

iscte

INSTITUTO
UNIVERSITÁRIO
DE LISBOA

Comparing The Social Security System in Portugal and in the USA in the Payment of Retirement Pensions

Miguel Prazeres Vairinhos

Master in Management

Supervisors:

PhD Vasco Barroso Gonçalves, Assistant Professor,
ISCTE - University Institute of Lisbon

October, 2023



BUSINESS
SCHOOL

Marketing, Operations and General Management Department

**Comparing The Social Security System in Portugal and in the USA in
the Payment of Retirement Pensions**

Miguel Prazeres Vairinhos

Master in Management

Supervisors:

PhD Vasco Barroso Gonçalves, Assistant Professor,
ISCTE - University Institute of Lisbon

October, 2023

Dedication

I would like to dedicate and thank my family and friends for helping me during this period. Specifically, my mother, my father, my grandparents from both sides and my girlfriend for their unconditional support during the whole process.

I would also like to thank Professor Vasco Barroso Gonçalves for his guidance and advice during the whole process which was of great support for the development of this work.

Thank you all

Table of Contents

<i>Dedication</i>	<i>i</i>
<i>Table of Contents</i>	<i>ii</i>
<i>List of Tables and Charts</i>	<i>iv</i>
<i>Abstract</i>	<i>v</i>
<i>Resumo</i>	<i>vi</i>
1. Introduction	1
2. Literature Review	2
2.1 Pension Definition.....	2
2.2 Types of Pension Plans.....	2
2.3 Pension Plan Funding.....	5
2.4 Social Security.....	6
2.4.1 Social Security in Portugal.....	7
2.4.2 Social Security in the USA.....	9
2.5 Replacement Rate.....	9
2.6 The main Concern with Pension Funds and how are they being addressed.....	10
2.7 Global Context.....	12
3 Methodology	14
3.1 Research Context.....	14
3.2 Research Design.....	14
3.3 Data Collection and Treatment.....	14
4 Discussion	16
4.1 Model 1 – Replacement rates comparison.....	16
4.1.1 Portuguese Case.....	16
4.1.2 USA case.....	17
4.2 Model 2 – Sustainability analysis of public pension systems.....	18
4.2.1 Portuguese case.....	19
4.2.2 USA case.....	20
4.3 Results Comparison and Analysis.....	21
4.3.1 Model 1.....	22
4.3.2 Model 2.....	22
4.3.3 Final considerations.....	24
5. Conclusion	26
6. Bibliography	27

7. Appendix.....	30
Appendix A – Portuguese Model 1.....	30
Appendix B – USA Model 1	33
Appendix C- IAS Table in Portuguese	36

List of Tables and Charts

Table 1- Accrual Rate Portugal

Chart 1- Replacement Rates (OCDE 2020)

Chart 2- Rise in the old-age to working-age ratio is accelerating (OCDE 2010)

Abstract

This thesis presents a comprehensive comparative analysis of the Portuguese and American social security systems concerning the payment of retirement pensions. With a focus on key factors such as eligibility criteria, benefit calculation methods, and sustainability, this research aims to shed light on the strengths, weaknesses, and nuances of each system.

Through rigorous quantitative analysis and qualitative assessments, this thesis offers insights into the financial stability and long-term viability of both systems. It examines the adequacy of retirement benefits, considering the different contribution rates and earnings replacement ratios.

By comparing these two social security models, this thesis aims to contribute to a deeper understanding of the challenges and opportunities faced by countries with varying approaches to pension provision. Ultimately, it seeks to inform policymakers and stakeholders about potential strategies for enhancing the sustainability and effectiveness of retirement pension systems in an ever-changing global landscape.

Keywords: pensions, pensions schemes, pension funds, social security, Portuguese Social Security, American Social Security

Resumo

Esta dissertação apresenta uma análise compreensiva do sistema de segurança social Português e Americano no pagamento de pensões de reforma. Focando se em fatores como os critérios de elegibilidade, o cálculo dos benefícios, a sustentabilidade, este trabalho tem como objetivo demonstrar quais as forças, fraquezas e nuances de cada um destes sistemas.

Através de uma rigorosa análise quantitativa e qualitativa esta dissertação oferece informações sobre a estabilidade financeira e a viabilidade destes sistemas a longo prazo. Analisando a adequabilidade das reformas tendo em conta as diferentes taxas de contribuição e da taxa de substituição em relação aos vencimentos á idade de reforma.

Comparando estes dois distintos sistemas de segurança social, será mais fácil perceber quais os desafios e oportunidades que cada um destes países terá de enfrentar. Por fim, o objetivo passa por informar as entidades reguladoras de possíveis estratégias que ajudem a alcançar uma maior sustentabilidade e eficiência nestes esquemas.

Palavras-Chave: Pensões, Reformas, Segurança Social, Fundos de Pensões, Segurança Social em Portugal, Segurança Social nos Estados Unidos.

1. Introduction

Retirement Pensions are essential to living, people would have to work their whole lives if there were no retirement pensions. Making this a very concerning topic to all countries in the world which aim to better the quality of life of their citizens.

Retirement pension can be paid by a variety of entities, from governments, in the form of social security, to private companies or even special funds created by workers unions, among others. The focus of this dissertation will be on the retirement benefits offered by social security in Portugal and in the USA. These two countries have distinct policies when it comes to handling social and economic issues, which makes it much more interesting to compare how these social security systems work when in terms of retirement pensions.

The way retirement systems work is not regulated likewise for the whole world, each country has its own laws about retirement and the payment of retirement pensions, which means that the way benefits are paid differs as well as the sustainability of each system.

Taking this into consideration, the main aim of this dissertation is to understand which social security systems is the most balanced and sustainable for all stakeholders involved, mainly the government and the citizens of each country. This will be done through two mathematical models that will help understand the main differences between the two countries.

These topics will be explored by answering the following questions:

- What are the main differences between the Portuguese and the American social security systems?
- Which of these systems is more beneficial for plan participants and which is more beneficial for plan setters?

These questions will be answered with the support of the literature review and of statistical studies and with the analysis of primary collected data, as well as through the formulation of a mathematical model. This way, the objectives defined for the research are the following:

- Understanding the main concepts connected to retirement pensions.
- Comprehending the differences between the Portuguese and American social security systems.
- Comparing both systems and arriving to a conclusion of which system is the most balanced.

2. Literature Review

To analyze the contrasting features of social security programs in Portugal and the United States, it is essential to first establish a clear understanding of the concept of pension. This entails delving into the various pension systems, their overarching operational mechanisms, and the diverse categories of pension plans. Only after grasping these fundamental aspects, we proceed to examine the unique characteristics of social security schemes in both the USA and Portugal.

The main topics associated with retirement indemnities will be presented. Then, there will be a focus on social security and how it works, and the specific rules and conditions imposed in each country.

To better comprehend this topic and concepts an extensive literature review of this was carried out.

2.1 Pension Definition

Retirement pension is the payments made to the beneficiaries after they retire. Those are defined through pension plans. Pension plans can be set up by insurance companies, employees, employers, and governments (Peijie Wang *et al.*, 2014)

Pensions can be paid in two different ways. One way is through annuities where yearly payments are made to pensioners starting once they retire. There are also lump sum payments which consist of paying the whole benefit in one payment or divided it into a specific amount of payments at retirement age. These forms of payment vary according to country or plan.

2.2 Types of Pension Plans

There are two major types of pension plans: the Defined contributions and Defined Benefits. (Wang. et al., 2014).

Defined contributions consist of each employee having his own account, in the pension fund, to which he and the employer make regular contributions, usually defined previously by the plan itself. The employee has some kind of control to decide in which assets to invest in. Ending up bearing almost all the risk (Rinaldi and Giacomel et al., 2008).

It is important to notice that the investment options in this case for the employee are limited to certain stock and bonds made available by the pension fund and it is not possible for a plan participant to invest in anything he wants to. He is limited to what is made available by

the pension fund. In this system, at retirement the participant will be presented with a retirement indemnity correspondent to the accumulated value of the funds in his retirement account.

Some Defined contribution plans also offer the options to their participants of purchasing a certain life annuity upon retirement. This life annuity is determined by the plan sponsor based on the participant's investment, salary, and interest rates. This is beneficial for participants who avoid bearing all the risk until retirement. However, this could also lead them to lose money if their investments turn out to be better than expected.

As for Defined benefit plans the employee is guaranteed a certain benefit upon retirement calculated through a formula which accounts for an average of final salary, years of service and accrual. In this case the employers bear the risk of default, meaning the employee is always guaranteed some benefit (Bodie et al, 1998).

Defined benefit plans were until recently the most common types of plans in most European countries including Portugal. Mandatory Define benefit plans were offered to the population, an example of this being the Social Security System where participants make contributions based on a percentage of their earnings and depending on that they get a benefit upon retirement. There are no investment options in this plan and the only way to increase benefit upon retirement is by increasing the amount contributed.

In both cases the plan participants can only have access to their pensions upon retirement. Even if the participant moves from one plan to another, he can't take his money in the moment. He either waits to receive it upon retirement or loses all that was discounted or finds a way to transfer the accumulated value to the new plan he moved to. The ease with which this can be done depends on plan rules and flexibility, but in most cases if a member leaves his current plan, he is entitled to what was accrued until then upon retirement. (Bodie et al, 1988)

Advantages of Defined Benefit Pension Plans:

- **Guaranteed Income:** One of the primary advantages of defined benefit pension plans is that they provide a guaranteed income stream to retirees upon retirement. These plans are not dependent on market conditions or stock fluctuations. However, in severe cases if the plan issuer is affected default, that is a possibility.
- **No Investment Risk:** Since the employer is responsible for investing the pension assets, employees do not bear any investment risk. Even if the investments do not perform as

expected, retirees will have a guaranteed pension upon retirement. This is an advantage in the perspective of the employee but a disadvantage for the employer.

Disadvantages of Defined Benefit Pension Plans:

- **Cost:** If not fully funded Defined benefit pension plans can be expensive to administer and maintain. Employers are required to make annual contributions to the plan, what can be a significant financial burden.
- **Complexity:** Defined benefit pension plans are complex and require a significant amount of expertise to manage. Employers may need to hire specialized staff or consultants to ensure that the plan is properly administered and that the investments are managed effectively. This complexity is a form of protecting plan participants, not allowing employers to make risky investments, and cutting their flexibility to avoid default.
- **Limited Flexibility:** Defined benefit pension plans provide employees just a small amount of freedom. After a pension has been earned, an employee often cannot transfer it to another retirement plan or take a lump sum withdrawal. For people who might need to use their retirement assets for unforeseen bills or emergencies, this lack of flexibility may be a drawback.

Advantages Defined contribution Plans.

- Individuals have greater control over their savings. As the contributions made into these plans are directed towards an investment account that is managed by professionals, individuals have the ability to choose the investment options that align with their risk tolerance and investment objectives.
- Another advantage of Defined contribution pension plans is that, in some cases, depending on the plan, the savings are portable from one plan to another. This allows employees to have more flexibility when choosing their plans. However, this does not happen for all plans.

Disadvantages Defined contribution Plans.

- The main disadvantage in these types of plans is the fact that employees are bearing all the risk because investment decisions are made by them, meaning they are dependent on market movements and, in the worst case, this can lead to a decrease in retirement income.

- Another disadvantage of Defined contribution pension plans is that they may not provide sufficient retirement income. While the potential for higher returns exists, there is no guarantee that individuals' investment returns will be sufficient to provide them with the retirement income they need. The uncertainty is a big factor because plan participants are not sure of their retirement income until they retire, always depending on market conditions.

2.3 Pension Plan Funding

Funding is an essential part of pension schemes, and they distinguish themselves according to the way they are funded. The forms of funding can be divided in three major types: (Cooper et al., 2006)

- Funded schemes, when some portion of assets, which are legally separated from the sponsor of the plan, represent a part of the liabilities. A scheme can be considered funded if its assets account for 2 years of liabilities, meaning if everyone was to retire that day the assets would be able to cover for 2 years of payments.
- Book reserve schemes, when a plan is funded by a reserve of assets that are set aside from the employer. This type of funding is riskier for plan participants because in case of default there is no protection.
- Pay as You Go funding system, which is most used for state pensions where plan participants make contributions that pay for their benefit in the future. This scheme normally also has a small reserve of assets but not in sufficient amount to be a considered a funded scheme (Cooper et al. 2006).

The main stakeholders responsible for setting up and funding pension plans are employers which set up pension plans because this is one of the best ways to retain their employees and attract new ones. These are the private pension funds.

The other stakeholder responsible for setting up pension plans is the government, and, in most cases, through Social Security, which is a social welfare system that distributes benefits to workers and their dependants based on what they have discounted during their working lives. This is a system sustained by the government and it is what is used in Portugal. The main aim of social security is to provide decent living conditions. These are the public pension funds. These public pension funds will be the main focus of this dissertation. (Wang et al., 2014)

2.4 Social Security

Considering the focus of this work will be on comparing the social security system both in Portugal and USA and their capacity to pay retirement pensions, it is relevant to give a historical background about the social security system in these countries, as well as to show their position in comparison to normal private pension funds.

Social security is a system of government programs and policies designed to provide financial assistance and support to individuals and families during various stages of life, particularly during times of economic turmoil. It's main priority is focused at protecting people from the risks and uncertainties associated with events such as old age, disability, unemployment, and the loss of a primary wage earner. This system is universal in Portugal, meaning all citizens are automatically enrolled in this system. In the USA despite not being universal it is estimated, that 94% of the population is enrolled in this plan (Congressional Research Service et al., 2021).

The core goal of social security is to promote social welfare by ensuring a basic level of economic well-being for citizens. This is typically achieved through the collection of mandatory contributions or taxes from individuals, employers, and sometimes the government itself. These funds are then pooled together and used to provide benefits and services to eligible individuals or groups (Ramachandran & Ramakrishnan, March 18, 2011).

The specific components and benefits of social security systems can vary between countries, but they commonly include:

- Retirement pensions: Payments made to individuals who have reached the designated retirement age, helping them maintain an income after leaving the workforce. This is the main focus of this dissertation.
- Disability benefits: Financial assistance provided to individuals who are unable to work due to a physical or mental disability.
- Unemployment benefits: Temporary financial aid for individuals who have lost their jobs involuntarily and are actively seeking employment.
- Survivor benefits: Payments made to the surviving dependents or family members of a deceased individual who was eligible for social security, ensuring their financial security.
- Healthcare coverage: Some social security systems include provisions for providing or subsidizing healthcare services, ensuring access to medical care.

(Social Security Administration and Segurança Social Direta, et al. 2023).

2.4.1 Social Security in Portugal

This section is focused on only one component of Social Security System in Portugal, Retirement pensions, focus of the study.

The minimum eligibility criteria for receiving a retirement pension necessitate a participant to have accrued at least 15 years' worth of registered remunerations upon retirement. Additionally, there exists a minimum retirement age set at 66 years and 6 months. Opting for retirement prior to reaching this age will result in penalties.

Regarding eligibility, a participant is only eligible for a pension if he contributed for the pension plan during at least 15 years. The final pension upon retirement is estimated based on a career earning average. This way of calculating the career average earnings was only adopted in 2022. It is a way of increasing sustainability for Social Security because until then only the best 10 years' salary was accounted for.

In terms of contributing, the contributions are a fixed percentage of workers salary with the worker contributing on average 11% of his wage and the employer 23.75% of his employee salary. This percentages may have some differences depending on if the worker is independent or working for someone else. However, on average, the values are the ones referred (Lagoa & Barradas, 2022).

The formula to calculate benefits in Portugal varies according to when the member joined social security. If it was before 2001 then the formula is the following (Segurança Social Direta., et al 2023)

Final Pension= $(P1 * C3 + P2 * C4) / C$, where

$P1$ =Average earnings of the 10 out of 15 best years of earnings until 2001 * 2%* Number of contributing years

$C3$ = Number of years of Contributions before 2001

$P2$ =Average Earnings After 2001 * Accrual Rate

$C4$ = Number of Years of Contributions after 2001

C =Total number of Years of earnings

This formula for member who joined before 2001 is very complex and that is why our analysis will focus on members who joined after 2002 where the formula to determine Benefits is:

$$\text{Final Pension} = \text{Career Average Earnings} * \text{Accrual Rate} * \text{Sustainability Factor}$$

It must be taken into consideration that the career average earnings are based on the best 40 years of remunerations. If the participant has at least 40 years of service, they are subject to revaluation based on the financial conditions of the country including both inflation and salary increase.

Regarding the accrual rate, it is directly connected to the years of service until retirement and the career earnings upon retirement. If the plan participant has more than 20 years of service, then the table below (Table1) will be used to determine the accrual rate. If it has less than 20 years of service accrual will be 2%.

IAS (“Indexante dos Apoios Sociais”) is a specific value defined every year, which accounts for changes in GDP and inflation, that changes according to economic conditions. This helps determine the category to which a member should belong to. For example, in 2020, IAS was 438.81 euros, meaning that, if earnings upon retirement were below 482,69 euros (1,1 IAS), then accrual rate would be 2.3% (Moura et al., 2023).

Instalments	Reference Remuneration indexed to IAS	Tax
1st	Until 1.1xIAS	2.3%
2nd	Higher 1.1xIAS until 2xIAS	2.25%
3rd	Higher 2xIAS until 4xIAS	2.2%
4th	Higher 4xIAS until 8xIAS	2.1%
5th	Higher than 8xIAS	2%

Table 1- Accrual Rate Portugal

Finally, the sustainability factors are determined based on mortality tables, withdrawal rate and life expectancy upon retirement. The main goal of this factor is to penalize early retirees and with this guaranteeing that social security has enough capacity to pay retirement pensions and other subsidies in the future. For example, in 2020 the penalty was 15%, which meant that someone who decided to retire earlier would be penalized with less 15% of what he or she was supposed to receive with the pension (Fortes, 2021, March 23).

In Portugal the importance of Social Security is notorious and represents 19.8% of total GDP for the country, meaning a huge percentage of the Portuguese gross domestic product is assigned to social security expenses. (Pordata, 2020)

2.4.2 Social Security in the USA

In the case of the USA, the minimum requirements to be entitled to a pension are being 62 years old, despite normal retirement age being 67, and having made contributions for at least 10 years.

In terms of contributions, they are paid in the form of social security taxes and correspond to 6.2% for employees and 6.2% for employers, amounting to a total of 12.4%.

The benefit is calculated following this formula: $\text{Pension} = \text{AIME} * \text{PIA}$

AIME (Average indexed monthly earnings) is an average of a worker's highest earnings upon 35 years of earning multiplied by an index, that brings nominal earning up to current level wages. This Index helps to cover for possible financial and demographic changes contributing for adjusting the earnings for changes in cost of living.

The PIA (Primary Insurance Amount) determines the amount a participant will get every month from his monthly AIME. It can be broken down by the following: 90% of AIME until \$1,115, 32% of AIME between \$1,115 and \$6,721 and 15% of any amount over \$6,721(Data from SSA).

To better comprehend the weight of social security in the US, it can be considered from the perspective of how much it weights in comparison to total GDP. According to statistics provided, it represents around 5.4% of total GDP (Statista, 2020).

2.5 Replacement Rate

Replacement Rates measure how effectively a certain pension plan is able to provide benefits in comparison to the beneficiary earnings before retirement. The following graph (Chart1) shows the replacement rate for each country in 2020. It may be noticed that for countries where the level of state support for retirement benefits is low, like the USA, the replacement rate is lower and decrease progressively as the level of income increases. On the other hand, in countries like Portugal, where state support is high, replacement rates are higher and don't change so drastically when the level of income shifts (Feldstein *et al.*, 2001).

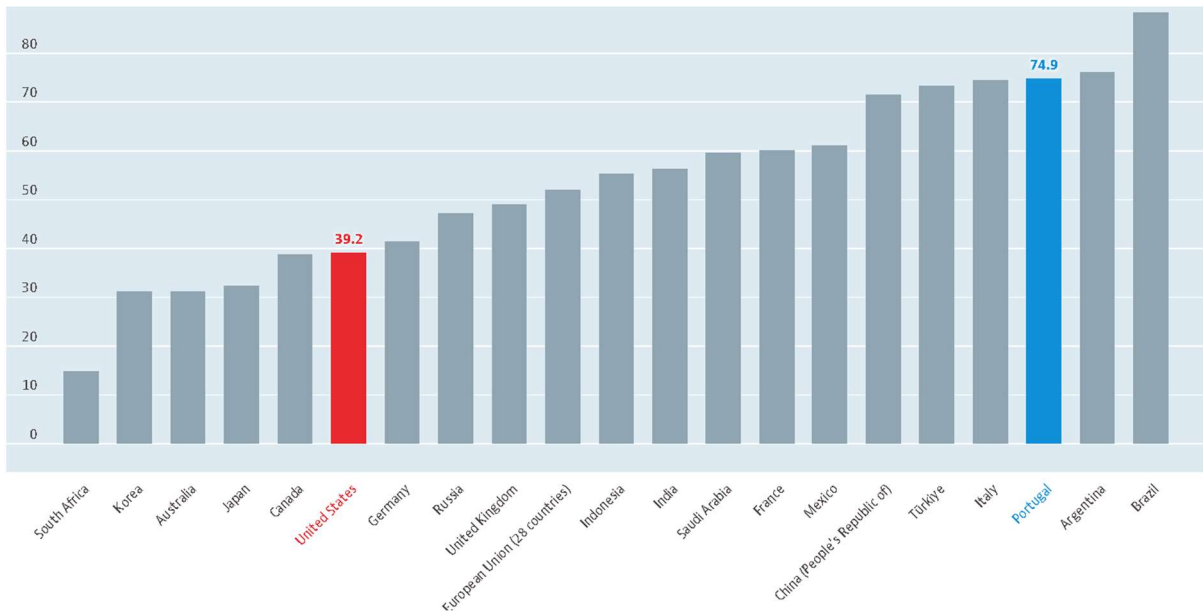


Chart 1. Replacement Rates (OCDE 2020)

2.6 The main Concern with Pension Funds and how are they being addressed.

Currently, the biggest concern OCDE has in terms of pension funds is the aging of the population. Retirees are living longer, meaning they get benefits for longer periods, and, at the same time, the working age population is decreasing, which means a lower number of workers contributing to pension plans which in the long run can be serious issue for sustaining pension plans. As can be seen in Chart 2 there is a rise in the old age to working age ratio, and according to this prediction, by 2070 the average age of the working population will be around 60 years, which is very worrisome (OECD 2019).

Portugal and the USA are not exempt from this trend. In the context of Portugal's demographics, this is evident as the population aged 65 and above accounts for 23% of the total population, while those under 14 years of age make up only 12.9%, as reported by INE (Instituto Nacional De Estatistica, et al. 2020). Additionally, the index for active population renewal, which stood at 94% in 2011, has dropped to 76% in 2020. This indicates a scarcity of emerging young individuals to offset the retiring workforce.

The situation in the United States closely parallels this pattern, as highlighted by the Administration for Community Living in their 2021 Profile of Older Americans. Their data reveals a 38% rise in the population aged 65 and older, in contrast to a mere 2% increase in the population below 65 years of age (Profile of Older Americans, et al., 2021).

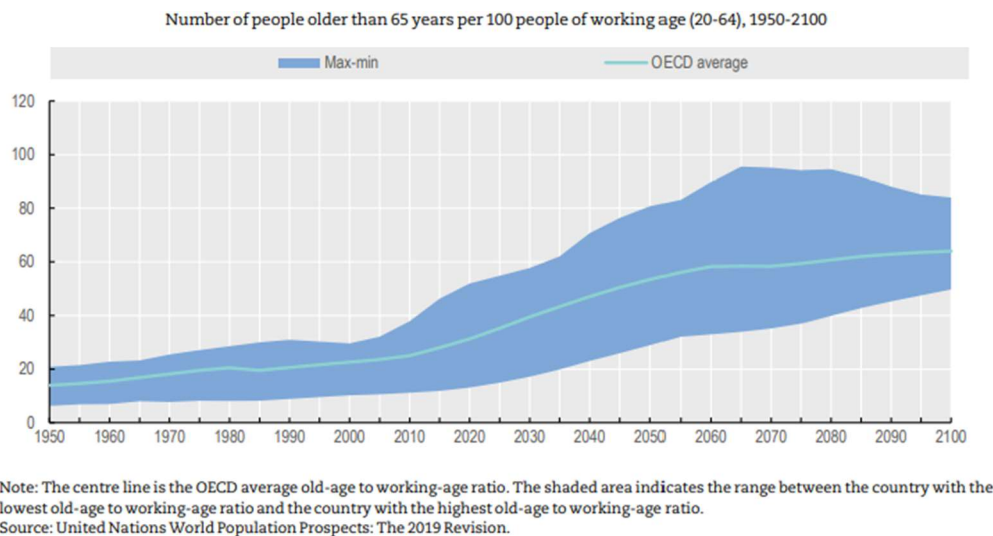


Chart 2. Rise in the old-age to working-age ratio is accelerating (OCDE 2010)

These concerns are being addressed by international entities like the World Bank International Labor Organization, the Geneva Association and International Monetary fund (ILO), which have created their own framework with multi pillar approaches aiming at allowing pension funds to be the most sustainable possible. They are as follows:

The World bank Multi- Pillar Model

- “Zero Pillar” aims at dealing with poverty and guaranteeing that all the elderly have minimum level of living conditions.
- “First Pillar” Contributions are connected to different levels of income, it is the Pay as You Go system.
- “Third Pillar” is related with voluntary contributions allowing plan members to contribute beyond what they are obliged to.
- “Fourth Pillar” is non-financial and is associated with informal support like health care, social programs, etc.

ILO Multi-tier model

- Anti-Poverty tier aims at providing decent living conditions to those with no means.
- Second tier, like the World Bank model, Pay as You Go defined benefits managed by the government with acceptable replacement rates.

- Third tier is related to mandatory contributions to privately managed pension funds, that will then generate a pension in a form of annuity upon retirement.
- The fourth tier is related with voluntary defined contributions, managed by private agencies.

Geneva Association Four-Pillar Program

- First Pillar, Pay as You Go state pension, like 2nd pillar of World Bank Framework
- Second Pillar, voluntary contributions to private pension plans
- Third pillar, the use of private savings and personal pensions as retirement indemnities
- Fourth Pillar, to fight the lack of working populations and the aging of the population, retirees should be authorized to have Part-Time jobs in order to complement their retirement indemnities.

Analyzing these three multi pillar models it is understandable that the models proposed by the World Bank and IMF are similar and seem to be more prepared to face the issues that are emerging nowadays, especially in comparison to the Geneva Association program (Wang et al., 2014).

2.7 Global Context

Despite the focus of this study being the comparison between Portugal and the USA, it is important to look at how other countries around the world organize their pensions systems and social security.

Looking for example at the European Union Members, their social security systems have a lot of similarities with the Portuguese and American systems.

Firstly, these systems rely on funding through taxes, primarily in the form of payroll taxes. The pay-as-you-go approach is typically employed, meaning that the taxes collected each year are utilized to provide benefits for current beneficiaries.

Secondly, the pension benefits offered are typically determined based on two main factors. One factor considered is the number of years the individual has contributed to the workforce, essentially rewarding their work history. Additionally, the individual's average lifetime earnings serve as another crucial determinant in calculating the pension benefits they are entitled to receive. (Feldstein, September 2021)

Despite these similarities there are always differences between countries in terms of legislation, retirement age, contributions, that influence the pensions upon retirement, which makes each country unique in terms of how their social security retirement pension systems work.

3 Methodology

3.1 Research Context

Social Security Retirement Pensions are fundamental to help maintain the minimal living conditions for elder population, as well as reducing poverty amongst the elderly. The importance of this topic has made it subject to an extensive number of studies and debates aimed at understanding which type of system is the most balanced for all stakeholders involved.

More recently, questions regarding the sustainability of pension plans have been brought to light due to the rapid aging of the population and consequent decrease in the active population renewal index. As some authors point out “(...) in recent decades, trust in the sustainability of the new pension pillar system has been shattered from the perspectives of both the government and the participants” (Wolf *et al.*, 2022).

With these new threats becoming more and more prominent, it is relevant to compare and assess the sustainability and overall situation of the social security in the payment of retirement pensions, for two countries like Portugal and USA which are very different in terms of how their systems are set up.

3.2 Research Design

The methodology for the present study is both qualitative and quantitative. From the literature review, the greater part of the information collected is of qualitative nature. The relevant quantitative data for the study will be collected from statistical sources and studies.

The combination of information of qualitative and quantitative nature will allow a better understanding about which of the pension systems is the most balanced and sustainable in the long run.

3.3 Data Collection and Treatment

The data collected for the study is a combination of statistics and the systematic review of literature on the topic.

The review of studies on the topic is focused on criteria search and key words and on the use of multiple interdisciplinary databases to attain maximum coverage possible. Some of the platforms used are Scopus, Google Scholar, Springer Link and SSRN. These platforms offer a large variety of articles and studies. For example, Springer Link provides access to recent and up to date articles (Wolf *et al.*, 2022), on the other hand SSRN allows to obtain more specific and advanced articles (Ramakrishnan *et al.*, 2011).

To identify the most relevant articles some key words are used. Key words include pensions, pensions schemes, pension funds, social security, legislation on pension schemes, sustainability of pension schemes, defined benefit, defined contribution, aging of the population.

The articles collected are organized by category and relevance. Some articles present the more theoretical topics, with focus on pension funds, how they are divided and how social security is organized in Portugal and in the USA. Other more recent studies concern main issues regarding pension schemes, like the aging of the population and other demographic trends.

The relevant data collected from statistical sources are inserted into the mathematical models and formulas conceived to clarify the main differences between the Portuguese and American social security systems in the payment of retirement indemnities.

This data treatment will allow a more structured analysis and a better understanding of each topic on its own, seeking to reach more clear and structured conclusions about the main research topics.

4 Discussion

To effectively compare and analyse the public pension systems of Portugal and USA, practical examples are considered to conclude on which system is more balanced. The comparison will consist of two stages:

- Stage 1: In the first stage of the comparison, the focus will be on comparing the replacement rates of both countries. This involves analysing the benefit formulas of each system to determine the extent to which they provide adequate benefits to plan participants. To accomplish this, a simulation will be carried out of individuals of average earnings with the calculation of the corresponding benefits they would receive under each system. By conducting this analysis, insights will be gained on which system offers more favourable benefits.
- Stage 2: In the second stage, the sustainability of both public pension systems will be assessed. This will be accomplished with a model that compares the revenue generated by social security and the current liability of each system. In this way, the long-term viability and durability of each system can be evaluated.

By separating the analysis into these two specific stages, insight can be gained on the sustainability of public pensions for both plan participants and plan setters. The comparison of results in the two countries may clarify the level of significance and the impact of social security in each country.

Besides presenting quantitative calculations and results, and additionally, the opinion from respected members of the retirement benefits community both in Portugal and the USA will also be considered.

4.1 Model 1 – Replacement rates comparison

4.1.1 Portuguese Case

Starting with the Portuguese case, the assumptions used are as follows, with data taken from official sources (Pordata and Seguraça Social Direta) and based on the year 2020.

- Retirement age: 66 years and 6 months; the reference person will retire at retirement age
- Current Age: 44, started working at 23 years old
- Monthly Earnings: 1250,8 euros (average earning in Portugal in 2020 (Pordata, et al, 2020))
- Annual Salary Growth = 1% (Assumed)
- Sustainability Factor = 0.8480 (Sustainability factor in 2020 in Portugal) (OECD, 2020)

- IAS2020 = 438.81 euros (Segurança Social Direta, et al. 2020)

Considering these assumptions and making the calculation (see Appendix A) this would mean that at retirement date the monthly salary would be 1636,31 euros and the monthly retirement pension 1168.55 euros, meaning there is a replacement rate of 71%. This is a quite high replacement rate in comparison with the rest of the world. However, it is important to note that the reference person considered has average earnings and that the replacement rate is dependent on the way earnings progress.

Looking at this case, if the person on our example was receiving a lower salary of, for example, 800 euros monthly, which is close to the Portuguese minimum salary, than making the calculations and with all other factors the same as previously, salary at retirement date would be 971.44 euros and the monthly retirement pension would be 724.72 euros (see Appendix A). This would mean a replacement rate of 75%.

With a higher monthly salary of 4000 euros, and with everything else constant, calculation would lead to a monthly salary upon retirement of 5181.03 euros, and a retirement indemnity of 3435.70 euros (see Appendix A), which represents a replacement rate of 66%.

In section 4.3 these results will be compared with those in the American System

4.1.2 USA case

In the case of the USA, similar assumptions were used to obtain the final year earnings and thus have a proper comparison between both countries.

- Retirement age: 66 years and 2 months
- Current Age: 44 started, working at 23 years old
- Salary: \$55,628 annual, which is the average salary for an American citizen (Statista , et al. 2020)
- Annual Salary Growth: 1%

The best way to follow the formula and legislation applied by the American social security was to use the online calculator provided by the Social Security Administration (SSA) and, after updating the calculator with the assumptions referenced above, it was possible to preview the development of yearly earnings based on economic and demographic assumptions until retirement date and to get the final estimate earnings. The final year earnings obtained is \$141,500, the final annual retirement benefit is \$56,448, resulting in a replacement rate of

39.9% (see the Appendix B). It is important to note that these results are not expressed in today's dollars but in future dollars taking already inflation into account.

This replacement rate compared with the Portuguese one is quite low, but it is relevant to consider that Americans invest their earnings into other retirement income sources, while in Portugal the only retirement income is the social security benefits. In the USA there are a lot of complementary pensions offered by employers and local governments.

On average the social security pensions represent about 50% (SSA. et al, nd) of the total retirement earnings for an American citizen. However, it is important to consider that the other sources of income are not as safe as social security. In fact, the amount at retirement may vary because, in most cases, the other retirement incomes consist of defined contributions plans where it is up to the employee how much to contribute and how to invest, meaning that there is a higher degree of risk in this type of income.

Taking this into account and doing as in the case of Portugal, the replacement rate was calculated for other different levels of individual salary (see the Appendix B).

For someone with an annual salary of 35000\$, which represents less twenty thousand than the average salary, and with everything else constant, earnings at retirement would be equal to \$89,100 and retirement pension to \$42,024, which represents a replacement rate of 47.2%, about 10 % higher than the average replacement rate in the USA.

Finally, for a higher individual annual salary of \$75000, twenty thousand more than the average salary in the USA, and with everything else constant, earnings at retirement will be equal to \$190,900. The retirement pension would be equal to \$70,008, representing a replacement rate of 36.6%, which is lower than the average replacement rate in the USA.

These last two examples show the disparity in terms of replacement rate when it comes to different levels of earnings. This is also relevant to assess the importance that social security retirement pensions have to avoid elderly poverty. In fact, the lower the income, the higher the replacement rate, aiming to enable the best living conditions to those closer to poverty.

4.2 Model 2 – Sustainability analysis of public pension systems

This second stage is centred on understanding the sustainability of the social security systems in each country when it comes to retirement income. A model is applied to determine how much does social security gain from contributions and how much is spent on retirement benefits.

First of all, to determine the revenue obtained by social security several assumptions must be taken into consideration: the amount of people who work, this meaning active population who is employed, the average annual salary subject to contributions and the contribution rate in each country. The model is:

$$RC = (AP*(1-Unemployment Rate))*AAE*C\% , \text{ where}$$

- RC- Revenue from Contributions
- AP- Active Population
- AAE- Average Annual Earnings subject to Contributions (monthly salary)
- C%- Contribution Percentage of total earnings

This model will allow to determine the revenue made by social security from contributions in each country. The data on Unemployment Rate, Average Earnings, Contribution % and active population come from statistics that are available online, like PorData, INE and Segurança Social Direta for Portugal and Statistica and SSA for the United States.

The second part of the model is focused on determining social security expenses with retirement income and consists of a simple product of the amount of people in retirement age and who are retired by the average annual retirement income. This gives an approximate estimate of the expenses related to retirement.

$$RE = RP * ARP , \text{ where}$$

- RE - Retirement Expense
- RP – Population with age equal or above retirement age
- ARP – Average Retirement Pension

With this model it will be possible to determine the expenses associated with retirement for social security.

After getting the results for both equations above it will be possible to understand how much do retirement pensions represent on social security total earnings and to have a better overview of the sustainability of social security systems.

4.2.1 Portuguese case

Starting by analysing the case of Portugal and with the information retrieved from official statistics the model is:

$$RC = (5,034,500 * (1 - 6.9\%)) * 17,511.2 * 34.75\%$$

$$RC = 28,521,787,728 \text{ euros.}, \text{ where}$$

$$AP = 5,034,500 \text{ (Pordata, et al., 2020)}$$

$$\text{Unemployment Rate} = 7\% \text{ (Pordata, et al., 2020)}$$

$$AAE = AE * 14, \text{ where AE - Average Monthly Earnings}$$

$$AE = 1250.8 \text{ euros (Pordata, et al., 2020)}$$

$$AAE = 1250.8 * 14 = 17,511.2 \text{ euros}$$

$$C\% = 34.75\%$$

This result means that social security total revenue is close to 29 billion euros per year. It is now important to determine the annual expense on retirement pensions in order to evaluate the weight of this pensions for social security.

$$RE = 2,385,368 * 5,814.3$$

$$RE = 13,869,245,162 \text{ Euros, where}$$

$$ARP = 5,814.3 \text{ (Pordata, et al., 2020)}$$

$$RP = 2,385,368 \text{ (Pordata, et al., 2020)}$$

With this result it can be verified that the expenses with retirement income represent about 50% of social security yearly revenue.

Over time, this value tends to rise due to population aging, particularly in Portugal, as demonstrated earlier. Consequently, there will be a decrease in the number of contributions while the amount of retirement pensions will increase. The findings presented provide insight into the significance and impact of retirement pensions on the overall social security system. Given the current trajectory and the aging population, this trend raises concerns regarding the sustainability of Portugal's social security system.

4.2.2 USA case

Moving on to the USA case and based on information retrieved from different statistical sources these are the results of applying the model:

$$RC = (150,464,790 * (1 - 8.05\%)) * \$53,383 * 12.4\%$$

$RC = \$915,822,435,554.90.$, where

$AP = 150464790$ (FRED, et al; 2020)

Unemployment rate = 8.05% (Statista, et al; 2020)

$AAE = \$53,383$ (SSA, et al; 2020)

$C\% = 12.4\%$

Social security revenue is therefore around 954 billion dollars per year. The yearly expense related with retirement benefits is determined next to evaluate how much this expense represents in the total revenue.

$RE = 48,227,000 * \$18,036$

$RE = \$869,822,172,000.00.$, where

$ARP = \$18,036$ (SSA, et al; 2020)

$RP = 48,227,000$ (SSA, et al; 2020)

This result means that retirement pensions represent at least 95% of USA's social security revenue. This value is quite high specially if we consider that there are other types of pensions like disability and unemployment pensions that are not accounted for in this model.

What was said for the case of Portugal is also applicable in the case of the USA in terms of an aging of the population that will cause this ratio to go upwards and closer to 100%. However, despite the aging of the population in the USA being not as aggravated as it is in Portugal, it is still a concern and something to take into consideration.

4.3 Results Comparison and Analysis

Comparing these two countries through the models presented will lead to a conclusion of which system is the most efficient and sustainable for both members and issuers, which in this case are the population and governments.

The primary objective of the first model was to examine pensions from the members' standpoint while also serving as a valuable tool for comprehending demographic trends. On the other hand, the second model was specifically focused on the government's perspective and aimed to assess the individual sustainability of various social security systems.

4.3.1 Model 1

By comparing the outcomes of the first model, we gain insight into the significant disparity between the average replacement rates in Portugal (71%) and the United States (39.3%). Nevertheless, a closer examination of how these replacement rates vary based on income levels reveals a consistent pattern: regardless of the specific percentages, the trend remains the same. As employees' earnings increase, the replacement rate declines, and conversely, as earnings decrease, the replacement rate rises.

The significant disparity in this aspect between the two countries can be attributed mainly to their respective policies and governmental approaches. Portugal stands as a striking example, where a vast majority of the population relies heavily on social security retirement benefits. As a consequence, there exists a necessity to offer a comparatively high replacement rate to ensure decent living conditions for the entire population. This unique dependency on social security plays a critical role in shaping the need for such a high replacement rate in Portugal.

The situation in the USA differs significantly, as social security retirement pensions only account for 35% of total earnings upon retirement. This is a consequence of the American government's comparatively lower emphasis and funding on Social Security in comparison to other countries. The resulting low replacement rate necessitates workers to explore additional complementary funds beyond social security retirement pensions. These alternative plans include private funds established by companies for their employees, state-wide funds that can be segmented by profession, and federal funds that differ from traditional social security plans.

However, in the case of the USA, a significant issue arises concerning a portion of the population who are unable to join other pension plans during their working lives, leaving them solely reliant on social security retirement benefits. In such situations, these benefits may not suffice to ensure minimal living conditions for retirees. For instance, let's consider a person from Model 1 with a low income whose final retirement benefit amounts to \$40,752. Considering the cost of living in the USA (Statista. et al, 2023) at around \$67,000 per year in 2023, the retirement indemnity wouldn't provide sufficient funds for the person to meet the minimal living conditions, which comes to show one of the biggest flaws in the American social security system.

4.3.2 Model 2

To assess and compare the sustainability of these two systems, we can utilize the outcomes generated by the second model, which computes the proportion of retirement benefits derived

from contributions made by plan members. Surprisingly, the findings diverge significantly: retirement benefits in Portugal constitute approximately 50% of social security revenue, while in the USA, this figure rises to 95% of total revenue. These results may deviate from initial expectations. Portugal's strong emphasis on Social Security might suggest that retirement indemnities would exert a more substantial influence on overall contributions. Conversely, the USA, despite its differing orientation, witnesses retirement pensions accounting for nearly the entirety of contributions.

Despite these results we must consider other factors when analysing the sustainability of both systems, related with the aging of the population and the weight these plans have in each country's GDP. These results were referenced in the literature review and can be now used to better explain the situation for each country.

Starting with Portugal, despite our model indicting that pension expenses only represents 50% of total revenue, the situation regarding sustainability isn't so favourable as it was depicted. This is due to social security representing 19% of total Portuguese GDP, meaning, despite contributions being high, that the Portuguese government still needs to give up one fifth of its budget for social security expenses. Besides this, there is also the concern of the aging of the population, which was referenced previously, which means a reduction in active population which in the long term means a reduction in total contributions as the number of retirees increase proving to create an unbalanced system.

According to João Pratas, the president of Portuguese Association of Investment Funds, Pensions, and Heritage, in an interview he gave to DECO, Portugal will face a serious issue with a lack of balance of this system between 2035 and 2060, due to the current demographic trends of aging of the population and decrease of active population. In his interview João Pratas also discusses the inexistence of any support from the government to other complementary sources of retirement income, which would allow the population to maintain better living conditions upon retirement (Deco Proteste Investe. et al., 2022).

This lack of support, associated with insufficient financial knowledge from the population regarding other complementary sources of retirement income, is the main reason why Portuguese population relies almost exclusively on social security retirement pensions and why there is so much pressure on this system in Portugal.

Shifting our focus to the United States, the scenario differs from that of Portugal. While retirement pensions constitute 95% of overall contributions, the distinction lies in the fact that

only 5% of the GDP is allocated to social security expenditures in the USA. This signifies that the American government allocates fewer resources to social security, resulting in a greater reliance on the contributions received. Unlike Portugal, government intervention is less pronounced in the United States' social security system.

Jason Fitchner, a former chief economist at the Social Security Administration, recently participated in an interview where he addressed critical inquiries concerning the future of the American social security system (Manganro, et al., 2023). His responses offer valuable insights for comprehending the sustainability landscape of the American social security system.

A significant area of concern for Fitchner revolves around the data furnished by the SSA, which suggests that by the year 2033, the social security trust fund—responsible for collecting payroll taxes—could be depleted unless there is government intervention. This potential depletion would result in a substantial 25% reduction in retirement benefits by 2035 (according to SSA Trustees Report 2023). It's important to note that this fund exhaustion scenario is contingent upon the absence of government intervention aimed at restoring the system's balance.

4.3.3 Final considerations

After analysing both models and taking into consideration the opinion and perspective of two specialists in the matter, one for each country, some considerations regarding each system can be made.

For the case of Portugal, there is high degree of dependence from social security benefits that can replace more than 71% of earnings upon retirement. This means there is no need for the Portuguese population to explore other sources of retirement income, like private funds or long-term investments, because there is a guaranteed income at retirement. However, this also means a bigger burden to the government.

The high level of dependency from social security allied with the aging of the population and inability to renew active population in the long term can mean a failure of this system and the need for the government to intervene even more directly.

Wrapping up the analysis of the Portuguese scenario, the primary concern, alongside the aging population, centres on the significant dependency of the Portuguese population on this system, imposing a potentially overwhelming burden on the government. The remedy entails initiating measures to encourage alternate non-governmental channels of retirement income. This could

involve providing tax advantages or other inducements, aiming to gradually alleviate the strain on social security retirement benefits over the long term.

In the USA's case the situation is quite distinct, the level of dependence from social security is low, accounts for 35% of total retirement benefits on average, as population has easier access to other sources of retirement income.

The main point that can be retained from analysing model 1 is associated with the American social security system low replacement rate, around 39%, which means social security retirement benefits on their own are not able to provide decent living conditions for population with lower-level income that does not have access to other complementary sources of retirement benefits.

In terms of the sustainability of this system, the American scenario is more concerning than initially anticipated. As evidenced by the outcomes of model 2, contributions account for a significant 91% of the total retirement benefits disbursed. Jason Fitchner further highlights that without governmental intervention within the upcoming decade, there's a looming risk of depleting the social security trust fund. This could result in a steep decline in the replacement rate, rendering social security nearly inconsequential in the context of funding retirement benefits.

In summary, it becomes evident that neither of these systems is flawlessly harmonized, making it challenging to definitively label one as more balanced than the other. Consequently, a hybrid approach should be considered that incorporates elements from both systems to achieve a more equitable and sustainable solution. This entails establishing replacement and contribution rates that strike a midpoint between the values observed in the USA and Portugal. Moreover, it involves endorsing supplementary retirement benefit sources as seen in the USA, while moderating government intervention to strike a balance between Portugal's direct involvement and the USA's more limited approach. This approach seeks to ensure the enduring sustainability of the system in the long run and to find a middle ground between two systems that are clearly unbalanced.

Having reached this solution it is relevant to understand that this would only work overtime, and it is something that cannot be achieved overnight. It would take plenty of years in order to rebalance these systems and for the population to understand and accept the benefits that this would bring. However, some other issues like the aging of the population may create a great threat for the survival of public and private pension plans.

5. Conclusion

In this study, along with the analysis of the general context of social security systems, two models were presented aiming at comparing the replacement rate of monthly salary by retirement pension of a reference citizen (in a model 1) and the sustainability of public pension systems (in a model 2) in Portugal and in the USA, as examples of two different types of systems, thus answering the research questions posed. After aligning the statistical data needed for applying the mathematical models, each system could be described in a more concise manner and allow an analytical comparison between them.

Having conducted a comparison and analysis of both systems it may be concluded that, in order to have balanced and sustainable systems, the best way seems to be to look for a middle ground between these two systems. In this way, the burden for governments could be reduced and, at the same time, still being able to provide a retirement income that will allow plan members to have decent living conditions.

It's worth highlighting that, while this study exclusively examines the social security systems concerning retirement benefits in Portugal and in the USA, there are numerous other public and private plans worldwide. This study is focused on these two countries that have different systems and different governing styles, enabling a challenging comparison.

Despite presenting a solution to the research questions, threats may arise such as the issue of the aging of the population and consequently the decrease of the working population, that will affect public and private plans in the long run.

Finally, it must be noticed that the topic of pension plans and pension funds can be explored from a variety of perspectives and is dependent on the evolution of population, economic, social and political national contexts. That is why it is very important that research is developed clarifying what needs to be done for the systems to be sustainable. If not, serious problems could arise for the society and the financial world as we know it today.

6. Bibliography

Active population: Aged 15-64: All persons for the United States. FRED. (2023, August 10). <https://fred.stlouisfed.org/series/LFAC64TTUSQ647S>

Active Population in Portugal. Statistics Portugal - web portal. (n.d.). https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=ine_indicadores&indOcorrCod=0010056&contexto=bd&selTab=tab2

Alegre, A., & Bermudez, L. (2001). Sustainability of pension systems with voluntary participation. In *Insurance: Mathematics and economics* (pp. 125–140). story, North-Holland. <https://doi.org/10.1016/j.insmatheco.2020.04.009> Q1(2021)

Backman, M. (n.d.). Study: Americans' average retirement income in 2023. The Motley Fool. <https://www.fool.com/research/average-retirement-income/>

Bodie, Z., Shoven, J., & Wise, D. (1988). Defined Benefit versus Defined Contribution Pension Plans: What are the Real Trade-offs? In *Pensions in the U. S. economy* (pp. 139–162). essay, University of Chicago press. <https://doi.org/10.7208/chicago/9780226062914.001.0001>

Ebbinghaus, B. (2011). The varieties of pension governance. <https://doi.org/10.1093/acprof:oso/9780199586028.001.0001>

Center on Budget and Policy Priorities . (2023, April 17). Top ten facts about social security - CBPP. <https://www.cbpp.org/sites/default/files/atoms/files/8-8-16socsec.pdf>

Congressional Research Service . (2021). (rep.). A Visual Depiction of the Shift from Defined Benefit (DB) to Defined Contribution (DC) Pension Plans in the Private Sector. Retrieved from <https://crsreports.congress.gov/product/pdf/IF/IF12007>.

Cost of living U.S. Statista. https://www.statista.com/topics/768/cost-of-living/?gclid=CjwKCAjwjOunBhB4EiwA94JWsEFaOh3lM1uT2lOB5utEpPXbi8hNr u-26846obwBQkxHTyjQZJEDQBoCWx4QAvD_BwE#editorsPicks

DeWitt, L. (2010, August 1). *Social Security Administration*. Social Security Administration Research, Statistics, and Policy Analysis. <https://www.ssa.gov/policy/docs/ssb/v70n3/v70n3p1.html>

Deco Proteste Investe. (2022, November 16). “às pessoas, Custa-Lhes Poupar para a reforma.” Deco Proteste Investe. <https://www.deco.proteste.pt/investe/investimentos/mercados-moedas/noticias/2022/11/as-pessoas-custa-lhes-poupar-para-reforma>

Feher, C., & De Bidegain, I. (2020). Pension Schemes in the COVID-19 Crisis: Impacts and Policy Considerations, IMF COVID-19 Special Series. *Fiscal Affairs*, 2020(1), 1–8. Retrieved from <https://www.imf.org/~media/Files/Publications/covid19-special-notes/enspecial-series-on-covid19pension-schemes-in-the-covid19-crisis-impacts-and-policy-considerations.ashx>

Feldstein, M. (2001). The Future of Social Security Pensions in Europe. <https://doi.org/10.3386/w8487>

Gruber, J., Milligan, K., & Wise, D. A. (2009, May). SOCIAL SECURITY PROGRAMS AND RETIREMENT AROUND THE WORLD: THE RELATIONSHIP TO YOUTH EMPLOYMENT, INTRODUCTION AND SUMMARY . https://www.nber.org/system/files/working_papers/w14647/w14647.pdf

Lab, Observador (2019, January 3). Regras de Ouro Para Saber Tudo sobre a reforma. <https://observador.pt/explicadores/regras-de-ouro-para-saber-tudo-sobre-a-reforma/>

Lagoa, S., & Barradas, R. (2022, January 1). [PDF] *Modelos de Organização E desafios Dos Sistemas de Pensões em Portugal numa perspetiva europeia: Semantic scholar*. [PDF] Modelos de organização e desafios dos sistemas de pensões em Portugal numa perspetiva Europeia | Semantic Scholar. <https://www.semanticscholar.org/paper/Modelos-de-organiza%C3%A7%C3%A3o-e-desafios-dos-sistemas-de-Lagoa-Barradas/00ea42b323bd9506081c5ca0b96664e4a1d861aa>

Manganaro, J. (2023, April 10). Social Security expert answers 12 common questions. ThinkAdvisor. <https://www.thinkadvisor.com/2023/04/10/12-questions-clients-will-ask-about-their-social-security-benefits/>

Objetivos e Princípios. Segurança Social . (2021, April 15). <https://www.seg-social.pt/objectivos-e-principios>

OECD. (2020). Recent Pension Reforms. In *Pensions at a glance 2019* (pp. 15–64). essay, ORGANIZATION FOR ECONOMIC. <https://doi.org/10.1787/451d8676-en>

O que É o fator de sustentabilidade? Doutor Finanças - Cuidamos da sua saúde financeira. (2021, March 23). <https://www.doutorfinancas.pt/vida-e-familia/o-que-e-o-fator-de-sustentabilidade/>

Pensão de Velhice. (August 11, 2023). <https://www.seg-social.pt/pensao-de-velhice>

População Residente com 65 e Mais Anos: Total e por Grupo Etário. Pordata. (n.d.). <https://www.pordata.pt/portugal/populacao+residente+com+65+e+mais+anos+total+e+por+grupo+etario-3508>

Ramachandran, Ramakrishnan, Social Security – The Way Forward (March 18, 2011). SKCOH Summit 8th Thinker’s and Writers Forum, March 2011, <https://ssrn.com/abstract=1814143>

Rinaldi, Ambrogio and Giacomel, Elisabetta, Information to Members of Dc Pension Plans: Conceptual Framework and International Trends (September 2008). <http://dx.doi.org/10.2139/ssrn.1813752>

Rodrigues, Pedro G., Social Security in Portugal: An Update of Long-Term Projections (October 2002). DGEP Working Paper No. 27 <http://dx.doi.org/10.2139/ssrn.649601>

Social Security Basic facts. (2023). <https://www.ssa.gov/news/press/factsheets/basicfact-alt.pdf>

- Social Security*. Social Security Retirement Benefit Calculation. (2023). <https://www.ssa.gov/oact/progdata/retirebenefit2.html>
- Social Security Outlays and forecast as a share of GDP U.S. 2033. Statista. (2023, May 3). <https://www.statista.com/statistics/217654/outlays-for-social-security-and-forecast-in-the-us-as-a-percentage-of-the-gdp/>
- Social Security coverage of state and Local Government Employees*. Congressional Research Service . (2021, November 10). <https://crsreports.congress.gov/product/pdf/R/R46961/2>
- Social Security National Average Wage Index. Social Security Administration. (2021). <https://www.ssa.gov/oact/cola/AWI.html#:~:text=The%20average%20amounts%20of%20wages,for%202020%20and%202021%2C%20respectively.>
- Sorsa, V.-P., & van der Zwan, N. (2021). Sustaining the unsustainable? the political sustainability of pensions in Finland and the Netherlands. *Journal of European Social Policy*, 32(1), 91–104. <https://doi.org/10.1177/09589287211035691> Q1(2021)
- Statista Research Department, & 29, A. (2023, August 29). *United States - total population 2027*. Statista. https://www.statista.com/statistics/263762/total-population-of-the-united-states/?gclid=Cj0KCQjw0vWnBhC6ARIsAJpJM6dV7bMZzJGdFHbWyWLMc4rzAp2rtOCa7ZFPB9xLEkMG0KkgygIaK-kaAoQbEALw_wcB
- Trenkamp, I. D. and B. (2021, January 1). Social Security Administration. Social Security Administration Research, Statistics, and Policy Analysis. <https://www.ssa.gov/policy/docs/workingpapers/wp116.html>
- U.S. Census Bureau quickfacts: United States. (n.d.-b). <https://www.census.gov/quickfacts/fact/table/US/PST045222>
- U.S. unemployment rate 1991-2023. MacroTrends. (n.d.). <https://www.macrotrends.net/countries/USA/united-states/unemployment-rate>
- Wang, Peijie and Zhang, Miao and Shand, Rory and Howell, Kerry, Retirement, Pension Systems and Models of Pension Systems (2014). <http://dx.doi.org/10.2139/ssrn.2476907>
- Wolf, I. (2022). Studying the equilibrium of pension designs when shifting to funded pension schemes: Economic theory and links to political factors. *SN Business & Economics*, 2(7). <https://doi.org/10.1007/s43546-022-00236-z> Q1(2021)
- Yasuoka, M. (2020). How should a government finance pension benefits? *Australian Economic Papers*, 60(1), 138–152. <https://doi.org/10.1111/1467-8454.12197>

7. Appendix

Appendix A – Portuguese Model 1

Base Example Portugal

Year	Age	Monthly Salary	Yearly Salary			
2002	23	817,40 €	11 443,60 €			
2003	24	849,60 €	11 894,40 €		Total Remuneration =	743 624,81 €
2004	25	877,50 €	12 285,00 €		Carrear Average Monthly Earnings=	1 327,90 €
2005	26	907,20 €	12 700,80 €		IAS = 438,81	Accrual IAS = 2.2%
2006	27	934,00 €	13 076,00 €		Accrual * N Years Working	0,88
2007	28	963,30 €	13 486,20 €		Final Pension	1 168,55 €
2008	29	1 008,00 €	14 112,00 €		Replacement Rate	71%
2009	30	1 034,20 €	14 478,80 €			
2010	31	1 075,30 €	15 054,20 €			
2011	32	1 083,80 €	15 173,20 €			
2012	33	1 094,70 €	15 325,80 €			
2013	34	1 093,30 €	15 306,20 €			
2014	35	1 093,20 €	15 304,80 €			
2015	36	1 096,70 €	15 353,80 €			
2016	37	1 107,90 €	15 510,60 €			
2017	38	1 133,30 €	15 866,20 €			
2018	39	1 170,30 €	16 384,20 €			
2019	40	1 238,29 €	17 336,09 €			
2020	41	1 250,80 €	17 511,20 €			
2021	42	1 275,94 €	17 863,18 €			
2022	43	1 288,70 €	18 041,81 €			
2023	44	1 301,59 €	18 222,22 €			
2024	45	1 314,60 €	18 404,45 €			
2025	46	1 327,75 €	18 588,49 €			
2026	47	1 341,03 €	18 774,38 €			
2027	48	1 354,44 €	18 962,12 €			
2028	49	1 367,98 €	19 151,74 €			
2029	50	1 381,66 €	19 343,26 €			
2030	51	1 395,48 €	19 536,69 €			
2031	52	1 409,43 €	19 732,06 €			
2032	53	1 423,53 €	19 929,38 €			
2033	54	1 437,76 €	20 128,67 €			
2034	55	1 452,14 €	20 329,96 €			
2035	56	1 466,66 €	20 533,26 €			
2036	57	1 481,33 €	20 738,59 €			
2037	58	1 496,14 €	20 945,98 €			
2038	59	1 511,10 €	21 155,44 €			
2039	60	1 526,21 €	21 366,99 €			
2040	61	1 541,48 €	21 580,66 €			
2041	62	1 556,89 €	21 796,47 €			
2042	63	1 572,46 €	22 014,43 €			
2043	64	1 588,18 €	22 234,58 €			
2044	65	1 604,07 €	22 456,92 €			
2045	66	1 620,11 €	22 681,49 €			
2046	67	1 636,31 €	22 908,31 €			

Lower Income Portugal

Year	Age	Monthly Salary	Yearly Salary				
2002	23	625,89 €	8 762,39 €			Total Remuneration =	450 936,22 €
2003	24	632,21 €	8 850,90 €				
2004	25	638,59 €	8 940,31 €			Carrear Average Monthly Earnings=	805,24 €
2005	26	645,04 €	9 030,61 €			IAS = 438,81	Accrual IAS=2.25%
2006	27	651,56 €	9 121,83 €			Accrual * N Years Working	0,9
2007	28	658,14 €	9 213,97 €			Final Pension	724,72 €
2008	29	664,79 €	9 307,04 €			Replacement Rate	75%
2009	30	671,50 €	9 401,05 €				
2010	31	678,29 €	9 496,01 €				
2011	32	685,14 €	9 591,93 €				
2012	33	692,06 €	9 688,82 €				
2013	34	699,05 €	9 786,69 €				
2014	35	706,11 €	9 885,54 €				
2015	36	713,24 €	9 985,40 €				
2016	37	720,45 €	10 086,26 €				
2017	38	727,72 €	10 188,14 €				
2018	39	735,08 €	10 291,05 €				
2019	40	742,50 €	10 395,00 €				
2020	41	750,00 €	10 500,00 €				
2021	42	757,50 €	10 605,00 €				
2022	43	765,08 €	10 711,05 €				
2023	44	772,73 €	10 818,16 €				
2024	45	780,45 €	10 926,34 €				
2025	46	788,26 €	11 035,61 €				
2026	47	796,14 €	11 145,96 €				
2027	48	804,10 €	11 257,42 €				
2028	49	812,14 €	11 370,00 €				
2029	50	820,26 €	11 483,70 €				
2030	51	828,47 €	11 598,53 €				
2031	52	836,75 €	11 714,52 €				
2032	53	845,12 €	11 831,66 €				
2033	54	853,57 €	11 949,98 €				
2034	55	862,11 €	12 069,48 €				
2035	56	870,73 €	12 190,17 €				
2036	57	879,43 €	12 312,08 €				
2037	58	888,23 €	12 435,20 €				
2038	59	897,11 €	12 559,55 €				
2039	60	906,08 €	12 685,14 €				
2040	61	915,14 €	12 812,00 €				
2041	62	924,29 €	12 940,12 €				
2042	63	933,54 €	13 069,52 €				
2043	64	942,87 €	13 200,21 €				
2044	65	952,30 €	13 332,21 €				
2045	66	961,82 €	13 465,54 €				
2046	67	971,44 €	13 600,19 €				

Higher Income Portugal

Year	Age	Monthly Salary	Yearly Salary				
2002	23	3 338,06 €	46 732,77 €			Total Remuneration =	2 404 993,17 €
2003	24	3 371,77 €	47 204,82 €				
2004	25	3 405,83 €	47 681,64 €			Carrear Average Monthly Earnings=	4 294,63 €
2005	26	3 440,23 €	48 163,27 €			IAS = 438,81	Accrual rate IAS = 2.1%
2006	27	3 474,98 €	48 649,77 €			Accrual * N Years Working	0,8
2007	28	3 510,08 €	49 141,18 €			Final Pension	3 435,70 €
2008	29	3 545,54 €	49 637,55 €			Replacement Rate	66%
2009	30	3 581,35 €	50 138,94 €				
2010	31	3 617,53 €	50 645,40 €				
2011	32	3 654,07 €	51 156,97 €				
2012	33	3 690,98 €	51 673,70 €				
2013	34	3 728,26 €	52 195,66 €				
2014	35	3 765,92 €	52 722,89 €				
2015	36	3 803,96 €	53 255,44 €				
2016	37	3 842,38 €	53 793,38 €				
2017	38	3 881,20 €	54 336,74 €				
2018	39	3 920,40 €	54 885,60 €				
2019	40	3 960,00 €	55 440,00 €				
2020	41	4 000,00 €	56 000,00 €				
2021	42	4 040,00 €	56 560,00 €				
2022	43	4 080,40 €	57 125,60 €				
2023	44	4 121,20 €	57 696,86 €				
2024	45	4 162,42 €	58 273,82 €				
2025	46	4 204,04 €	58 856,56 €				
2026	47	4 246,08 €	59 445,13 €				
2027	48	4 288,54 €	60 039,58 €				
2028	49	4 331,43 €	60 639,98 €				
2029	50	4 374,74 €	61 246,38 €				
2030	51	4 418,49 €	61 858,84 €				
2031	52	4 462,67 €	62 477,43 €				
2032	53	4 507,30 €	63 102,20 €				
2033	54	4 552,37 €	63 733,22 €				
2034	55	4 597,90 €	64 370,56 €				
2035	56	4 643,88 €	65 014,26 €				
2036	57	4 690,31 €	65 664,40 €				
2037	58	4 737,22 €	66 321,05 €				
2038	59	4 784,59 €	66 984,26 €				
2039	60	4 832,44 €	67 654,10 €				
2040	61	4 880,76 €	68 330,64 €				
2041	62	4 929,57 €	69 013,95 €				
2042	63	4 978,86 €	69 704,09 €				
2043	64	5 028,65 €	70 401,13 €				
2044	65	5 078,94 €	71 105,14 €				
2045	66	5 129,73 €	71 816,19 €				
2046	67	5 181,03 €	72 534,35 €				

Appendix B – USA Model 1

Base Example USA

The table at right shows the estimated annual amounts of your taxable earnings that we used to calculate your monthly retirement benefit. We estimated these earnings based on the amount of earnings you said you would receive in 2023. We do not use earnings in the year you begin receiving benefits.

For the disability and survivors estimates, we assumed that you became disabled or died today. We did not use future earnings in calculating those estimates.

If you feel that the past earnings shown here are much different from your actual earnings, then you can change the earnings by selecting one of two different methods.

- Enter the amounts you want to change. Please note that you will be sending personal data over the Internet – this is not a secure medium.
- Change the assumed earnings growth rate for past earnings. You may choose to make your earnings grow faster or slower than national average wages by entering a [relative growth factor](#) below. Choosing a positive number will cause your earnings to grow faster than the national average; choosing a negative number will cause slower than average growth. Entering a relative growth factor of 2, for example, means your wages will grow 2 percent faster than the national average.
Relative growth factor for past earnings: %
If you change a growth factor, be sure that you have checked box number 2 above!

Because you chose to use estimated future earnings in your benefit calculation, you may adjust the growth rate for your future earnings with a relative growth factor, as described above for past earnings.
Relative growth factor for future earnings: %
To provide a conservative estimate of your benefit, we reduce the growth of future earnings after age 59 by one percentage point.

Note that the last year of earnings used in estimating your retirement benefit is the year before the year in which retirement begins (yours begins in 2046).

Past earnings		Future earnings	
Year	Taxable amount	Year	Taxable amount
1996	\$ 0	2024	\$58,300
1997	\$ 0	2025	\$61,200
1998	\$ 0	2026	\$64,400
1999	\$ 0	2027	\$67,700
2000	\$ 0	2028	\$71,100
2001	\$ 0	2029	\$74,700
2002	\$ 18,500	2030	\$78,500
2003	\$ 19,300	2031	\$82,400
2004	\$ 20,600	2032	\$86,400
2005	\$ 21,800	2033	\$90,500
2006	\$ 23,200	2034	\$94,700
2007	\$ 24,800	2035	\$99,200
2008	\$ 25,800	2036	\$102,800
2009	\$ 25,900	2037	\$106,600
2010	\$ 27,100	2038	\$110,500
2011	\$ 28,500	2039	\$114,500
2012	\$ 30,000	2040	\$118,700
2013	\$ 31,000	2041	\$123,000
2014	\$ 32,700	2042	\$127,400
2015	\$ 34,500	2043	\$132,000
2016	\$ 35,600	2044	\$136,700
2017	\$ 37,600	2045	\$141,500
2018	\$ 39,700		
2019	\$ 42,000		
2020	\$ 44,100		
2021	\$ 49,000		
2022	\$ 52,300		
2023	\$ 55,600		

Note: Estimated number of credits earned before age 62 is 152. Minimum requirement is 40 credits.

[Privacy Policy](#) | [Website Policies & Other Important Information](#) | [Site Map](#)

Retirement

Your estimated monthly benefit amount, beginning at age 67 and 3 months in 2046, is **\$4,704.00**. For your estimate, we assumed [future increases in prices or earnings](#).

We have calculated your benefits by making certain assumptions about your past and future earnings. Please look at these earnings to see if they appear reasonable to you. You can change them and see the effect on your benefit estimates!

Information you submitted

Date of birth: 01/01/1979
Current earnings: \$55,600.00
Benefit in future (inflated) dollars
Retirement month: 03/2046

Social Security benefits are the foundation on which to build a financially secure retirement. Savings and pensions also are key components of your retirement plan.

Lower Income

	Past earnings		Future earnings	
	Year	Taxable amount	Year	Taxable amount
1996	\$ 0	2024	\$36,700	
1997	\$ 0	2025	\$38,500	
1998	\$ 0	2026	\$40,500	
1999	\$ 0	2027	\$42,600	
2000	\$ 0	2028	\$44,800	
2001	\$ 0	2029	\$47,000	
2002	\$ 11,600	2030	\$49,400	
2003	\$ 12,100	2031	\$51,900	
2004	\$ 12,900	2032	\$54,400	
2005	\$ 13,700	2033	\$57,000	
2006	\$ 14,600	2034	\$59,600	
2007	\$ 15,600	2035	\$62,400	
2008	\$ 16,300	2036	\$64,700	
2009	\$ 16,300	2037	\$67,100	
2010	\$ 17,000	2038	\$69,500	
2011	\$ 17,900	2039	\$72,100	
2012	\$ 18,900	2040	\$74,700	
2013	\$ 19,500	2041	\$77,400	
2014	\$ 20,600	2042	\$80,200	
2015	\$ 21,700	2043	\$83,100	
2016	\$ 22,400	2044	\$86,000	
2017	\$ 23,600	2045	\$89,100	
2018	\$ 25,000			
2019	\$ 26,400			
2020	\$ 27,700			
2021	\$ 30,800			
2022	\$ 32,900			
2023	\$ 35,000			

The table at right shows the estimated annual amounts of your taxable earnings that we used to calculate your monthly retirement benefit. We estimated these earnings based on the amount of earnings you said you would receive in 2023. We do not use earnings in the year you begin receiving benefits.

For the disability and survivors estimates, we assumed that you became disabled or died today. We did not use future earnings in calculating those estimates.

If you feel that the past earnings shown here are much different from your actual earnings, then you can change the earnings by selecting one of two different methods.

- Enter the amounts you want to change. Please note that you will be sending personal data over the Internet – this is not a secure medium.
- Change the assumed earnings growth rate for past earnings. You may choose to make your earnings grow faster or slower than national average wages by entering a [relative growth factor](#) below. Choosing a positive number will cause your earnings to grow faster than the national average; choosing a negative number will cause slower than average growth. Entering a relative growth factor of 2, for example, means your wages will grow 2 percent faster than the national average.
Relative growth factor for past earnings: %
If you change a growth factor, be sure that you have checked box number 2 above!

Because you chose to use estimated future earnings in your benefit calculation, you may adjust the growth rate for your future earnings with a relative growth factor, as described above for past earnings.
Relative growth factor for future earnings: %
To provide a conservative estimate of your benefit, we reduce the growth of future earnings after age 59 by one percentage point.

Note that the last year of earnings used in estimating your retirement benefit is the year before the year in which retirement begins (yours begins in 2046).

Note: Estimated number of credits earned before age 62 is 152. Minimum requirement is 40 credits.

Retirement

Your estimated monthly benefit amount, beginning at age 67 and 3 months in 2046, is **\$3,502.00**. For your estimate, we assumed [future increases in prices or earnings](#).

We have calculated your benefits by making certain assumptions about your past and future earnings. Please look at these earnings to see if they appear reasonable to you. You can change them and see the effect on your benefit estimates!

Information you submitted

Date of birth: 01/01/1979
Current earnings: \$35,000.00
Benefit in future (inflated) dollars
Retirement month: 03/2046

Social Security benefits are the foundation on which to build a financially secure retirement. Savings and pensions also are key components of your retirement plan.

Higher Income

The table at right shows the estimated annual amounts of your taxable earnings that we used to calculate your monthly retirement benefit. We estimated these earnings based on the amount of earnings you said you would receive in 2023. We do not use earnings in the year you begin receiving benefits.

For the disability and survivors estimates, we assumed that you became disabled or died today. We did not use future earnings in calculating those estimates.

If you feel that the past earnings shown here are much different from your actual earnings, then you can change the earnings by selecting one of two different methods.

1. Enter the amounts you want to change. Please note that you will be sending personal data over the Internet – this is not a secure medium.
2. Change the assumed earnings growth rate for past earnings. You may choose to make your earnings grow faster or slower than national average wages by entering a [relative growth factor](#) below. Choosing a positive number will cause your earnings to grow faster than the national average; choosing a negative number will cause slower than average growth. Entering a relative growth factor of 2, for example, means your wages will grow 2 percent faster than the national average.

Relative growth factor for past earnings: %

If you change a growth factor, be sure that you have checked box number 2 above!

Because you chose to use estimated future earnings in your benefit calculation, you may adjust the growth rate for your future earnings with a relative growth factor, as described above for past earnings.

Relative growth factor for future earnings: %

To provide a conservative estimate of your benefit, we reduce the growth of future earnings after age 59 by one percentage point.

Note that the last year of earnings used in estimating your retirement benefit is the year before the year in which retirement begins (yours begins in 2046).

Past earnings		Future earnings	
Year	Taxable amount	Year	Taxable amount
1996	\$ 0	2024	\$78,600
1997	\$ 0	2025	\$82,600
1998	\$ 0	2026	\$86,900
1999	\$ 0	2027	\$91,300
2000	\$ 0	2028	\$95,900
2001	\$ 0	2029	\$100,800
2002	\$ 24,900	2030	\$105,900
2003	\$ 26,000	2031	\$111,200
2004	\$ 27,700	2032	\$116,600
2005	\$ 29,300	2033	\$122,100
2006	\$ 31,300	2034	\$127,800
2007	\$ 33,400	2035	\$133,800
2008	\$ 34,800	2036	\$138,700
2009	\$ 35,000	2037	\$143,800
2010	\$ 36,500	2038	\$149,000
2011	\$ 38,400	2039	\$154,500
2012	\$ 40,400	2040	\$160,100
2013	\$ 41,800	2041	\$165,900
2014	\$ 44,100	2042	\$171,900
2015	\$ 46,500	2043	\$178,000
2016	\$ 48,000	2044	\$184,400
2017	\$ 50,700	2045	\$190,900
2018	\$ 53,600		
2019	\$ 56,700		
2020	\$ 59,400		
2021	\$ 66,000		
2022	\$ 70,600		
2023	\$ 75,000		

Note: Estimated number of credits earned before age 62 is 152. Minimum requirement is 40 credits.

Retirement

Your estimated monthly benefit amount, beginning at age 67 and 3 months in 2046, is **\$5,834.00**. For your estimate, we assumed [future increases in prices or earnings](#).

We have calculated your benefits by making certain assumptions about your past and future earnings. Please look at these earnings to see if they appear reasonable to you. You can change them and see the effect on your benefit estimates!

Information you submitted

Date of birth: 01/01/1979
Current earnings: \$75,000.00
Benefit in future (inflated) dollars
Retirement month: 03/2046

Social Security benefits are the foundation on which to build a financially secure retirement. Savings and pensions also are key components of your retirement plan.

Appendix C- IAS Table in Portuguese

IAS table in Portuguese

Parcelas	Remuneração de referência por indexação ao IAS	Taxas
1. ^a	Até 1,1xIAS	2,3%
2. ^a	Superior a 1,1xIAS até 2xIAS	2,25%
3. ^a	Superior a 2xIAS até 4xIAS	2,2%
4. ^a	Superior a 4xIAS até 8xIAS	2,1%
5. ^a	Superior a 8xIAS	2%