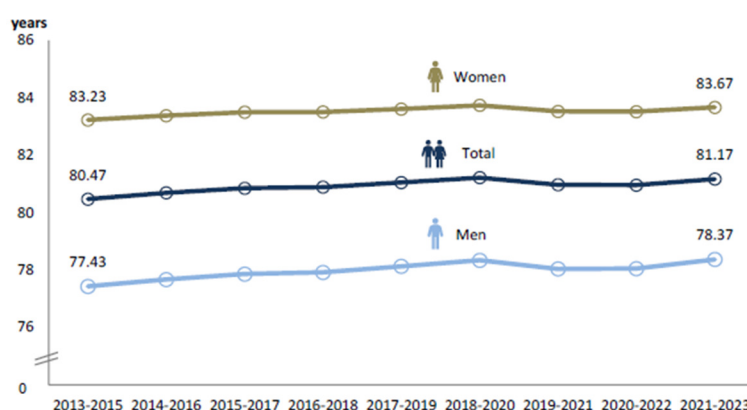
In Portugal, the SFI was 1.44 in 2023, which means that fertility in Portugal and all EU Member States will still be below the fertility replacement level of 2.1 children per woman.

Fertility rates below the level necessary to ensure the natural replacement of the population, are contributing to the reduction of the working-age population.

The average life expectancy can be measured from birth or from a determinate year¹². According to readings on the topic by several authors, namely Barr & Diamond (2009), Garcia & Lopes (2009) and Silva et al. (2004), empirical approaches to the problem of financial sustainability on PPS focus on economic forecasting models, demographic hypotheses and institutional indicators, studies produced over recent years by the European Union, the OECD, the IMF, the World Bank were reviewed and analysed.

Although there is no consensus among demographers on very long-term projections of life expectancy, there's no doubt that this projection underestimates these increases, which may lead to an underestimation of the impact of ageing on sustainability of the PPS. Once again, European Union (2021), estimates an increase in life expectancy of 7.4 years for men and 6.1 years for women, with the largest increases in the Member States with the lowest life expectancy. In Portugal, as shown in Figure 3-2 the average life expectancy for both sexes in 2023 was 81.17 years, which corresponds to an increase of 0.21 years (2.52 months) compared to the previous triennium (80.96 years), 78.37 years for men and 83.67 years for women.

Figure 3-2 Life expectancy at birth (years), Portugal, 2013-2015 to 2021-2023



Source: Instituto Nacional de Estatística. (2024). *Estatísticas demográficas 2023*. INE.

<https://www.ine.pt/xurl/pub/697720720>

¹² At birth: Average number of years that a person at birth can expect to live, maintaining the mortality rates by age observed at the time; At 65 years: Average number of years that a person who reaches the exact age of 65 can still expect to live, maintaining the mortality rates by age observed at the time.

Together with the narrowing of the base of the age pyramid, the progressive increase in average life expectancy will be reflected in the growing weight of the elderly in the total population, contributing to the doubling of the elderly dependency ratio between 2020-70, which is progressing at a rapid pace, wide for the dangerous barrier of one active person for every inactive one.

Ageing population is one of the long-term trends with the greatest impact on the old-age pension system (Foster, 2012; Garcia & Rocha da Silva, 2019), ageing doesn't have to impact negatively sustainability on PPS as long as elder people can chose their retirement age. If on the one hand the ALE has been increasing due to advances in medicine and the improvement of living conditions (Miladinov, 2020), on the other hand SFI has been decreasing as a result of social and cultural changes (Danzer & Zyska, 2020; Fenge & Scheubel, 2014), to which are added economic difficulties in supporting large families, (United Nations Population Fund & HelpAge International, 2012).

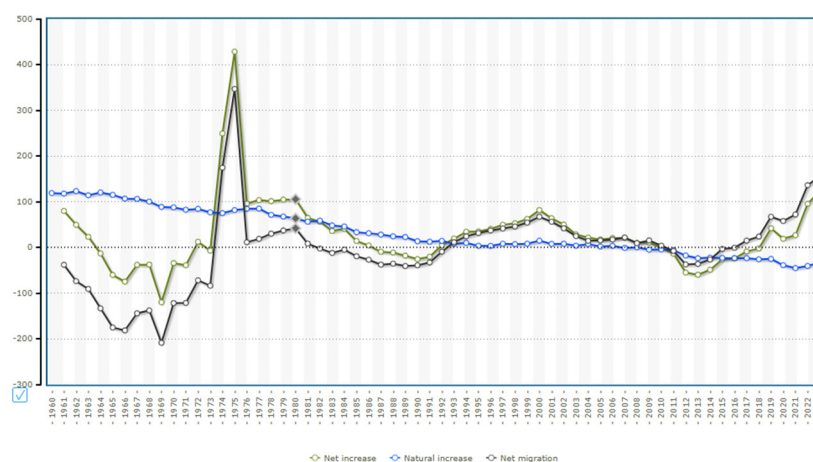
Ageing population, is another of the target demographic factors of analysis of the various European Institutions, (European Union, 2021), Economic and Financial Affairs Co (Hinrichs, 2021; Outlioua & Fazouane, 2023), in the context of PPS sustainability, with the continued and increasingly intense increase, represents the most serious and long-lasting challenge for the developed and developing countries of the EU. Currently, Italy and Germany are the "oldest" countries in Europe, with a higher percentage of elderly. However, in the middle of this century, when the ageing process reaches its peak, Portugal, Spain and Greece will occupy the first place. Ageing is a dissociative phenomenon: some individual characteristics decrease, while others resist. In fact, the approach to active AP is to keep people working as long as possible, developing skills and skills in the workforce, as well as sustaining the benefits of SS (Foster, 2012; Garcia & Rocha da Silva, 2019).

In recent years, demographic ageing in most developed countries is nothing new and Portugal is no exception. Reducing birth rates and morbidity translates into an inversion of the age pyramid (decreasing young population) and an increase in the elderly population. Young population and working-age population (16 to 64 years of age) decrease, rather than the elderly population (65 or more), which gradually increases. On the other hand, families are increasingly smaller and the active population (Rego, 2019) is also decreasing, within the IMF Report (2023) the future increase in pension and health expenditure caused by AP is putting the PPS under pressure.

According to the United Nations Organization, there will be an estimated 727 million people aged 65 and over worldwide in 2020. This number is expected to more than double to over 1.5 billion by 2050. The proportion of older people in the world's population is expected to rise from 9.3% in 2020 to 16% in 2050. For Portugal, the European Commission, (2021) estimates that the working population will fall to 4.2 million by 2070, which would make Portugal the European country with the highest old-age dependency ratio, that is, one working person for every three pensioners.

Migrations it's a population movement that includes the migration of refugees, displaced persons, uprooted people and economic migrants. In Portugal, it is the Migration Observatory that investigates the effects of foreigners on the SS system and concludes that social protection has been accessible to the vast majority of immigrants in Portugal and that it has been effective in absorbing the impact of the crisis. Partly due to their demographic structure, immigrants are large net contributors to the system, (Foster, 2012; da Silva et al., 2004; Santos & Fabían, 2012). The various studies highlight the positive impacts of migration on the sustainability of the PPS, even taking into account the Portuguese economy (Alves et al., 2019). In Figure 3-3, we can see the total movement of the Portuguese population, from 1960 to 2023¹³.

Figure 3-3 Annual growth: total, natural and migratory in Portugal



Source: PORDATA. (2024). *Annual estimates of resident population – Portugal*. Based on data from Instituto Nacional de Estatística. <https://prod2.pordata.pt/en/db/portugal/search+environment/chart>

¹³ 1980 - Change of concept: from 1960 to 1979, considering the impossibility of separating the information of "Ignored and other residences "in" Residences abroad "and" Ignored residences", the number of deaths is identical to the General Total of deaths occurred in Portugal, irrespective of the country of residence of the deceased; as from 1980, the figures include the deaths of individuals residing in Portugal and those with ignored place of residency and exclude deaths of residents abroad.

Portugal has recorded successive increases in the immigration flow (Pereira & Azevedo, 2019), which not only contribute positively to the rise in the birth rate (2022 SFI increased to 1.43 children per woman (1.35 in 2021, 1.41 in 2020, INE) as well as the increase in the number of contributors (2022 Contributors increased up to 693 390 (482 913 in 2021, 417 228 in 2020) in Instituto de Informática, I.P. (2023) to the pension system. Nowhere, is increased immigration a viable option for maintaining a stable population size or a constant age structure, which would considerably alleviate the pressure on PPS, while net migration would exacerbate the difficulties of a stable population. However, we would need to have 0.1 million immigrants in 2025 and 1.9 million in 2050 to combat risk of failure of PPS according to Santos & Fabían (2012). In table 3-1 we summarize the relationship found in each of the studies covered for demographic factors and how they expected to influence sustainability of PPS.

Table 3-1 Demographic factors influence the sustainability of the PPS

Demographic factors	Authors							
	da Silva et al (2004)	Barr and Diamond (2009)	Garcia and Lopes (2009)	Nerlich and Schroth (2018)	Garcia and Rocha da Silva (2019)	Alves et al (2019)	Lagoa and Barradas (2019)	Outlioua and Fazouane (2023)
Syntethic Fertility Index	+	+	+	+		+	+	+
Average Life Expectancy	-	-	-	-		-	-	-
Migration effects	+/-					+/-	+/-	
Ageing population	+	+	+	+	-	+	+	+

Source: made by the author.

3.2.2.Social factors

As already mentioned, the Citizenship social protection system aims to guarantee benefits to replace earned income in the event of certain contingencies such as unemployment, illness or old-age, for those who have a career contribution rate or less than 15 years and for those who can't save properly for retirement (Institute of Public Policy – Lisbon (2019), our society provides a minimum pension (D'Addio & Whitehouse, 2012) to reduce the risk of poverty. According to IMF Report (2023), the capacity of social transfers (excluding old-age pensions) to mitigate this risk, is limited and also puts the PPS under pressure and surely affects its sustainability, furthermore, worrying data emerges with a 22.4% increase in 2021 of people at risk of poverty and social exclusion in Portugal contrasting with most European member states.

When there is no sustainability plan for the PPS together with an ageing population, the situation of financial imbalance becomes more complicated and worsens the implicit debt of the PPS, the price of which will have to be paid by future generations. In effect, the coexistence of several pension attribution systems (unemployment benefits, minimum

pension, disability pension, among others) without the necessary adequate governance and good management of Social Security Financial Stabilization Fund do not promote the sustainability of the PPS and worsen social issues, such as inequalities between beneficiaries, due to the reforms carried out (Peinado & Serrano, 2017).

For example, these type of social pensions, especially means-tested benefits (unemployment pension it's a monetary benefit granted to the unemployed beneficiary, to compensate for the lack of remuneration caused by the involuntary loss of employment, provided that the conditions for attribution are met or minimum pension are financed by public administration revenues, often paid for explicitly out of general revenues rather than contributions. The attribution of the minimum pension to individuals with short careers in contributing to SS, puts pressure on the system and affects the sustainability of the PPS, unemployment benefit is financed through workers and employers contributions to SS. During periods of unemployment, workers do not make contributions to the system, which can reduce SS revenues. However, unemployment benefit contributes to social stability by allowing individuals to maintain a minimum level of income while looking for a new job.

Invalidity and old-age pensioners under the general regime with a contributory career relevant to the pension formation rate of less than 15 years are guaranteed a minimum pension value of (euro) 319.49 € defined by Portaria n.º 424/2023, de 11 de Dezembro, (2023). In table 3-2 we summarize the relationship found in each of the studies covered for social factors and how they expected to influence sustainability of PPS.

Table 3-2 Social factors influence the sustainability of the PPS

Social factors	Authors						
	da Silva et al (2004)	Barr and Diamond (2009)	Garcia and Lopes (2009)	Peinado and Serrano (2017)	Garcia and Rocha da Silva (2019)	Lagoa and Barradas (2019)	Outlioua and Fazouane (2023)
Unemployment benefits	-	-	+	+	+	-	-
Minimum Pension		-	+	+		-	-

Source: made by the author.

3.2.3. Government policies

The government policies (Peinado & Serrano, 2014) with regard to the PPS are enshrined in the Constitution of the Portuguese Republic (Ferreira et al., 2016) and even with its implementation in 1976 during the transition to democracy, SS maintained previous organising principles. Even so, this resilience of the beveridge model of the Portuguese PPS was not an impediment to the expansion of social protection based on

universal principles, granting successive governments room for manoeuvre to define their policies (Perreira et al., 2023).

As Ferreira et al. (2016) explain in their article, the economic context in Portugal with weak economic growth, together with the European Community's support for population ageing and the growing expenditure on old-age pensions, led the majority government to carry out the SS reform that took place in 2007, with measures such as: counting the entire contributory career, that is, without prejudice to acquired rights but with prejudice to rights in training (pension component already formed vs. future contributions), with significant implications for future pension replacement rate, positively affecting sustainability, introduction of the sustainability factor (cut applied) indexed to the evolution of the indicator average life expectancy published by the INE, leading to restrictions on early retirement and increase in the legal retirement age, penalizing the value of the old-age pension (OECD, 2019), but positively influencing the sustainability of the PPS, review of the annual update rule, new pension indexing rules, linked to the real GDP growth average and the CPI, also with positive impact on PPS sustainability. Currently, the Portuguese social state, along with what happens in European countries, is confronted not only by sustainability and the adequacy of the PPS, as well as the duty to guarantee equality throughout the employment life cycle and between social groups (Cyrek & Fura, 2019).

The PPS faces several political risks including the impossibility of maintaining the same level of benefits for future pensions under the same conditions, given the generosity of most pension schemes that have not yet reached maturity, in view previously implemented rules, that is, the pensions awarded have a value above the contributions made to their formation. This failure to deliver the level of benefits originally promised may result in serious political consequences, since the population covered would not be willing to accept an increase in contributions, or a decrease in the level of retirement income, or even an increase in the retirement age, in order to maintain the same level of benefits. It is therefore necessary to introduce and creation of mechanisms for automatic adjustment of pension scheme parameters (indexing retirement age to average life expectancy, indexing pensions to wage growth, or inflation or GDP growth). This proposal is the ideal alternative for multiple parameters for possible pension system reforms (Godínez-Olivares et al., 2016), although difficult to implement.

A recommendation made by international organisations such as the World Bank (1994, 2008) and the OECD (2005) is concerned with the importance of having a multi-pillar PPS, positively influencing the sustainability in effect, a multi-pillar system like the one implemented in Portugal makes it possible to separate the two main objectives of the PPS: reduce poverty among the elderly (minimum pension) and provide a substitute income (old-age pension).

Portugal could be identified as the country where the poverty risk for the elderly population is expected to be higher in the future, because of its falling benefit ratio. This doubly aged society, where fewer people die, and even fewer people are born, faces a multiplicity of challenges that imply adaptation to a scarcer, older, less dynamic and more dependent population (Rodrigues, 2018, p. 1995). The increase in ALE and the AP lead, among others, to obvious repercussions on the sustainability of PPS.

The decrease in the active population and the consequent decrease in productivity in a society where those who are “active” provide better living conditions for those who have become inactive, constitutes a socially worrying situation. Nerlich and Schroth (2018) states that the payment of pensions and the growing need for social and health support for the increasingly elderly population could trigger an open confrontation between generations (Silva & Ribeiro, 2017). However, Silva and Ribeiro (2017), states that the interests of the youngest and the oldest are not incompatible, so conditions and opportunities will have to be created so that people of all ages can enjoy an active and fulfilled life contributing to their autonomy, the economy and society. For this to happen, a change in attitudes towards ageing is necessary. Faced with these challenges in contemporary societies, particularly in terms of management and readjustment of the labour market, sustainability of health systems and social protection, Europe 2020 has established some objectives to be achieved, including ensuring a Sustainable Development Goals of 73.5% for people aged 20 to 64 (European Commission, 2019).

As the ageing of the population represents a major challenge for PPS in all Member States, in 2012 the European Commission published its White Paper called “*An agenda for adequate, safe and sustainable pensions*” (European Commission, 2012), which presents recommendations to make adequate and sustainable old-age pension in the long term, guaranteeing an adequate income in reform, in order to allow older people to have a decent standard of living and enjoy economic independence (Carvalho, 2014; European Commission, 2012). These recommendations involve a better balance between the number of years spent working and the number of years of retirement, the association of retirement age with increased life expectancy, the restriction of schemes

for access to early retirement, incentives to prolong life professional career and the reduction of disparities between men and women in terms of old-age pension. It is intended through these measures ensure budgetary sustainability to meet increasingly high pension expenditure (Carvalho, 2013).

In Portugal, it is estimated that replacement rates, the difference between the last wage and the first old-age pension could, in the medium term, represent a loss of income of around 50%. The reference remuneration corresponds to the total annual remuneration for the entire contributory career divided by the number of calendar years with remuneration records (with a limit of 40) multiplied by 14.

According to Lei de Bases n.º 4/2007 de 16 Janeiro, (2007), as amended by Lei n.º 83-A/2013, de 30 de Dezembro, (2013), art.º 4, the priority objectives of the SS system are:

- a) Guarantee the realisation of the right to SS;
- b) Promote the sustained improvement of conditions and levels of social protection and the reinforcement of respective equity;
- c) Promote the effectiveness of the system and the efficiency of its management.

Faced with the challenges posed by ageing, it is necessary to invest in innovative policies and practices, such as the European Innovation Partnership in the field of active and healthy ageing, whose objective is to increase the average lifespan citizens healthy lifestyle (Carvalho, 2014). Financial sustainability can be improved not only through adjusting the retirement age, but also through adjustments to benefits (such as the application of the sustainability factor and restriction of early retirements). The sustainability factor consists of the percentage deducted from the value of the renovation, as a penalty for bringing it forward. This percentage is defined annually by the Government (15.8% in 2024 and estimated at 16.9% in 2025), based on average life expectancy and for ensuring the sustainability of PPS.

Individuals who are 60 years old or over and have at least 40 years of contributions may now be eligible to apply for early retirement. The sustainability factor (cut) will be applied to the value of the old-age pension for those who intend to retire before the legally defined age, as well as the reduction factor 0.5% for each month remaining until legal retirement age. Normal retirement age is defined as the age at which individuals are eligible to request retirement without penalty, taking on a full career from 26 years old. Taking into account the increase in average life expectancy seen in 2022 and 2023, the normal age

for accessing the old-age pension under the general SS regime in 2025 will increase to 66 years and 7 months, as published in Portaria n.º 414/2023, de 7 de Dezembro, (2023). As already seen updating the value of old-age pensions is an essential element of any pension system, public or private, due to the importance it has in guaranteeing the purchasing power of pensioners and the impact it has on the financial sustainability of the system.

In Portugal, two pension update models coexist: the indexation of pensions to variations in specific pre-determined indicators, real GDP growth, corresponding to the average annual growth rate of the last two years and the average variation of the last 12 months of the CPI, without housing, available in December of the year prior to the year in which the update is reported, and the discretionary update determined by each Government and which has been subject to successive changes over the 16 years of application of the pension update rule. Most of reviewed literature was able to demonstrate that increasing the legal retirement age and therefore increasing the period of contributions has a greater impact on the sustainability of the PPS than reducing the amount of the pension (Outlioua & Fazouane, 2023). Increasing the legal retirement age is one of the measures adopted by countries to deal with the impacts of ageing, along with other measures, this legal increase, also has great impact on the sustainability of PPS. Based on the literature review presented, we summarize in Table 3-3 the relationship found in each of the studies covered for government policies and how they expected to influence sustainability of PPS.

Table 3-3 Government policies influence the sustainability of the PPS

Government policies	Authors						
	Barr and Diamond (2009)	Garcia and Lopes (2009)	Peinado and Serrano (2014)	Garcia (2017)	Nerlich and Schroth (2018)	Alves et al (2019)	Lagoa and Barradas (2019)
Count of the entire contributory career	+		+				+
Sustainability factor (applied cut)	+		+	+		+	+
Restriction of early retirements	+	+	+	+	+		+
Review of the annual update rule	+	+	+	+			+
Increase in the legal retirement age	+		+				+

Source: made by the author.

3.2.4. Macroeconomic factors

Macroeconomics is an area of economic study, that aims to broadly analyse the economic phenomena of a country, considering everything that influences it and how they interrelate. In addition to analysing how certain indexes appear at the moment and influence political decisions, this field also focuses on the behaviour of phenomena over

time. John Maynard Keynes (1886-1946) was one of the most important economists in history, graduated in Mathematics and author of the concept of macroeconomics.

The PPS faces several macroeconomic risks, such as low economic growth, high unemployment rate and consequent low employability rate, low productivity, low wage growth, in addition to the financial crisis from 2008 to 2011, and the COVID-19 pandemic that gave rise to hyperinflation in the markets in 2022, may continue (Garcia & Lopes, 2009; da Silva et al., 2004). Although some of these factors are not visible in the short term, their intensity may be too harsh for sustainability of the PPS. When Portugal had to turn to the IMF, after 2011, in the so-called memorandum of understanding, drastic pension reforms were demanded, namely a reduction in the old-age pension, cuts in unemployment benefits, suspension of the application of pension indexation rules and freezing them, among others. On the other hand, rapid economic growth will ensure that the pension regime can provide higher pensions and becomes more resilient (Peinado & Serrano, 2014), likewise, the sustainability of the PPS has a fundamental effect on socioeconomic development of a country stimulating local and national economies (Mourao & Vilela, 2020).

GDP growth rate is the standard measure of added value created through the production of goods and services in a country during a given period, GDP measure is important because it provides information about the size and performance of a country's economy. The GDP growth rate is often used as a general indicator of economic health. Roughly speaking, an increase in GDP is interpreted as a sign that the economy is strong, and employment is likely to increase as companies need to hire more workers, thus increasing income. When GDP is declining, as was the case in many countries during the recent global economic crisis, employment often declines, we may also have a third scenario, in which GDP may be growing, but not at a speed sufficient to create jobs. A country's economy is subject to cycles over time, sometimes in periods of expansion and sometimes in periods of slow growth or even recession.

The employment factor is the ratio between the employed population and the population aged 20-64, providing information on the percentage of the working-age population employed. Increasing the employment rate is considered one of the most effective measures to increase the sustainability of the PPS (Cyrek & Fura, 2019), in addition to the positive effect on GDP, a higher employment rate translates into a higher contribution rate and more employment, causing workers to remain active longer. Despite the significant increase in the employment rate and labour force of women and older workers, strong negative population development will lead to a reduction in the labour

force. The perspectives of the (European Union, 2021), for Portugal, it will be an increase in public expenditure on pensions by 1 p.p. of GDP in 2030 due to a decrease in the employment rate by 0.7% (Portugal Country Fiche on Pensions Ageing Report 2021, 2021).

The unemployment rate measures the proportion of the workforce that is not employed but could be. A decrease in the unemployment rate is another well-regarded measure to increase the sustainability of the PPS (Peinado & Serrano, 2017), in addition to the positive effect, reducing unemployment benefits, it also causes an increase in contributions. According to IMF Report (2023), employment and unemployment rates in Portugal in 2021 show a slight improvement compared to the EU average, with some differences observed in the *Madeira* and *Açores* and youth unemployment which, although it improved, remained high and above pre-Covid-19 values.

As seen before if the productivity growth rate does not compensate the average population growth rate plus the ratio of pensioners to employees, the system becomes unsustainable from the point of view of strong sustainability. If we look at the national data from European Union (2021), considering Amaral (2007) definition of sustainability, we see that the PPS does not meet the condition of strong sustainability. Productivity growth remains a key challenge for the Portuguese economy, real productivity growth increased by 4.6% in 2022, but overall productivity decreased to 74.6% in 2022 from the 80% recorded in 2010, (IMF, 2013). On average, the productivity of our economy, which grew 3.45% in the last 3 years, is not enough to offset the 6.25% growth in the ratio of pensioners to employees, plus the growth rate of the average pension, which grew 4.4% over last 3 years. Despite the medium/long-term improvement in projections for the labour market, the variation in productivity will be insufficient to offset the effect of the demographic component.

Inflation rate is a general increase in prices over time, calculated based on the Consumer Price Index¹⁴ (CPI). Real inflation rate, is higher than the inflation rate, calculated individually for each household taking income, into account. Although the nominal

¹⁴ CPI is produced by the Instituto Nacional de Estatística and aims to measure changes over time in the prices of a set of goods and services considered representative of the expenditure structure of families residing in Portugal.

inflation rate is calculated using the basket of goods¹⁵, which assumes that the quality of goods and services remains constant over time. On one hand, constant technological advances improve the quality of products, leading to an underestimation of the true value obtained by consumers. On the other hand, if quality deteriorates, for example due to cost reduction measures, the basket may not accurately capture this decrease in value. However, this model does not take into account the evolution of consumers preferences and consumption habits over time due to changes in lifestyle, technology and social trends (Nerlich & Schroth, 2018). The basket, based on a historical portrait, may not be representative of current consumption patterns. Although various adjustments implemented regularly, they largely do not reflect changes in the real economy.

Inflation has direct consequences for consumers pockets. Right from the start, we see a reduction in purchasing power, due to the amount received (wages or pensions) that do not follow the general rise in prices. As a consequence, investment and consumption decisions are postponed by companies and families, generating drops in demand, which economically affects the entire production cycle. In a scenario of high inflation, it becomes more difficult to balance the budget and reserve part of the income for savings. In OECD (2023), is suggested that pensioners, as well as working-age population may have to face benefit adjustment due to high inflation. As already mentioned, the update of old-age pensions is indexed to the inflation rate, making it more favourable for pensioners, than indexing to the real-wage rate causing an increase in costs for the PPS.

Real wage growth rate is the measure of wage growth over a year, it is closely linked to the productivity growth rate. Contrary to what happens in Portugal, whose pension updates are indexed to GDP and the inflation rate, several European countries also index pension payments to real wage growth if it is positive, OECD (2023). Although the real wage growth rate does not directly affect the calculation of old-age pensions, it still positively affects the sustainability of the PPS (Peinado & Serrano, 2014), contributing to an increase in the value of mandatory contributions.

¹⁵ Basket of goods representing a pre-determined set of goods and services that reflects the average consumption pattern in a specific base year, including housing, food, clothing, transport, medical care, as well as education, communication and leisure expenses.

The trend in Portugal is for a drop in the weight of work wages in national income, which contributes to a reduction in SS contributions. Between 2001 and 2015, the weight of wages in GDP at market prices went from 60.4% to 51.4%, according to Annual Macroeconomic database (Lagoa & Barradas, 2019). Between 2021-2022, the weight of wages in GDP in Portugal fell from 47.9% to 47.1% (2020 and 2021 data were influenced by the pandemic crisis, recession and employment maintenance measures) (República Portuguesa, 2023). In table 3-4 we summarize the relationship found in each of the studies covered for macroeconomic factors and how they expected to influence sustainability of PPS.

Table 3-4 Macroeconomic factors influence the sustainability of the PPS

Macroeconomical factors	Authors						
	da Silva et al (2004)	Barr and Diamond (2009)	Garcia and Lopes (2009)	Garcia and Rocha da Silva (2019)	Alves et al (2019)	Lagoa and Barradas (2019)	Outlioua and Fazouane (2023)
GDP Growth Rate	+	+	+	+	+	+	+
Employment Growth Rate	+	+	+		+	+	+
Productivity Growth Rate	+	+	+	+	+	+	+
Real Wage Growth Rate	+	+	+			+	+
Real Inflation Rate	-	+				+	+
Unemployment Growth Rate	-	-	-	+	+	-	+

Source: made by the author.

3.2.5. Financial factors

The way the PPS is financed is also one of the factors that influences sustainability of the PPS. For example, PAYG models' assumption that benefits from the PPS are financed by current contributions, are no longer sustainable for OECD countries without major structural reforms (OECD, 2019). In this sense, the World Bank (1994), in its report on the old-age crisis, warned countries about the fragility of distribution schemes in the face of demographic factors, unless the parameters of these schemes are periodically adjusted, namely contribution rates, legal retirement age and pension amount. By financial sustainability, we mean that contributions from employers and employees are sufficient to guarantee the payment of pensions over the years. Financial factors are important as we will use them to manage the sustainability of the system, as they are factors that can be controlled by the State (Gleißner et al., 2022) through changes in tax rates applicable both to employers and workers, and also to promote individual capitalisation through more attractive conditions and future guarantees of a working fund for retirement. The PPS is financed by the State budget, employers contributions, workers contributions and individual capitalisation. In 2022, the total amount of income was 35,525,845,529 €. The PPS is financed on a PAYG basis. The overall rate of 34.75% is divided between 11% of the gross income paid by workers and 23.75% paid by the

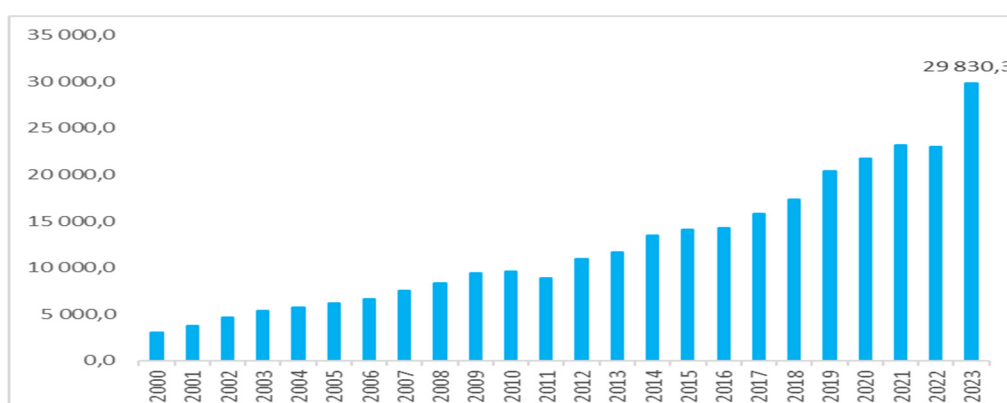
employers. In 2022 the total of employer's contributions was 15,358,588,027.90 €. There were a total of 517,680 active employers and domestic workers. Contribution tax of 11% of base wage, with a total of 7,113,451,297.13 € for dependent workers. For self-employed workers the value of their contributions in 2022 was 549,820,661.87 €. Independent workers, generality of service providers, have a rate of 21.4% or 25.2% if they are Individual Entrepreneurs. Contracting entities have a tax of 7% if economic dependence is between 50 and 80% or 10% if economic dependence exceeds 80% of the previous year's taxable income. Of the 34.75% charged, 20.21% are for payment of old-age pensions, 4.29% are for the payment of disability pensions and 2.44% for survivor pensions.

In 2017, an additional tax to municipal property was created, designed with the aim of increasing the diversification of financing sources for the SSFSF. Also, contributions (varying between 0.5 p.p. and 2 p.p.) from corporate income tax are used to finance PPS.

In 2020 the financing by State budget, comprehends 883,417,428€ from value added tax to SS, and 20,441,498.5 million euros of current income.

Between 2017 and 2020, additional tax to municipal property and partial corporate income tax revenues were 1,051.6 million euros, (0.5% of 2019 GDP) allocated to SSFSF. The SSFSF arises in 1989 from the need to ensure expenses with the payment of old-age pension for a minimum period of 2 years. In order to achieve what is proposed, the surplus from the general SS contributory regime is transferred to the fund, as well as part of the workers contributions. In 2023, the SSFSF had almost 30 billion euros of assets as we can see in Figure 3-4.

Figure 3-1 Social security financial stabilisation fund assets growth



Source: Conselho das Finanças Públicas. (2024). *Evolução orçamental da Segurança Social e da CGA em 2023*. <https://www.cfp.pt/pt/publicacoes/sectores-das-administracoes-publicas/evolucao-orcamental-da-seguranca-social-e-da-cga-em-2023>

International Labour Organization (ILO) in the report (Internacional Labour Organization, 2021) also recommends a gradual transition from public PAYG regimes to privately financed schemes. The argument is based on several elements, including financial returns, intergenerational equity, resilience to demographic and financial factors and positive effects on the economy (national savings, investment and formalization of the labour market), as well positive impact on sustainability of the PPS.

Private financing can help avoid the effects of ageing. Thus, Lagoa and Barradas (2019) states that, for a certain demographic group, individual capitalisation would provide a better long-term return and would constitute an overall more efficient system, unfortunately in Portugal, private PPS have never had large scale, covering only a percentage of less than 5% of the active population (Bravo, 2021). Furthermore, this financing provides immunity from government policies inherent to a PAYG system, especially if future generations refuse increases in their contributions. Complementary schemes of a private nature include individual supplementary schemes and collectives. The legal framework of these is much more extensive (Garcia, 2017) being managed by organisations in the cooperative, social and private sector, namely: mutual associations, insurance companies and specialized pension fund management companies.

The public capitalisation scheme - retirement certificates is a complementary SS scheme that acts as a savings account to reinforce the old-age pension. Is due to additional discounts that are placed in our accounts name. This is part of an investment fund the Retirement certificate fund. When the retirement age is reached, the accumulated value can be received all at once or in monthly payments and/or the total or partial amount can be transferred to the complementary plan (children or spouse). A pension fund is an autonomous asset intended to finance pension plans, they are one of the most important players in the financial market managing in 2020 more than 23,046,130 million euros according to Supervisory authority and pension funds. Investment in pension funds is one of the main functions of the public capitalisation system to ensure both the performance and the financial security of pension plan benefits, it is crucial that this function is implemented and managed responsibly. Policymakers therefore have a key role to play in ensuring that regulation encourages prudent management to achieve the complementary objectives of reform. Based on the literature review presented throughout this third chapter, we compiled information for financial factors in Table 3-5, with the variables and how they affect sustainability in the PPS.

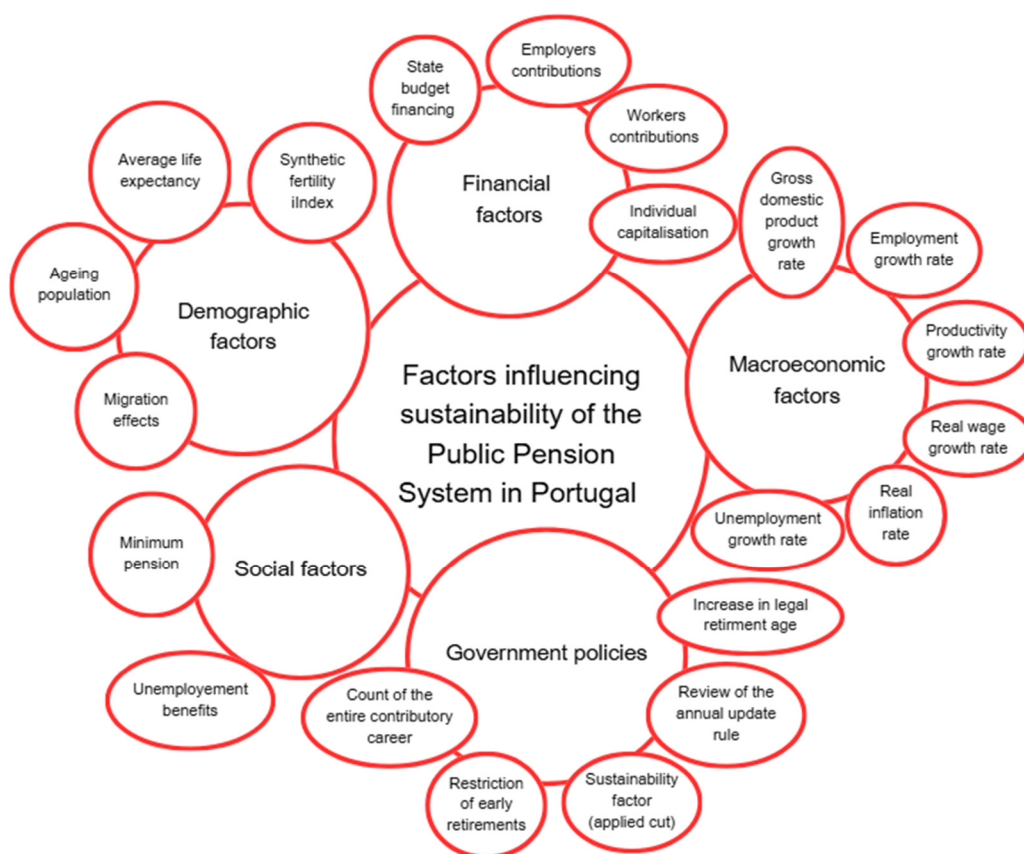
Table 3-5 Financial factors influence the sustainability of the PPS

Financial Sustainability factors	Authors					
	da Silva et al (2004)	Barr and Diamond (2009)	Garcia and Lopes (2009)	Alves et al (2019)	Lagoa and Barradas (2019)	Outlioua and Fazouane (2023)
State Budget Financing	+		+		+	+
Employers Contributions	+	+	+		+	+
Workers Contributions	+	+	+		+	+
Individual Capitalization	+	+		+	+	

Source: made by the author.

We present in Figure 3-1 the factors that influence the sustainability of PPS as derived from the literature review in this chapter. These factors will serve as foundation for developmet of the investigation methodology in chapter four and analysis of the results in chapter five.

Figure 3-4 Factors that influence sustainability of PPS.



Source:made by the author.

4. Research Methodology

In this chapter, we present the research methodology adopted in this work, is a quantitative research strategy and present research hypothesis. In previous chapter we present the concepts of sustainability, and the factors that affect it.

In the quantitative study, we seek the perception of CA about the factors that most influence PPS sustainability through the development of multiple linear regression models.

4.1. Research hypotheses

With this work we used linear regression model to measure the perception of CA about the factors that most influence PPS sustainability in Portugal, we tried to find out, what level of influence CA attributed to demographic, social factors, macroeconomic, financial factors and finally what impact they attribute to tackling the reduction in income at retirement age (government policies). Based on the literature review the following research hypotheses were formulated:

Hypothesis 1: Sustainability of the PPS is negatively influenced by demographic factors.

Hypothesis 2: Sustainability of the PPS is negatively influenced by social factors.

Hypothesis 3: Sustainability of the PPS is positively influenced by government policies.

Hypothesis 4: Sustainability of the PPS is positively influenced by macroeconomic factors.

Hypothesis 5: Sustainability of the PPS is positively influenced by financial factors.

4.2. Data collection instrument

The questionnaire was designed to assess the factors that most influence sustainability of the PPS in Portugal from the perspective of CA. The questionnaire was formulated and available on the online platform Google Docs – Google Forms.

The questionnaire ([Appendice 3](#)) contains seven parts: the first part intends to qualify the respondents, the second part collects respondents opinion about the influence of demographic factors on the PPS, namely, synthetic fertility index, average life expectancy, migration effects and ageing population. The third part investigates the

respondents opinion about the influence of social factors on the PPS, analysing two areas: unemployment benefits and minimum pension. The fourth part analyses respondents opinion about the influence of macroeconomic factors, with six questions on the effects of GDP growth rate, employment growth rate, productivity growth rate, real wage growth rate, real inflation rate, unemployment growth rate on the sustainability of the PPS. In the fifth part, the questionnaire explores the impact of financial factors on the PPS, with four questions related to state budget financing, employer contributions, workers contributions and individual capitalisation. Finally, the sixth part evaluates the respondents opinion on the impact of government policies. This part includes five questions that analyse government policies, such as count of the entire contributory career, sustainability factor (cut applied), restriction of early retirements, review of the annual update rule and increase in the legal retirement age. In addition, the questionnaire includes a section for suggestions/contributions to the study, where respondents can present their ideas and recommendations based on their personal experience or specialised knowledge.

Part 2 to 6 all have four-point Likert-type response scales, these scales are most easily adapted, constructed and applied, as they are non-comparative scales. The traditional 5-point Likert scale, having a neutral point, does not force the respondent to think and normally receives a higher perception of responses for this same reason. Using the 4-point scale (Likert, 1932), on the other hand, eliminates the neutral point and provides a better capture of CA sensitivity (Trojan & Sipraki, 2015).

In order to verify the clarity of the language and the transparency of the questions, the questionnaire was subject to a pre-test .

Questions 7, 12, 15, 22 and 27 were used to measure factors that most influence sustainability of the PPS through five closed questions to assess the impact of most factors (social and economic divided into demographic, social and government policies, macroeconomic and financial factors) for the CA.

With a total of 32 questions, the questionnaire was available to be answered by CA between October 2021 and March 2023, also between May and September of 2022, were sent email to accountant firms sorted on Yellow Pages ([Appendice 4](#)) requesting a response to the questionnaire. In collaboration with the Order of Certified Accountants, the questionnaire was published on the institutional page: <https://www.occ.pt/pt-pt/noticias/inquerito-fatores-que-influenciam-sustentabilidade-do-sistema-de-pensoes-em-portugal> on May 25 of 2022 and was available for responses until March 2023.

4.3. Population and sample characterization

The choice of the population fell on the CA, not only for their knowledge of the topic under analysis, due to their educational background and professional training, but also because we thought was interesting to know what was their understanding about it.

In a population of 67,659 active members of the Certified Accountants Order, 30,841 responsible for accounts, 401 responses were obtained, of which we disregarded 15 as they were not valid, 11 non-members of the order and 4 were duplicated, corresponding to a response rate of 12.5%. Of the 386 valid responses, we can characterise the sample in terms of gender with 67.7% of the responses being answered by females and 32.3% by males, the majority of respondents have between 41 and 60 years old, are professionals whose experience is mostly between 11 and 30 years and their academic background is in Accounting and Finance, Business Management, Economics, Taxation and Auditing, the results can be observed in Table 4-1.

Table 4-1 Sample characterization

Gender	Female	261	67.7%
	Male	125	32.3%
Age	Less than 30 years	20	5.2%
	Between 31 and 40 Years	61	15.8%
	Between 41 and 50 Years	176	45.6%
	Between 51 and 60 Years	86	22.3%
	Between 61 and 70 Years	38	9.8%
	More than 71 Years	5	1.3%
Professional Experience	Between 0 and 10 Years	78	20.2%
	Between 11 and 20 Years	93	24.1%
	Between 21 and 30 Years	149	38.6%
	Between 31 and 40 Years	46	11.9%
	Between 41 and 50 Years	20	5.2%
Academic Degree	Degree	283	73%
	Master Degree	65	17%
	PHD	4	1%
	Others	34	9%

Source: made by the author.

4.4.Linear regression model

The linear regression models to be developed estimate if the sustainability of the PPS is positively or negatively influenced by demographic, social, macroeconomic, financial factors and government policies.

We will evaluate the reliability of the models and their assumptions with the Kolmogorov-Smirnov and Shapiro Wilk normality tests. Correlations among the variables will be examined using the Pearson correlation matrix.

Subsequently, hypothesis tests were developed using linear regressions, aiming to confirm the study hypotheses initially defined.

To test the influence of the independent factors on the sustainability of the PPS, we resorted to the development of four multiple linear regression models that consists of verifying the existence of a functional relationship between the sustainability value and the independent variables.

4.4.1.Dependent variable and independent variables

The dependent variable of the linear regression model developed is Sustainability Index calculated for each of the individual responses in order to assess the impact of these factors on the PPS sustainability in the opinion of the CA (de Oliveira Claro & Claro, 2008). We created four indexes composed of the average of the sums of values in order to measure the sensitivity (Moreno Pires & Fidélis, 2015) of CA regarding the sustainability of the PPS for model one and for measure CA perceptions about the influence of each variable in the respective indexes in the other three models. Five closed questions were used to assess the impact of most factors (demographic, social and governmental policies, macroeconomic and financial factors) on PPS sustainability. The answers were possible in four dimensions of impact: 1- no impact; 2- little impact; 3- some impact and 4- lots of impact.

Model one was developed to analyse the influence of a set of variables (demographic, social and governmental policies, macroeconomic and financial factors) on the sustainability of the PPS. The other three models follow a different approach.

Following this, three linear regression models were developed, to examine how each variable contributes to the overall value of the three indexes, which quantify the relationship between the independent variables and the dependent variable in the context of sustainability of the public pension system.

Model two analyses the influence of demographic variables on the demographic factors sustainability index (DFSI).

Model three evaluates the influence of social variables and government policies on the social factors and government policies sustainability index (SFGPSI).

Model four examines the impact of macroeconomic and financial variables on the macroeconomic factors and financial factors sustainability index (MFFSI).

Model one evaluates the influence of general factors on sustainability of PPS, with the dependent variable certified accountants sustainability index – CASI. The independent variables are demographic factors, social factors, macroeconomic factors, financial factors and government policies, see Table 4-2.

Table 4-2 Questions used to measure sustainability

Generality factors
Q7 - What is the impact of demographic factors on the PPS?
Q12 - What is the impact of social factors on the PPS?
Q15 - What is the impact of macroeconomic factors on the PPS?
Q22 - What is the impact of financial factors on the PPS?
Q27 - What is the impact of new measures to address the decline in income at retirement age, re-categorized as Government Policies?
(1 -no impact to 4 - lots of impact)
Used by da Silva et al (2004) and Alves et al (2019) and Lagoa & Barradas (2019)

Source: made by the author.

Model two evaluates the influence of demographic variables on the demographic factors sustainability index (DFSI) and the independent variables are: synthetic fertility index that measures the average number of live children born per woman of childbearing age (15-49 years), the average life expectancy that measures the life expectancy from birth, migration effects that are population movements and the ageing population that there is an increasing median age in the population, because of decline in fertility rates and rise in life expectancy.

These variables are important because they affect the demographic structure of the country, which in turn influences the sustainability of the PPS. If fewer children are born, the population is ageing and people are living longer, this creates a challenge for the

pension system, as there will be more people receiving benefits and fewer people contributing to the system, see Table 4-3.

Table 4-3 Questions used to measure sustainability of demographic factors

Demographic factors
Q8 - Synthetic fertility index
Q9 - Average life expectancy
Q10 - Migration effects
Q11 - Ageing population
(1 -no impact to 4 - lots of impact)
Used by da Silva et al (2004) and Alves et al (2019) and Lagoa & Barradas (2019)

Source: made by the author.

Model three evaluates the influence of social variables and government policies on the social factors and government policies sustainability index (SFGPSI), with the independent variables: unemployment benefit which is a sum of money that is paid each month to those who have lost their job involuntarily, minimum pension is a benefit awarded monthly to those who do not meet the conditions to be entitled to an old-age pension, count of entire contributory career that measure so that all wages count towards the formation of the old-age pension, sustainability factor (applied cut), restriction of early retirements, measured to avoid early retirement, review of the annual update rule, measured to index annual old-age pension and increase in the legal retirement age, measured to address the financial consequences of ageing. The SFGPSI index reflects the way in which social factors and government policies affect the functioning of the pension system in Portugal, from the perspective of the CA. By analysing each variable in isolation, the model offers a detailed view of how these elements influence pension revenues and payments, helping to understand how they contribute to the system's performance.

This model does not focus on the sustainability of the pension system itself, but rather on how each social factor and government policies individually contribute to the index, allowing for a better understanding of the impacts of these variables and helping to make informed decisions about the public policies needed to guarantee the financial health of the pension system in the long term, see Table 4-4 and Table 4-5.

Table 4-4 Questions used to measure sustainability of government policies

Social factors

Q13 - Unemployment benefits

Q14 - Minimum pension

(1 -no impact to 4 - lots of impact)

Used by: Garcia (2017) and Outlioua & Fazouane (2023)

Source: made by the author.

Table 4-5 Questions used to measure sustainability of social factors

New measures to address the decline in income at retirement age, re-categorized as Government Policies

Q28 - Count of entire contributory career

Q29 - Sustainability factor (applied cut)

Q30 - Restriction of early retirements

Q31 - Review of the annual update rule

Q32 - Increase in the legal retirement age

(1 -no impact to 4 - lots of impact)

Used by: Peinado & Serrano (2014) and Lagoa & Barradas (2019)

Source: made by the author.

Model four evaluates the influence of macroeconomic and financial variables on macroeconomic and financial factor sustainability index MFFSI with the independent variables of macroeconomic factors: GDP GR is a standard measure of the added value created through the production of goods and services in a country over a given period, employment GR is the measure of the amount of employment growth over a year, productivity GR is the measure of the amount of productivity growth over a year, real wage GR is the measure of wage growth over a year, the real inflation rate is the generalised increase in the prices of goods and services in a given economy, discounting the effects of inflation, unemployment GR is the measure of unemployment growth over a year and for the financial factors were considered: financing by the state budget for the PPS is intended to finance the citizenship pillar of the social protection system and is, once again, measured by public expenditure in relation to GDP, employer contribution and workers contribution is a tax on basic salary and both contributions are measured in the SS budget execution. Individual capitalisation is a supplementary SS scheme that acts as a savings account to increase the old-age pension. Model four analyses

macroeconomic and financial factors together to understand how each variable impacts on the macroeconomic and financial factors sustainability index (MFFSI). This index reflects the way in which macroeconomic and financial factors influence the functioning of the pension system in Portugal. The model provides a detailed view of how each element influences the system's revenues and pension payments, helping to understand how each variable contributes to the system's performance.

Model four does not focus directly on the sustainability of the pension system, but rather on how each macroeconomic and financial variable contributes individually to the index. This allows for a more in-depth understanding of the impacts of these variables and facilitates informed decision-making on the public policies needed to guarantee the long-term financial health of the pension system see Table 4-6 and Table 4-7.

Table 4-6 Questions used to measure sustainability of macroeconomic factors

Macroeconomic factors
Q16 - Gross domestic product growth rate
Q17 - Employment growth rate
Q18 - Productivity growth rate
Q19 - Real wage growth rate
Q20 - Real inflation rate
Q21 - Unemployment growth rate
(1 -no impact to 4 - lots of impact)
Used by: da Silva et al (2004) and Outlioua & Fazouane (2023)

Source: made by the author.

Table 4-7 Questions used to measure sustainability of financial factors

Financial factors
Q23 - State budget financing
Q24 - Employers contributions
Q25 - Workers contributions
Q26 - Individual capitalisation
(1 -no impact to 4 - lots of impact)
Used by: da Silva et al (2004) and Lagoa & Barradas (2019)

Source: made by the author.

Therefore, to validate the research hypotheses, we formulated the followings multiple linear regression:

Model 1: $CASi = \beta_0 + \beta_1DFi + \beta_2SFi + \beta_3GPi + \beta_4MFi + \beta_5FFi + \varepsilon_i$, where,

$CASi$ = Certified accountants sustainability index i

β_0 = Ordered at the origin

β_j ($j=1, \dots, 5$) = Partial slopes, that is, variation in the value of sustainability i per unit of variation of group independent variable

ε_i = Model errors or residuals i

Model 2: $DFSi = \beta_0 + \beta_1SFi + \beta_2ALEi + \beta_3MEi + \beta_4APi + \varepsilon_i$, where,

$DFSi$ = Demographic factors sustainability index i

β_0 = Ordered at the origin

β_j ($j=1, \dots, 4$) = Partial slopes, that is, variation in the value of sustainability i per unit of variation of group independent variable

ε_i = Model errors or residuals i

Model 3: $SFGPSi = \beta_0 + \beta_1UBi + \beta_2MPi + \beta_3CECCi + \beta_4SFACi + \beta_5RERi + \beta_6RAURi + \beta_7ILRAi + \varepsilon_i$, where,

$SFGPSi$ = Social factors and government policies sustainability index i

β_0 = Ordered at the origin

β_j ($j=1, \dots, 2$) = Partial slopes, that is, variation in the value of sustainability i per unit of variation of group independent variable

ε_i = Model errors or residuals i

Model 4: $MFFSi = \beta_0 + \beta_1GDPGRi + \beta_2EGRi + \beta_3PGRi + \beta_4RWGRi + \beta_5RIRi + \beta_6UGRi + \beta_7SBFi + \beta_8ECi + \beta_9WCi + \beta_{10}ICi + \varepsilon_i$, where,

$MFFSi$ = Macroeconomic and financial factors sustainability index i

β_0 = Ordered at the origin

β_j ($j=1, \dots, 6$) = Partial slopes, that is, variation in the value of sustainability i per unit of variation of group independent variable

ε_i = Model errors or residuals i

5. Results

In this chapter we will present the results obtained within the scope of our study. We begin by presenting the descriptive statistics of the variables and the Pearson correlation coefficients. Next, we present the linear regression models developed.

We will be analysing the variance, the coefficient tests, the coefficients of determination and also verifying compliance with the assumptions underlying the linear regression models, such as the analysis of residuals and variables independent, by carrying out normality tests.

To conclude the chapter, we will answer to validate hypothesis test, which allows us to obtain final conclusions about our object of study.

5.1. Descriptive statistics

We characterized the general and independent variables through the use of measures of central tendency (mean, median and mode), measures of dispersion (standard deviation), measures of non-central tendency (maximum and minimum) and percentile analysis to the factors in general.

Table 5-1 Model one statistics

		Demographic factors	Social factors	Government Policies	Macroeconomical factors	Financial factors	CASI
N	Valid	379	382	378	385	384	386
	Missing	7	4	8	1	2	0
	Mean	3.21	2.83	2.83	2.3	3.10	2.82
	Median	3	3	3	2	3	2.80
	Mode	3	3	3	2	3	3
	Std. Deviation	0.784	0.811	0.802	0.831	0.719	0.559
	Variance	0.615	0.658	0.643	0.691	0.518	0.313
	Range	3	3	3	3	3	3
	Minimum	1	1	1	1	1	1
	Maximum	4	4	4	4	4	4
Percentiles	25	3	2	2	2	3	2.60
	50	3	3	3	2	3	2.80
	75	4	3	3	3	4	3.20

Analysing Table 5-1, the mean average indicates the importance CA attributed to each of the factors. It is 3.21 for demographic factors, 2.83 for social factors and for government policies, 2.3 for macroeconomic factors and 3.1 for financial factors.

The median value is equal to 3 for all factors with exception made for macroeconomic factors whose value is 2 and represents the central value of the sample.

The first quartile presents a value of 3 for the demographic and financial factors, 2 for all other factors, which means that 25% of CA attribute importance in the factors that influence sustainability are less than or equal to 3 for demographic and financial factors and 2 for social, macroeconomic and government policies respectively. The second quartile corresponds to the median value, 3 for all factors exception made to macroeconomic which value is 2 and represents the 50th percentile, meaning that 50% of CA attribute importance in factors that influence sustainability are less than or equal to 3 (or 2). The third quartile is equal to 4 for demographic and financial factors, 3 for all remaining factors, which suggests that 75% of the importance attributed by CA are less than or equal to 4 for the demographic and financial factors and 3 for social, macroeconomic and government policies respectively.

Table 5-2 Model two statistics

		SFI	ALE	ME	AP	DFSI
N	Valid	382	383	386	386	386
	Missing	4	3	0	0	0
	Mean	3.81	3.85	3.29	3.90	3.692
	Median	4	4	3	4	3.75
	Mode	4	4	4	4	4.00
	Std. Deviation	0.485	0.368	0.852	0.335	0.376
	Variance	0.235	0.135	0.725	0.113	0.142
	Range	3	2	4	3	3
	Minimum	1	2	0	1	1
	Maximum	4	4	4	4	4
Percentiles	25	4	4	3	4	3.5
	50	4	4	3	4	3.75
	75	4	4	4	4	4

SFI Sintethic Fertility Index; ALE Average Life Expectancy; ME Migration Effects; AP Ageing population; DFI Demographic factors Sustainability Index

Analysing Table 5-2, the mean for all factors is between minimum value of 3.29 for migration effects and 3.9 for ageing population, the median value is 3 for migration effects, 4 for SFI, ALE and AP and 3.75 for demographic factors sustainability index. The mode value is 4 for all factors, with the median being a more robust measure of central tendency than the mean and the mode, as it is less subject to changes in extreme values, we can state that half of the observations are equal to or lower than the median and the

other half have observations equal to or higher than the median, we conclude that half of the recorded observations have a value less than or equal to 4 and the other half observations, have a value equal to or greater than 4, this for factors whose median is 4, we conclude exactly the same for factors whose median is 3 and 3.75. The first quartile presents value of 4 for SFI, ALE and AP, ME presents 3 and DFSI presents 3.5 for the first quartile, meaning that 25% of CA attribute importance in the factors that influence demographic sustainability are less than or equal to 4, 3 or 3.5 for factors respectively. The second quartile corresponds to the median value, already analysed and represents the 50th percentile, meaning that 50% of CA attribute importance in factors that influence demographic sustainability are less than or equal to 4 and 3 respectively. The third quartile is equal to 4 for all factors, suggesting that 75% of the importance attributed by CA are less than or equal to 4 for presented factors.

Table 5-3 Model three statistics

		UB	MP	CECC	SFAC	RER	RAUR	IRLA	SFGPSI
N	Valid	381	380	383	369	382	369	373	386
	Missing	5	6	3	17	4	17	13	0
	Mean	3.46	3.19	3.58	3.55	3.53	3.38	3.55	3.38
	Median	3	3	4	4	4	3	4	3.43
	Mode	3	3	4	4	4	3	4	4
	Std. Deviation	0.499	0.700	0.594	0.564	0.617	0.611	0.614	0.454
	Variance	0.249	0.490	0.353	0.319	0.381	0.373	0.377	0.206
	Range	1	3	3	2	3	3	3	3
	Minimum	3	1	1	2	1	1	1	1
	Maximum	4	4	4	4	4	4	4	4
Percentiles	25	3	3	3	3	3	3	3	3.14
	50	3	3	4	4	4	3	4	3.43
	75	4	4	4	4	4	4	4	3.71

UB Unemployment benefits; MP Minimum Pension; CECC Count of the entire contributory career; SFAC Sustainability factor (applied cut); RER Restriction of early retirements; RAUR Review Update Annual Rule; IRLA Increase in the legal retirement age; SFGPI Social Factors and Government Policies Sustainability Index

Analysing Table 5-3, the mean for all factors is between minimum value of 3.19 for minimum pension and 3.58 for CECC, the median value is 3 for UB, MP and RAUR, 4 for CECC, SFAP, RER and IRLA and 3.43 for social factors and government policies sustainability index. The mode value is 3 for UB, MP and RAUR and 4 for all others, with the median being a more robust measure of central tendency than the mean and the mode, as it is less subject to changes in extreme values, we can state that half of the observations are equal to or lower than the median and the other half have observations equal to or higher than the median, we conclude that half of the recorded observations have a value less than or equal to 3 and the other half observations, have a value equal to or greater than 3, this for factors whose median is 3, we conclude exactly the same

for factors whose median is 4 and 3.43. The first quartile presents value of 3 for all values, exception made to SFGPSI, 3.14 for the first quartile, meaning that 25% of CA attribute importance in the factors that influence social factors and government policies sustainability index are less than or equal to 3 or 3.14 for factors respectively. The second quartile corresponds to the median value, already analysed and represents the 50th percentile, meaning that 50% of CA attribute importance in factors that influence social factors and government policies sustainability index are less than or equal to 3 and 4 respectively. The third quartile is equal to 4 for all factors, exception once more so SFGPSI which is 3.71 suggesting that 75% of the importance attributed by CA are less than or equal to 3.71 or 4 for presented factors.

Table 5-4 Model four statistics

		GDPGR	EGR	PGR	RWGR	RIR	UGR	SBF	EC	WC	IC	MFFSI
N	Valid	373	382	376	382	372	381	375	384	384	360	386
	Missing	13	4	10	4	14	5	11	2	2	26	0
	Mean	3.42	3.58	3.29	3.58	3.49	3.48	3.52	3.74	3.68	2.87	3.73
	Median	3	4	3	4	4	4	4	4	4	3	3.78
	Mode	4	4	3	4	4	4	4	4	4	3	4
	Std. Deviation	0.624	0.554	0.684	0.587	0.655	0.614	0.626	0.532	0.526	0.802	0.497
	Variance	0.389	0.307	0.468	0.345	0.428	0.376	0.395	0.283	0.277	0.643	0.247
	Range	3	3	3	3	3	3	3	3	2	3	4
	Minimum	1	1	1	1	1	1	1	1	2	1	0
	Maximum	4	4	4	4	4	4	4	4	4	4	4
Percentiles	25	3	3	3	3	3	3	3	4	3	2	3.50
	50	3	4	3	4	4	4	4	4	4	3	3.78
	75	4	4	4	4	4	4	4	4	4	3	4.07

GDPGR Gross Domestic Product Growth Rate; EGR Employment Growth Rate; PGR Productivity Growth Rate; RWGR Real Wage Growth Rate; RIR Real Inflation Rate; UGR Unemployment Growth Rate; SBF State Budget Financing; EC Employers Contributions; WC Workers Contributions; IC Individual Capitalization; MFFSI Macroeconomical and Financial factors Sustainability Index

Analysing Table 5-4, the mean for all factors is between minimum value of 2.87 for IC and 3.79 for EC, the median value is 3 for GDPGR, PGR and IC, 3.73 for MFFSI and, 4 for the remaining factors. The mode value is 3 for PGR and IC, 4 for all factors, we conclude that half of the recorded observations have a value less than or equal to 4 and the other half observations, have a value equal to or greater than 4, this for factors whose median is 4, we conclude exactly the same for factors whose median is 3. The first quartile presents value of 2 to IC, 3 to GDPGR, EGR, PGR, RWGR, RIR, UGR, SBF, WC, 3.5 to MFFSI and 4 for EC, meaning that 25% of CA attribute importance in the factors that influence macroeconomic factors and financial factors sustainability index are less than or equal to each value respectively. The second quartile corresponds to the Median value, already analysed and represents the 50th percentile, meaning that 50% of CA attribute importance in factors that influence macroeconomic factors and

financial factors sustainability index are less than or equal to median values respectively. The third quartile is equal to 4 for almost all factors, exception made to IC and MFFSI suggesting that 75% of the importance attributed by CA are less than or equal to 4 for presented factors.

5.1.1. Pearson correlation coefficient

Pearson correlation coefficient measures the intensity and direction of the linear correlation/association between the quantitative variables in social sciences, weak correlations are considered when the absolute value of the coefficient is less than 0.25; moderate when it is between 0.25 and 0.5; strong when it is between 0.5 and 0.75 and very strong when it is greater than 0.75 (Marôco, 2014).

Table 5-5 Model one Pearsons coefficient correlation

	DF	SF	GP	MF	FF	CASI
Demographic factors	1	.344**	.273**	0.077	.465**	.639**
Social factors		1	.277**	.271**	.494**	.723**
Government Policies			1	.105*	.367**	.603**
Macroeconomical factors				1	.278**	.495**
Financial sustainability factors					1	.776**
CASI						1

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

DF-Demographic factors; SF-Social factors; GP-Government Policies; MF-Macroeconomical factors;
FSF-Financial sustainability factors; CASI-Certified Accountants Sustainability Index

Analysing Table 5-5, we have a unique very strong correlation between CASI and financial factors, CASI shows strong correlation with all variables, exception made to macroeconomic factors which correlation is moderate. Demographic factors show moderate correlations with social factors, government policies and financial factors, social factors present moderate correlation with government policies, macroeconomic and financial factors, government policies presents moderate correlation with financial factors. Macroeconomic factors shows moderate correlations with financial factors. All other correlations are weak as they have values below 0.25.

Table 5-6 Model two Pearsons coefficient correlation

	SFI	ALE	ME	AP	DFSI
Synthetic Fertility Index	1	.255**	.157**	.238**	.593**
Average Life Expectancy		1	0.0978425	.392**	.553**
Migration Effects			1	.125*	.735**
Ageing population				1	.452**
DFSI					1

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

SFI Synthetic Fertility Index; ALE Average Life Expectancy; ME Migration Effects; AP Ageing population; DFSI Demographic factors Sustainability Index

Analysing Table 5-6, synthetic fertility index shows strong correlation with DFSI, moderate correlations with ALE, AP and weak correlation with ME. Average life expectancy shows strong correlation with DFSI, moderate correlations with AP and weak correlation with ME. Migration effects shows strong correlation with DFSI, and weak correlation with AP. Ageing Population shows moderate correlation with DFSI.

Table 5-7 Model three Pearsons coefficient correlation

	UB	MP	CECC	SFAC	RER	RAUR	IRLA	SFGPSI
Unemployment Benefits	1	.340**	.106*	-0.014	-0.094	-0.005	-0.024	.219**
Minimum Pension		1	.112*	.148**	0.068	.153**	.191**	.433**
Count of the entire contributory career			1	.303**	.162**	.304**	.245**	.470**
Sustainability factor (applied cut)				1	.396**	.430**	.433**	.608**
Restriction of early retirements					1	.399**	.402**	.517**
Review of the annual update rule						1	.423**	.639**
Increase in the legal retirement age							1	.591**
SFGPSI								1

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

UB Unemployment benefits; MP Minimum Pension; CECC Count of the entire contributory career; SFAC Sustainability factor (applied cut); RER Restriction of early retirements; RAUR Review Update Annual Rule; IRLA Increase in the legal retirement age; SFGPI Social Factors and Government Policies Sustainability Index

Analysing Table 5-7, social factors and government policies sustainability index shows weak correlation with unemployment benefits, moderate correlations with variables MP, CECC. It also shows strong correlation with sustainability factor (applied cut), restriction of early retirements, review of the annual update rule and increase of legal retirement age. Unemployment benefits, shows only a moderate correlation with MP, being the other correlations classified as weak. Minimum pension, beside correlations already identified, shows only weak correlations with the other variables. Count of the entire

contributory career presents moderate correlation with SFAC, RAUR and IRLA, and weak correlations with UB, MP and RER. The variable sustainability factor (applied cut) presents weak correlation with UB and MP, moderate correlation with RER, RAUR and IRLA. Restriction of early retirements shows weak correlation with UB, MP and CECC, moderate correlation with SFAC, RAUR and IRLA. Review of the annual update rule show moderate correlations with CECC, SFAC and RER. Increase in the legal retirement age shows moderate correlations with CECC, SFAC, RER and RAUR.

Table 5-8 Model four Pearsons coefficient correlation

	GDPGR	EGR	PGR	RWGR	RIR	UGR	SBF	EC	WC	IC	MFFSI
GDP Growth Rate	1	.511**	.571**	.425**	.409**	.390**	.163**	0.083	0.080	.210**	.618**
Employment Growth Rate		1	.418**	.471**	.223**	.506**	0.092	.212**	.162**	.201**	.576**
Productivity Growth Rate			1	.452**	.397**	.387**	.157**	0.055	0.018	.205**	.668**
Real Wage Growth Rate				1	.435**	.425**	.154**	.231**	.239**	.240**	.621**
Real Inflation Rate					1	.291**	.242**	.112*	.114*	.215**	.570**
Unemployment Growth Rate						1	.110*	.155**	.122*	.294**	.554**
State Budget Financing							1	.147**	.130*	0.093	.362**
Employers Contributions								1	.502**	.104*	.339**
Workers Contributions									1	.176**	.313**
Individual Capitalization										1	.433**
MFFSI											1

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

GDPGR Gross Domestic Product Growth Rate; EGR Employment Growth Rate; PGR Productivity Growth Rate; RWGR Real Wage Growth Rate; RIR Real Inflation Rate; UGR Unemployment Growth Rate; SBF State Budget Financing; EC Employers Contributions; WC Workers Contributions; IC Individual Capitalization; MFFSI Macroeconomical and Financial factors Sustainability Index

Verifying the Table 5-8, the existing correlations between the 11 variables, we can find ten strong correlations between macroeconomic and financial factors index and GDPGR, EGR, PGR, RWGR, RIR and UGR, also gross domestic product growth rate show strong correlation with EGR and PGR, employment growth rate as strong correlation with UGR, employers contributions show strong correlation with WC. Sixteen moderate correlations and twenty nine weak correlations can be identified, Gross domestic product growth rate show moderate correlation with RWRG, RIR, UGR and weak correlation with SBF, EC WC and IC. Employment growth rate show moderate correlation with PGR, RWRG and weak correlation with RIR, SBF, EC, WC and IC. Productivity growth rate show moderate correlation with RWRG, RIR, UGR, weak correlation with SBF, EC, WC and IC. Real wage growth rate shows moderate correlation with RIR, UGR and weak correlation with SBF, EC, WC and IC. Real inflation rate shows moderate correlation with UGR, weak correlation with SBF, EC, WC and IC. Unemployment growth rate only as one moderate correlation with IC being the other correlations weak. State budget financing beside moderate correlation already identified, only shows weak correlations. Employer's contributions show weak correlation with IC, Worker's contributions show weak correlation with IC.

This first analysis of central tendency and distribution measures and Pearson correlation coefficients reveals that demographic factors and financial factors are generally viewed as the most important, with a higher average and central tendency (median and mode). On the other hand, social factors, government policies, and macroeconomic factors are seen as less important, with lower mean scores. Demographic factors such as the ageing population and average life expectancy are consistently rated higher, while migration effects are given a slightly lower emphasis.

We can conclude that model one presents a very strong correlation between the variable financial factors and CASI, that could bias the results obtained, the other three models present an absence of very strong correlations between the variables.

5.2. Linear regression model

The multiple linear regression models were estimated based on the development of a linear regression and using the *enter* method as a variable selection method.

Model one evaluates the influence of general factors on sustainability of PPS.

$$\text{Model 1: CASI}_i = \beta_0 + \beta_1 \text{DF}_i + \beta_2 \text{SF}_i + \beta_3 \text{GP}_i + \beta_4 \text{MF}_i + \beta_5 \text{FF}_i + \varepsilon_i$$

Model two evaluates the influence of demographic variables on the demographic factors sustainability index.

$$\text{Model 2: DFSI}_i = \beta_0 + \beta_1 \text{SFI}_i + \beta_2 \text{ALE}_i + \beta_3 \text{ME}_i + \beta_4 \text{AP}_i + \varepsilon_i$$

Model three evaluates the influence of social variables and government policies on the social factors and government policies sustainability index.

$$\text{Model 3: SFGPSI}_i = \beta_0 + \beta_1 \text{UB}_i + \beta_2 \text{MP}_i + \beta_3 \text{CECC}_i + \beta_4 \text{SFAC}_i + \beta_5 \text{RER}_i + \beta_6 \text{RAUR}_i + \beta_7 \text{ILRA}_i + \varepsilon_i$$

Model four evaluates the influence of macroeconomic and financial variables on macroeconomic factors and the financial factor sustainability index.

$$\text{Model 4: MFFSI}_i = \beta_0 + \beta_1 \text{GDPGR}_i + \beta_2 \text{EGR}_i + \beta_3 \text{PGR}_i + \beta_4 \text{RWGR}_i + \beta_5 \text{RIR}_i + \beta_6 \text{UGR}_i + \beta_7 \text{SBFI}_i + \beta_8 \text{EC}_i + \beta_9 \text{WC}_i + \beta_{10} \text{IC}_i + \varepsilon_i$$

5.2.1. Analysis of variance of the models

After obtaining the regression models, we began by evaluating whether or not any of the variables can influence the sustainability value, and whether or not the models adjusted to the data are significant. Upon analyzing Table 5-9, which presents the linear

regression results for all models, we observed that the data suitability was optimal when using the *enter* method. To further refine our analysis, we decided to apply the *stepwise* method to identify which factors best explain the variance and predictability of the data.

We conclude, through the F test, that at least one of the variables included in our model has a significant effect on the variation in the sustainability value. Additionally, we can say that the models adjusted to the data are significant. Moreover, as mentioned by (Marôco, 2014), with this test alone, we are unable to conclude whether all or just some variables have a significant influence on the variation in the sustainability value of the PPS in Portugal.

Table 5-9 Models ANOVA F-Test

Model's		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	56.7543447024422	1	56.7543447024422	540.254698402379	<.001 ^b
	Residual	38.4486987758187	366	0.105051089551417		
	Total	95.203043478261	367			
2	Regression	22.7560804253104	1	22.7560804253104	506.286784718435	<.001 ^c
	Residual	16.9899722062686	378	0.0449470164187001		
	Total	39.746052631579	379			
3	Regression	18.5643842945523	1	18.5643842945523	301.536192501919	<.001 ^d
	Residual	20.9940139918761	341	0.0615660234365868		
	Total	39.5583982864284	342			
4	Regression	26.3149875212358	1	26.3149875212358	359.603626929177	<.001 ^e
	Residual	24.5145492410458	335	0.073177758928495		
	Total	50.8295367622816	336			

b. Dependent Variable: Certified Accountants Sustainability Index Predictors: (Constant), Financial factors

c. Dependent Variable: Demographic factors Index Predictors: (Constant), Migration Effects

d. Dependent Variable: Social Factors and Government Policies Index Predictors: (Constant), Sustainability factor (applied cut)

e. Dependent Variable: Macroeconomical and Financial sustainability factors Index Predictors: (Constant), Real Wage Growth Rate

Analysing Table 5-9, for the estimated linear regression models, we concluded, through the F test and p-value <0.05, that at least one of the variables included in each of our models has a significant effect on the variation on the sustainability value.

5.2.2. Tests for model coefficients

The coefficients of the estimated regression models, obtained for each of the independent variables, which allow us to write each of the adjusted models are presented in Table 5-10, 5-11, 5-12 and 5-13. We also include in the tables, the values of t-Student test and p-value, allowing us to conclude whether or not the variables have an influence on the sustainability value.

Table 5-10 Model one coefficients

Model 1	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	
	B	Std. Error	Beta			
1	(Constant)	1.073	0.079		13.561	0.000
	Financial factors	0.574	0.025	0.772	23.243	0.000
2	(Constant)	0.784	0.065		11.975	0.000
	Financial factors	0.406	0.022	0.547	18.062	0.000
	Social factors	0.285	0.019	0.451	14.896	0.000
3	(Constant)	0.487	0.055		8.937	0.000
	Financial factors	0.332	0.018	0.447	18.266	0.000
	Social factors	0.256	0.015	0.404	16.995	0.000
	Government Policies	0.216	0.014	0.340	15.380	0.000

1. Dependent Variable: CA Sustainability Index

For the first model, we conclude based on the value of t-Student test and p-value being lower than the level of significance considered (0.05) that the financial factors have significant influence on the sustainability of the PPS in Portugal. Regarding the second model, our conclusion, based on t-Student test and p-value lower than 0.05, that Migration Effects have a significant influence on the demographic factors sustainability index.

Table 5-11 Model two coefficients

Model 2	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	
	B	Std. Error	Beta			
1	(Constant)	2.734	0.045		60.653	0.000
	Migration Effects	0.298	0.013	0.757	22.501	0.000
2	(Constant)	1.567	0.060		26.190	0.000
	Migration Effects	0.267	0.009	0.679	30.425	0.000
	Synthetic Fertility Index	0.333	0.015	0.500	22.430	0.000
3	(Constant)	0.519	0.048		10.769	0.000
	Migration Effects	0.258	0.005	0.655	53.491	0.000
	Synthetic Fertility Index	0.273	0.008	0.409	32.458	0.000
	Average Life Expectancy	0.339	0.011	0.371	29.648	0.000

1. Dependent Variable: Demographic factors Index

In the third model, we determined that, given the T-Student test and p-value being under 0.05, the Sustainability Factor (cut applied) significantly affects the social factors and government policies sustainability index.

Table 5-12 Model three coefficients

Model 3	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	1.992	0.086		23.057	0.000
Sustainability factor (applied cut)	0.417	0.024	0.685	17.365	0.000
(Constant)	1.545	0.078		19.720	0.000
2 Sustainability factor (applied cut)	0.288	0.022	0.473	13.126	0.000
Review of the annual update rule	0.267	0.020	0.472	13.108	0.000
(Constant)	1.103	0.067		16.429	0.000
3 Sustainability factor (applied cut)	0.255	0.017	0.419	14.909	0.000
Review of the annual update rule	0.249	0.016	0.440	15.768	0.000
Minimum Pension	0.193	0.013	0.385	15.178	0.000

1. Dependent Variable: Social Factors and Government Policies Index

For the fourth model, we conclude, based on the value of the t-Student test and the p-value is lower than the level of significance, that the real wage growth rate has a significant influence on macroeconomic factors and the financial factor sustainability index.

Table 5-13 Model four coefficients

Model 4	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	2.098	0.092		22.854	0.000
Real Wage Growth Rate	0.480	0.025	0.720	18.963	0.000
(Constant)	1.532	0.084		18.261	0.000
2 Real Wage Growth Rate	0.347	0.022	0.520	15.480	0.000
GDP Growth Rate	0.304	0.022	0.465	13.844	0.000
(Constant)	1.322	0.073		18.014	0.000
3 Real Wage Growth Rate	0.309	0.019	0.463	16.029	0.000
GDP Growth Rate	0.281	0.019	0.429	15.007	0.000
Individual Capitalization	0.149	0.013	0.306	11.510	0.000

1. Dependent Variable: Macroeconomical and Financial factors Index

5.2.3. Determinant coefficients

The coefficient of determination (R^2) is a measure of the size of the effect of the independent variables on the dependent variable, measuring the proportion of the total variability that is explained by the regression model (Marôco, 2014).

In this context, considering the R^2 of the models shown in Table 5-14, we conclude that in model one, two and four, there is a good fit to the data, since the values are 0.596, 0.573 and 0.518 respectively for one variable in each model, major than 0.5 according to Marôco, 2014, in social sciences values above 0.5 are already considered a good fit of the model to the data. Even if we consider the adjusted coefficient of determination (R^2_a), which, according to that author, is a better estimator of the quality of the model's fit to the data than R^2 , we also conclude that the models have a good fit to the data, since the R^2_a continues to be greater than 0.5. On the other hand, model three is the only one whose value is below 0.5, no less we conclude that the model has an acceptable fit, with the value of 0.468 for Sustainability factor (applied cut) being responsible for 46.8% of the data in the model.

5.2.4. Validation of model assumptions

The aim is to verify whether the typical assumptions of linear regression are verified and whether the regression models that we created are reliable or not. To this end, the linear regression models that we obtained can only be used to infer functional relationships between dependent and the independent variables if a set of assumptions relating to them are respected (Marôco, 2014). For each of the models, we will confirm that the relationship between the CASI for model one, the DFSI for model two, the SFGPSI for model three, and the MFFSI for model four, and the respective independent variables, is linear.

Table 5-14 Models summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.772 ^a	0.596	0.595	0.32412	0.596	540.255	1	366	0.000
2	.757 ^b	0.573	0.571	0.21201	0.573	506.287	1	378	0.000
3	.685 ^c	0.469	0.468	0.248163	0.469	301.536	1	341	0.000
4	.720 ^d	0.518	0.516	0.27051	0.518	359.604	1	335	0.000

a. Predictors: (Constant), Financial sustainability factors

b. Predictors: (Constant), Migration Effects

c. Predictors: (Constant), Sustainability factor (applied cut)

d. Predictors: (Constant), Real Wage Growth Rate

We will verify the identified errors assumptions: do the errors follow a normal distribution, do errors have a mean zero, principle of homoscedasticity, errors have a variance δ^2 constant and an absence of autocorrelation, errors are independent and random and the independent variables are orthogonal, that is, they are not correlated, or have weak correlations.

Table 5-15 Models Kolmogorov-Smirnov and Shapiro-Wilk test

Model's	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
1	0.096	368	0.000	0.985	368	0.001
2 Standardized	0.332	380	0.000	0.802	380	0.000
3 Residual	0.116	343	0.000	0.968	343	0.000
4	0.154	337	0.000	0.956	337	0.000

a. Lilliefors Significance Correction

Finally, we will analyse the principle of multicollinearity, an assumption about the predictor variables, whether there is an absence of a strong relationship between the independent variables and this can be verified by analysing the VIF (variance inflation factor).

Error analysis

To check whether the errors have a normal distribution, we used the *Kolmogorov-Smirnov* and *Shapiro-Wilk* tests, through which we tested the hypothesis:

$$H_0: \varepsilon \sim N(\mu; \sigma) \text{ vs } H_1: \varepsilon \not\sim N(\mu; \sigma)$$

According to Table 5-15, the p-values produced for all models allow us to conclude that, the errors don't have a normal distribution, since the p-value in each test is lower than the level of significance that we have been considering ($\alpha = 0.05$) and, for this reason, we rejected the hypothesis 0 that was being tested, therefore exist statistical inference that the errors do not have a normal distribution.

The *Kolmogorov-Smirnov* it is very sensitive to outliers and an unreliable test, even with the Lilliefors correction to make it less sensitive to extreme values, and should not be used as the only test to verify normality, so that matter, we use *Shapiro-Wilk* tests, having unfortunately obtained the same results.

The assumption of normal distribution of errors can also be verified graphically through the histogram and the normal probability graph (Q-Q plot of residuals), the first is a bar graph that demonstrates a frequency distribution and the second shows that the values

represented must be distributed more or less along the main diagonal, so that it can be concluded that the residues have a normal distribution (Marôco, 2014). In this context, graphs were generated for all models and can be consulted in [Appendice 5](#).

From the visual analysis of the graphs, we concluded that in the bar graph the line appears to follow a normal distribution, and in the probability graph most of the points presented are close to the main diagonal, leading us to conclude that the errors follow a normal distribution.

The assumption that the residuals have a zero mean is not guaranteed by the linear regression method that we used to generate the model obtained. So we resorted to descriptive statistical analysis to confirm the assumption, that the errors do have a mean of zero as verified in Table 5-16.

Table 5-16 Models descriptives statistics errors

Standardized Residual	N	Mean	Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic
Model 1	368	0.0000001	0.00000010	0.000
Model 2	380	0.0000000	0.00000016	0.000
Model 3	343	0.0000000	0.00000007	0.000
Model 4	337	0.0000003	0.00000018	0.000

The assumption of homoscedasticity, whose confirmation we obtain through the verification that the errors have constant variance and are independent, was made using the scatter diagram between the predicted (standardised) values and the residual (standardised) values of the model 2 errors. The scatter-plot obtained can be consulted in [Appendice 6](#) allowing us to conclude that the variance, in each of them, is approximately constant, since the residues are distributed in a more or less random way around zero. Additionally, the points appear distributed, in a more or less random way and, therefore, based on the residual dispersion diagram, there does not appear to be any relationship between them, which is why they are assumed to be independent. Errors are distributed more randomly, that is, more independent, and with constant variance, although we find irregular errors that can result in outliers, errors that influence the normal distribution of model errors.

Analysis of independent variables - principle of multicollinearity

One of the main assumptions to be validated during linear regression is to check whether the independent variables are in fact independent of each other. Once the existence of

correlations between the independent variables has been confirmed, we can say that we have a problem of collinearity or multicollinearity. If this situation of multicollinearity is confirmed, we cannot say that the models obtained by regression are adjusted and credible models. Therefore, if we confirm the complete absence of any linear relationship between the independent variables, they are said to be orthogonal (Marôco, 2014).

One of the procedures to be adopted to verify the existence of linear relationships between the independent variables is the analysis of the bivariate correlation matrix, which we have already carried out in point 5.2. However, as also mentioned by Marôco, 2014, although high bivariate correlations between independent variables can lead to multicollinearity problems, these correlation coefficients are only valid for two-by-two variables, and there may be a linear association between more of two unidentified variables. So, we opted for another methodology mentioned by the author, which does not suffer from the problem of bivariate correlations, which is the analysis of the Variance Inflation Factor, (VIF) and which, when it presents values above a certain pre-established threshold (usually 5 or 10), already indicates multicollinearity problems in the independent variables.

Through the analysis of the VIF obtained for each of the independent variables included in each one of the generated models, shown in Table 5-17, we can see that all VIF are 1, which confirms the absence of multicollinearity problems in the generated models, since for the total absence of multicollinearity, the VIF must be less than 3.

Table 5-17 Models VIF

Collinearity Statistics		Tolerance	VIF
1	(Constant) Financial factors	1.000	1.000
2	(Constant) Migration Effects	1.000	1.000
3	(Constant) Sustainability factor (applied cut)	1.000	1.000
4	(Constant) Real Wage Growth Rate	1.000	1.000

1. Dependent Variable: CA Sustainability Index

2. Dependent Variable: Demographic factors Sustainability Index

3. Dependent Variable: Social Factors and Government Policies Sustainability Index

4. Dependent Variable: Macroeconomical and Financial Sustainability factors Index

Regression models confirm that financial factors have the most direct and significant influence on sustainability of the PPS in Portugal, while demographic factors, social factors, government policies and macroeconomic factors also play a role, though their

impact might be less direct or vary in significance depending on the model in Sustainability Index. The models generally fit the data well and most linear regression assumptions, including normality of errors, zero mean, homoscedasticity, and independence, were satisfied, with only minor issues regarding normality. Multicollinearity was not a concern, as VIF values indicated independence between variables. Overall, the models are reliable and offer valuable insights into the factors affecting sustainability in PPS in Portugal.

5.3.Validation of hypothesis testing

The linear regression models obtained, having verified and validated their reliability in the previous points, will allow us to address the hypotheses formulated in chapter four. These models will first validate that the selected factors effectively influence the sustainability of the PPS in Portugal from the perspective of CA.

$$\text{Model 1: CASI}_i = -1.11022302462516\text{E-}16 + 0.20\text{DF}_i + 0.20\text{SF}_i + 0.20\text{GP}_i + 0.20\text{MF}_i + 0.20\text{FF}_i + \varepsilon_i$$

Model one will be used to validate the hypotheses one to five formulated in chapter four. The objective is to test, for each unit variation of each of the factors, whether the sustainability of the PPS is positively or negatively influenced and whether these results are consistent with the literature review. In other words, the value of sustainability is expected to increase with the increase in the value of each of the factors, keeping the others constant at each moment. This linear regression model was generated with *enter* method and has the perfect adjustment. In order to verify the influence of the factors on the sustainability of the PPS in Portugal, indicates that for each unit variation of any of the factors, the sustainability value varies positively by 0.20 units.

H1: Sustainability of the PPS is negatively influenced by demographic factors. In model one, demographic factors (DF) are included with a coefficient of 0.20. This suggests no significant negative impact on sustainability, contradicting Hypothesis 1.

H2: Sustainability of the PPS is negatively influenced by social factors. Social factors have a coefficient of 0.20, indicating no significant negative influence, which does not support Hypothesis 2.

H3: Sustainability of the PPS is positively influenced by government policies. With a coefficient of 0.20, government policies show a positive influence, which aligns with Hypothesis 3, suggesting that government policies positively affect sustainability.

H4: Sustainability of the PPS is positively influenced by macroeconomic factors. The macroeconomic factors also have a coefficient of 0.20, supporting Hypothesis 4, as they positively contribute to sustainability.

H5: Sustainability of the PPS is positively influenced by financial factors. Financial factors with a coefficient of 0.20, confirm a positive relationship, supporting Hypothesis 5, indicating that financial aspects play a significant role in enhancing sustainability.

In order to assess which of the general factors, those already identified, demographic, social, government policies, macroeconomic and financial have the most impact on the sustainability of the PPS in Portugal from the CA perspective, a parsimonious model¹⁶ was created by applying the *stepwise* method to model one, with 59.5% of the variability of the model explained with the variable financial factors, whose unit variation causes the sustainability of the PPS in Portugal to vary by 0.574 units.

$$\text{Model 1P: CASI}_i = 1.073 + 0.574\text{FF}_i + \varepsilon_i$$

The linear regression model allowed us to evaluate, from the perspective of CA, that the most influential factors in the sustainability of the PPS are financial factors.

Linear regression model two allowed us to evaluate the influence of demographic variables on the demographic factors sustainability index (DFSI) and the independent variables synthetic fertility index, average life expectancy, migration effects and ageing population. The results obtained, from the perspective of CA, are as follows:

$$\text{Model 2: DFSI}_i = -1.33226762955019\text{E-}15 + 0.25\text{SFI}_i + 0.25\text{ALE}_i + 0.25\text{ME}_i + 0.251\text{AP}_i + \varepsilon_i$$

Model two intended to evaluate the importance of each of the factors synthetic fertility Index, average life expectancy, ageing population and migration effects, has on the demographic factors sustainability index from the perspective of CA. Results indicate that for each unit variation of one of the factors, the demographic factors sustainability index varies positively by 0.25 units.

¹⁶ Parsimonious model is simple and have great explanatory predictive power, they explain data with a minimum number of parameters or predictor variables

Parsimonious model was created, to assess which of the factors, SFI, ALE, AP and ME has the greatest impact on the demographic factors sustainability index from the perspective of CA, with 57.1% of the variability of the model explained with the variable migrations effects whose unit variation causes the demographic factors sustainability index to vary by 0.298 units.

$$\text{Model 2P: DFSI}_i = 2.734 + 0.298\text{ME}_i + \varepsilon_i$$

The linear regression model three aims to evaluate social variables and government policies on the social factors and government policies sustainability index. The model considers the following independent variables: unemployment benefits, minimum pension, count of entire contributory career, sustainability factor (applied cut), restriction of early retirements, review of the annual update rule and increase in the legal retirement age. This model provides insights into how these social and government policy variables influence the social factors and government policies sustainability index, from the perspective of CA. Results indicate that for each unit variation of any of the factors, the social factors and government policies sustainability index varies positively by 0.143 units.

$$\text{Model 3: SFGPSI}_i = 3.1641356201817\text{E-}15 + 0.143\text{UB}_i + 0.143\text{MP}_i + 0.143\text{CECC}_i + 0.143\text{SFAC}_i + 0.143\text{RER}_i + 0.143\text{RAUR}_i + 0.143\text{ILRA}_i + \varepsilon_i$$

Once again a parsimonious model was generated, intended to evaluate which of the factors unemployment benefits, minimum pension, count of the entire contributory career, sustainability factor (applied cut), restriction of early retirements, review of the annual update rule and increase in the legal retirement age has the greatest impact on the social factors and government policies sustainability index from the perspective of CA, with 46.8% of the variability of the model explained by the variable sustainability factor (applied cut), whose unit variation causes the social factors and government policies sustainability index to vary by 0.417 units.

$$\text{Model 3P: SFGPSI}_i = 1.992 + 0.417\text{SFAC}_i + \varepsilon_i$$

Linear regression model four does not differ from the previous one, in that it aims to evaluate the influence of macroeconomic and financial variables on macroeconomic factors and financial factor sustainability index with the independent variables of macroeconomic factors: GDP GR, employment GR, productivity GR, real wage GR, real inflation rate, unemployment GR, State budget financing, employers contribution, workers contribution and individual capitalisation.

Model four analyses macroeconomic and financial factors together to understand how each variable impacts on the macroeconomic and financial factors sustainability index. Results indicate that for each unit variation of the factors GDP GR, employment GR, productivity GR, real wage GR, real inflation rate, unemployment GR, the macroeconomic factors and the financial factor sustainability index varies positively by 0.117 units and for each unit variation of state budget financing, employers contribution, workers contribution and individual capitalisation the macroeconomic factors and the financial factor sustainability index varies positively by 0.100 units.

$$\text{Model 4: } \text{MFFSI}_i = -1.88737914186277\text{E-}15 + 0.117\text{GDPGR}_i + 0.117\text{EGR}_i + 0.117\text{PGR}_i + 0.117\text{RWGR}_i + 0.117\text{RIR}_i + 0.117\text{UGR}_i + 0.100\text{SBF}_i + 0.100\text{EC}_i + 0.100\text{WC}_i + 0.100\text{IC}_i + \varepsilon_i$$

Parsimonious model generated, intend to valuate which of the GDP GR, employment GR, productivity GR, real wage GR, real inflation rate and unemployment GR, state budget financing, employers contributions, workers contributions and individual capitalisation have the greatest impact on the macroeconomic and financial factors sustainability index from the perspective of CA, identifies real wage GR as the factor that explains 51.6% of the variability of the model whose unit variation causes the macroeconomic factors and the financial factor sustainability index to vary by 0.480 units.

$$\text{Model 4P: } \text{MFFSI}_i = 2.098 + 0.480\text{RWGR}_i + \varepsilon_i$$

In short, the analysis of the factors that influence the sustainability of PPS in Portugal produced significant insights into perceptions of CA, the use of measures of central tendency and dispersion clarified the importance attributed to several independent variables, highlighting in particular the role critical of financial factors, followed by demographic factors sustainability index like migration effects. Social factors and government policies, though important, have a more moderate effect on social factors and government policies sustainability index. Macroeconomic factors such as real wage growth rate also play a key role, highlighting the multifaceted nature of macroeconomic and financial factors sustainability index.

Analysis of correlations revealed mostly weak interactions, between most factors, emphasizing the uniqueness of strong relationships within specific areas. Furthermore, the regression models demonstrate that the independent variables have a significant impact on the perception of sustainability, where the fit to the models data was considered good.

Table 5-18 Hypothesis results

	Model validation
H1: Sustainability of the PPS is negatively influenced by demographic factors	no
H2: Sustainability of the PPS is negatively influenced by social factors	no
H 3: Sustainability of the PPS is positively influenced by government policies	yes
H 4: Sustainability of the PPS is positively influenced by macroeconomical factors	yes
H 5: Sustainability of the PPS is positively influenced by financial factors	yes

Source: made by the author.

As shown in Table 5-18, the analysis of the linear regression model elucidated the significant factors that influence the sustainability of the PPS in Portugal from the perspective of CA.

The results validate hypotheses three, four and five, with the positive impact of government policies, macroeconomic and financial factors on the sustainability of the PPS in Portugal, while challenging the assumptions of hypotheses one and two, regarding the negative influence of demographic and social factors.

6. Conclusion

The aim of this master's thesis was to analyse which factors most influence the sustainability of the public pension system in Portugal, from the perspective of certified accountants. This is a complex issue, shaped by various economic, demographic, social and institutional factors that CA, with their experience, and training in accounting, finance and risk management can offer a particular opinion on these dynamics.

Since the 1990s, various reports and studies by national and international organisations such as the Bank of Portugal, the OECD and the EU have warned of the need for structural reforms in the pension system to guarantee its long-term sustainability. The publication of *Livro Branco da Segurança Social*, in 1998, Comissão do Livro Branco da Segurança Social (1998), rekindled concern about the sustainability of the PPS. After the 2008 crisis and the budgetary adjustment that began in 2011, this debate intensified in national and European political circles. According to studies, some authors defend the sustainability of the PPS, while others consider it unsustainable, generating political controversy. The sustainability of the PPS in Portugal depends on the interaction of three main factors: demographic (ratio between the working population and pensioners), governmental (fiscal and social policies) and economic (economic development and contributory capacity).

We analyse demographic factors, including the synthetic fertility index, average life expectancy, ageing population and migration effects, which directly influence the relationship between workers and pensioners, essential for the sustainability of the PPS. For social factors, we look at the minimum pension and unemployment benefits and how they can influence the sustainability of the PPS. Government policies ranges from fiscal decisions to social policies that determine the distribution of resources, including new measures to address the reduction in retirement income, such as the calculation of the old-age pension and restrictions on early retirement. Economic factors include economic development and the ability of taxpayers to fulfil their tax obligations, which are vital for guaranteeing adequate resources for old-age pensions and social benefits. We categorize these factors into macroeconomic and financial factors. Macroeconomic factors are essential for assessing a country's economic health and significantly affect the sustainability of the PPS, therefore we analyse indicators such as the GDP growth rate, the employment growth rate, the productivity growth rate, the real wage growth rate, the real inflation rate and the unemployment growth rate. Financial factors are related to the financing of the PPS in Portugal, which comes from various sources, each of which has a unique impact on the financial sustainability of the system. The sources of funding

include the State budget, employer contributions, workers contributions and individual capitalisation. This information helps to understand the extent to which the PPS can be maintained in the light of economic dynamics and the effectiveness of the different funding streams in supporting its longevity.

We adopted a quantitative analysis methodology, building one linear regression model to determine which factors most influence the PPS in Portugal, from the perspective of CA. Other three linear regression were developed to evaluate the CA perception about the demographic variables and how they affect the demographic factors sustainability index, the social and government policies variables and how they impact on the social factors and government policies sustainability index and macroeconomic and financial variables and their impact on the macroeconomic factors and financial factor sustainability index. The parsimonious model, which aims to have the best explanation or prediction model with the least complexity, was derived from model one. It allowed the determination that for the certified accountants, the financial factors have the greatest impact on the sustainability of the PPS, with a positive variation of 0.574 units for each unit of financial factors. The analysis of the subsequent parcimounios models derived form model two, three and four, confirmed that the variables migration effects, sustainability factor (cut applied) and real wage growth rate are the variables that stand out, most certified accountants perception of theses variables in their respective indexes.

Financial factors emerged as the most critical element, with a pronounced ability to improve sustainability. The variable financial factors composed of financing by State budget, employer contributions, workers contributions and individual capitalisation, are the set of variables with positive impact on the sustainability of the PPS in Portugal. Migration effects, sustainability factor (applied cut) and real wage growth rate, are the variables that stand out in the remaining models. The models collectively highlight the need for targeted interventions and informed policymaking to strengthen the resilience of the SS public pension system. As we navigate the complexities of public finance, it is critical to leverage this knowledge, fostering a collaborative approach among stakeholders to ensure the long-term viability of Portugal's PPS.

We conclude, based on statistical tests and analysis of the results, that the linear regression model clarified the significant factors that influence the sustainability of the PPS in Portugal from the CA perspective. The conclusions validate hypotheses three, four and five, confirming the positive impact of government policies, macroeconomic and financial factors on the sustainability of PPS in Portugal, while challenging the

assumptions of hypotheses one and two, regarding the negative influence of demographic and social factors that are not confirmed, from the perspective of certified accountants. Through an analysis of demographic and social factors, government policies, macroeconomic and financial factors, we found that although demographic and social factors do not have a negative impact on sustainability, as previously assumed, the influence of government policies, macroeconomic conditions and financial factors are significantly positive. Financial factors play a dominant role in improving sustainability of the PPS, namely through the appropriate management of pension funds, adjustments in contributions, the implementation of financial reforms and the adaptation of the system to economic and demographic changes, which are fundamental to keeping the PPS financially healthy. Furthermore, financial incentives and investment diversification are key strategies to ensure that the pension system continues to offer financial security to future generations.

The opinion of CA, indicates a critical need for policymakers to focus on refining financial strategies and improving macroeconomic stability to ensure the long-term viability of the PPS. The importance of informed government policies further underscores the need for strategic reforms in SS governance. As Portugal faces the challenges of an ageing population and evolving economic conditions, our findings highlight the importance of implementing responsive policies that promote financial inclusion and sustainable growth. Recent reforms reflect a proactive approach to addressing the challenges posed by an ageing population and economic uncertainty. The introduction of the sustainability factor, adjustments in retirement age and efforts to promote active ageing represent strategies to reinforce the resilience of sustainability of the PPS.

This work not only contributes to the theoretical discussion on sustainability on PPS in Portugal, but also serves as a call to action for policymakers. It is essential that future reforms are evidence-based, with broad involvement of diverse stakeholders. The conclusions described in this work are the opinion of a professional class knowledgeable about the topic analysed, being one of its limitations, that's why we suggest future research, expanding the sample of respondents. The evidence presented remains as reliable as possible, taking into account the uncertainties surrounding future data and results. It can be argued that these quantitative conclusions serve as a fundamental basis regarding the scarcity of accessible data experienced until recently, offering relevant information on the factors that influence the sustainability of the PPS in Portugal.

Future research should expand the sample size and examine additional variables to better capture the complexity of sustainability factors on Portuguese PPS.

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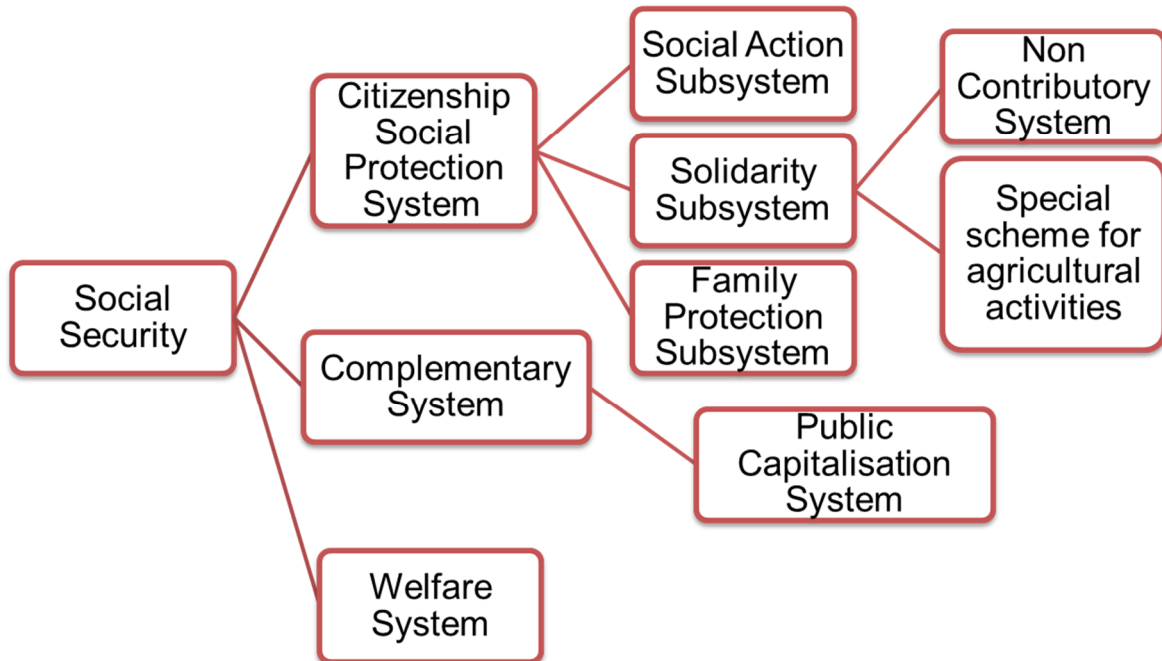
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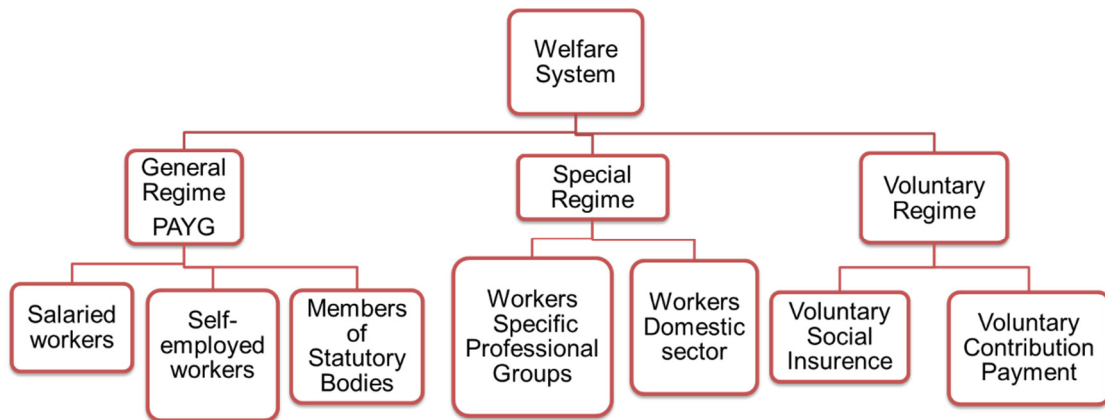
Appendices

[Appendice 1](#) Social Security Organisational chart.



Source: made by the author based on *Lei de Bases n.º 4/2007, de 16 de janeiro – Lei de Bases da Segurança Social*.

[Appendice 2](#) Welfare system organisational chart.



Source: made by the author based on *Lei de Bases n.º 4/2007, de 16 de janeiro – Lei de Bases da Segurança Social*.

[Appendice 3](#) - Questionnaire “Fatores que influenciam a sustentabilidade do sistema de pensões em Portugal pela perspectiva dos Contabilistas Certificados”

Fatores que influenciam a sustentabilidade do sistema de pensões em Portugal

pela perspectiva dos Contabilistas Certificados

* Indica uma pergunta obrigatória

1. Inscrição na Ordem dos Contabilistas Certificados *

2. Género *

Marcar apenas uma oval.

M

F

3. Idade? *

Marcar tudo o que for aplicável.

Menos de 30 Anos

Entre 31 e 40 Anos

Entre 41 e 50 Anos

Entre 51 e 60 Anos

Entre 61 e 70 Anos

Mais 71 Anos

4. Qual a sua experiência Profissional em Contabilidade? (Número de Anos) *

5. Qual o seu Grau Académico: * *

Marcar apenas uma oval.

Doutoramento

Mestrado

Licenciatura

Outra:

6. Qual a sua Área de Formação? *

7. Qual o impacto dos fatores demográficos no sistema de pensões? *

Marcar apenas uma oval.

1 2 3 4 5

8. Índice Natalidade *

Marcar tudo o que for aplicável.

Nenhum Impacto

Pouco Impacto

Algum Impacto

Muito Impacto

Não Sei

9. Esperança Média de Vida *

Marcar tudo o que for aplicável.

Nenhum Impacto

Pouco Impacto

Algum Impacto

Muito Impacto

Não Sei

10. Migração *

Marcar tudo o que for aplicável.

- Nenhum Impacto
- Pouco Impacto
- Algum Impacto
- Muito Impacto
- Não Sei

11. Envelhecimento da População *

Marcar tudo o que for aplicável.

- Nenhum Impacto
- Pouco Impacto
- Algum Impacto
- Muito Impacto
- Não Sei

12. Qual o impacto dos fatores sociais no sistema de pensões? *

Marcar apenas uma oval.

1 2 3 4 5

13. Desemprego *

Marcar tudo o que for aplicável.

- Nenhum Impacto
- Pouco Impacto
- Algum Impacto
- Muito Impacto
- Não Sei

14. Pensão Mínima *

Marcar tudo o que for aplicável.

- Nenhum Impacto
- Pouco Impacto
- Algum Impacto
- Muito Impacto
- Não Sei

15. Qual o impacto dos fatores macroeconómicos no sistema de pensões? *

Marcar apenas uma oval.

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

16. Taxa Crescimento PIB *

Marcar tudo o que for aplicável.

- Nenhum Impacto
- Pouco Impacto
- Algum Impacto
- Muito Impacto
- Não Sei

17. Taxa Crescimento emprego *

Marcar tudo o que for aplicável.

- Nenhum Impacto
- Pouco Impacto
- Algum Impacto
- Muito Impacto
- Não Sei

18. Taxa de Crescimento Produtividade *

Marcar tudo o que for aplicável.

- Nenhum Impacto
- Pouco Impacto
- Algum Impacto
- Muito Impacto
- Não Sei

19. Taxa Crescimento Real dos Salários *

Marcar tudo o que for aplicável.

- Nenhum Impacto
- Pouco Impacto
- Algum Impacto
- Muito Impacto
- Não Sei

20. Taxa Inflação Real *

Marcar tudo o que for aplicável.

- Nenhum Impacto
- Pouco Impacto
- Algum Impacto
- Muito Impacto
- Não Sei

21. Taxa Crescimento Desemprego *

Marcar tudo o que for aplicável.

- Nenhum Impacto
- Pouco Impacto
- Algum Impacto
- Muito Impacto
- Não Sei

22. Qual o impacto dos fatores sustentabilidade financeira no sistema de pensões? *

Marcar apenas uma oval.

1 2 3 4 5

○ ○ ○ ○ ○

23. Financiamento via Orçamento de Estado *

Marcar tudo o que for aplicável.

- Nenhum Impacto
- Pouco Impacto
- Algum Impacto
- Muito Impacto
- Não Sei

24. Contribuições das Entidades Empregadoras *

Marcar tudo o que for aplicável.

- Nenhum Impacto
- Pouco Impacto
- Algum Impacto
- Muito Impacto
- Não Sei

25. Contribuições Trabalhadores *

Marcar tudo o que for aplicável.

- Nenhum Impacto
- Pouco Impacto
- Algum Impacto
- Muito Impacto
- Não Sei

26. Capitalização Individual *

Marcar tudo o que for aplicável.

- Nenhum Impacto
- Pouco Impacto
- Algum Impacto
- Muito Impacto
- Não Sei

27. Qual o impacto que atribui a novas medidas para fazer face ao decréscimo de rendimento na idade da Reforma? *

Marcar apenas uma oval.

1 2 3 4 5

28. Contagem de toda a carreira contributiva *

Marcar tudo o que for aplicável.

- Nenhum Impacto
- Pouco Impacto
- Algum Impacto
- Muito Impacto
- Não Sei

29. Fator de sustentabilidade (corte aplicado) *

Marcar tudo o que for aplicável.

- Nenhum Impacto
- Pouco Impacto
- Algum Impacto
- Muito Impacto
- Não Sei

30. Restrição das reformas antecipadas *

Marcar tudo o que for aplicável.

- Nenhum Impacto
- Pouco Impacto
- Algum Impacto
- Muito Impacto
- Não Sei

31. Revisão da regra de atualização anual *

Marcar tudo o que for aplicável.

- Nenhum Impacto
- Pouco Impacto
- Algum Impacto
- Muito Impacto
- Não Sei

32. Aumento da Idade legal de Reforma *

Marcar tudo o que for aplicável.

- Nenhum Impacto
- Pouco Impacto
- Algum Impacto
- Muito Impacto
- Não Sei

33. Tem alguma sugestão/contributo para este estudo? *

Este conteúdo não foi criado nem aprovado pela Google.

Google Formulários

[Appendice 4](#) – Email sent to accountants sorted on yellow pages

Ex. mo(a) Sr. ^{o(a)} Contabilista Certificado

No sentido de poder analisar os fatores que influenciam a sustentabilidade do sistema de pensões em Portugal pela perspetiva dos Contabilistas Certificados, torna-se essencial obter a opinião dos pares, pelo que é extremamente importante que responda ao questionário que em seguida lhe apresentamos.

Tratando-se de um trabalho exclusivamente académico elaborado por uma Contabilista Certificada (n.º 93257), Ana Rita Serralho Nazário Ferreira, no âmbito do Mestrado em Finanças Empresariais da Escola Superior de Tecnologia e Gestão de Leiria.

Com o presente questionário pretende-se recolher dados relevantes em relação à sustentabilidade do sistema de pensões em Portugal.

Garantimos que os dados recolhidos serão tratados com respeito pelo anonimato e confidencialidade dos mesmos, reforçando o facto de a sua colabouração ser valiosa! O seu preenchimento levará aproximadamente 5 min.

Muito agradecemos desde já a sua colabouração, que é essencial.

Para participar clique por favor no link abaixo:

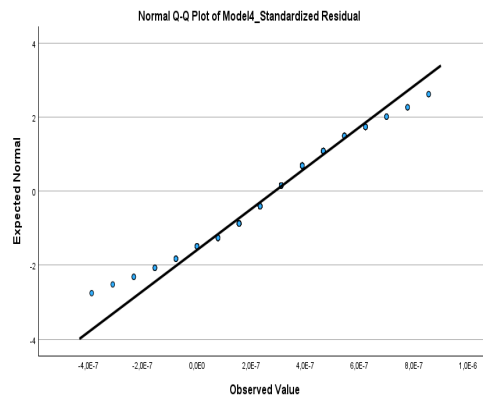
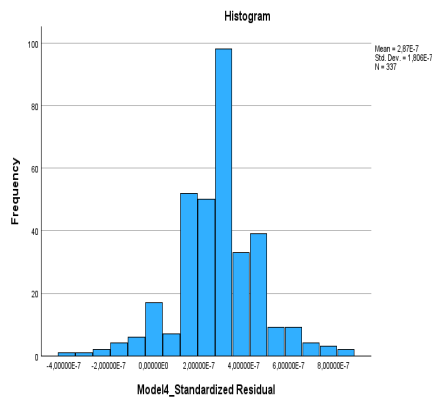
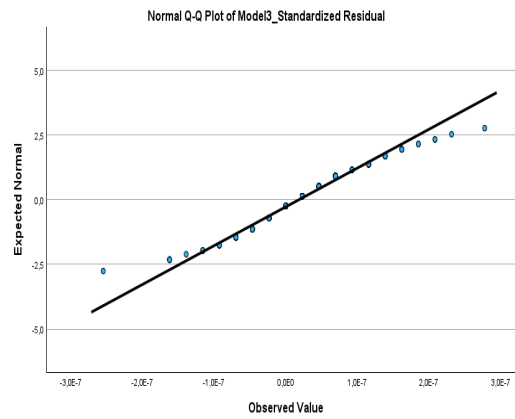
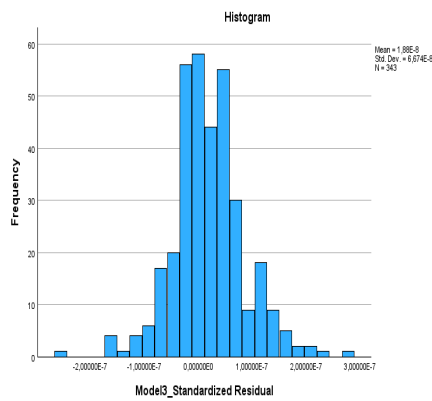
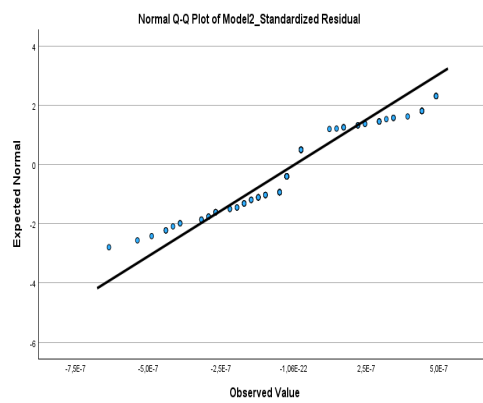
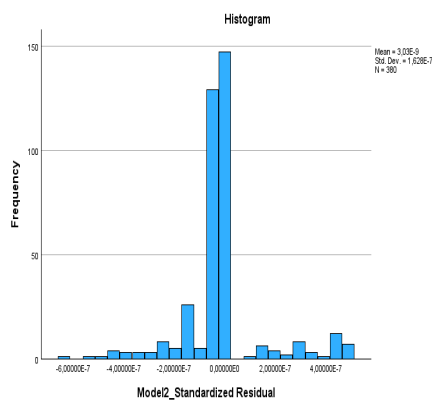
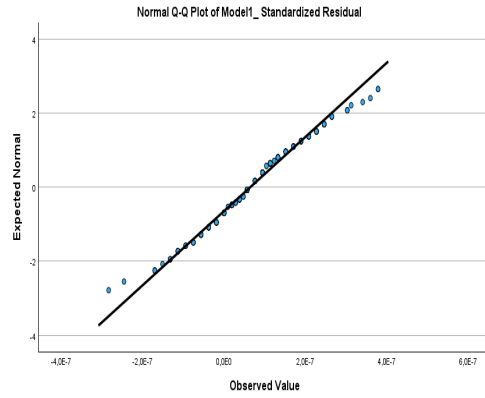
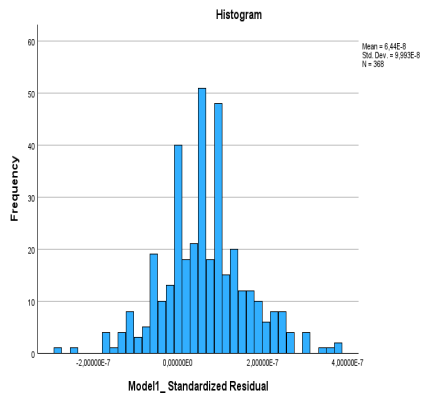
<https://docs.google.com/forms/d/e/1FAIpQLSccgeXYAA7xCGrwX1JhTIsCAMxo4dRPsJmsbZtOue-eDBb7sQ/viewform>

Antecipadamente grata,

Melhores Cumprimentos

Rita Ferreira

Appendice 5 – Standardized Residual Histogram's and Q-Q Plot



[Appendice 6](#) – Standardized Predicted and Residual Scatter-plots

