The role of Pensions in determining Income Inequality in Portugal

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Dissertation written under the supervision of Professor Miguel Gouveia

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Abstract

This dissertation aims to study the role of Pensions in determining Income Inequality in Portugal. To do so, data on income and living conditions of the Portuguese households were analyzed using the ICOR (*Inquérito às Condições de Vida e Rendimento*) datasets. The methodology used follows the same procedure as Brewer, Muriel, & Wren-Lewis (2009). The decomposition by income source allowed to conclude that, between 2004 and 2019, the increase in pensions contribution to income inequality was accompanied by the increase in the weight of pensions in the total income of the Portuguese families. Considering the upward trend in the number of people with 65 years old and above in Portugal, we can expect an increase in the pensions contribution to total income inequality, if the pension system remains unaltered. The decomposition by population subgroups allowed to conclude that, between 2004 and 2019, although the share of the subgroup that had an old-age pension as the main income source increased, the inequality within that same subgroup decreased. Furthermore, the majority of the decrease in total inequality is explained by the decrease in inequality within the subgroup, rather than between the different subgroups. Pensions contribute to inequality but to a lesser extent than that of the labor income they replace, which is due not only to non-contributory pensions but also to partially redistributive pension formation rules.

Keywords: individual distribution of equivalent income, income inequality, pensions, mean log deviation, Theil index, decomposition, population subgroups

O papel das pensões na determinação da desigualdade de rendimentos em Portugal

Beatriz Valério

Resumo

Esta dissertação tem como objetivo estudar o papel das pensões na determinação da desigualdade de rendimento em Portugal. Para tal, foram analisados os dados do rendimento e das condições de vida dos agregados das famílias Portuguesas utilizando a base de dados do Inquérito às Condições de Vida e Rendimento. A metodologia utilizada segue os mesmos procedimentos da metodologia utilizada por Brewer, Muriel & Wren-Lewis (2009). A decomposição por fontes de rendimento permitiu concluir que, entre 2004 e 2019, o aumento da contribuição das pensões para a desigualdade de rendimentos foi acompanhado pelo aumento do peso das pensões no rendimento total das famílias Portuguesas. Tendo em consideração a tendência de aumento do número de pessoas com 65 e mais anos em Portugal, será de esperar um aumento da contribuição das pensões para a desigualdade total do rendimento, se o sistema de pensões se mantiver inalterado. A decomposição por subgrupos populacionais permitiu concluir que, entre 2004 e 2019, embora seja registado um aumento na proporção do subgrupo que tinha uma pensão por velhice como principal fonte de rendimento, a desigualdade dentro desse mesmo subgrupo diminuiu. Além disso, a maior parte da diminuição da desigualdade total é explicada pela diminuição da desigualdade dentro do subgrupo, e não entre os diferentes subgrupos. As pensões contribuem para a desigualdade, mas com uma menor intensidade que a dos rendimentos do trabalho que vêm substituir. Isto deve-se não só às pensões não contributivas, como também às regras parcialmente redistributivas de formação das pensões.

Palavras-chave: rendimento disponível por adulto equivalente, desigualdade de rendimentos, pensões, *mean log deviation*, índice *Theil*, decomposição, subgrupos de população

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1. Introduction

This study aims to understand the role of pensions in determining income inequality in Portugal, in the period between 2004 and 2019. In order to contextualize this project, it is important to focus on two phenomena: income inequality and aging.

The world population is aging. This the dominant demographic phenomenon of the 21st century (Bloom & Luca, 2016). Portugal is one of the countries where we can see this phenomenon (see table A1). There is a downward trend in the number of people under 64 years old and an upward trend in the number of people with 65 years old and above (OECD, 2019). As a consequence, the pension system is expected to be under great pressure. In 2015, Portugal had a little over 3 million pensioners. This means that 29 percent of the resident population was receiving, at least, one pension (Botelho Azevedo, P. Manso. & Nicola, 2019). Although we know that it is not only those 65 and over that receive pension, this age group represents the majority of those that receive at least one pension (see table A2).

Another phenomenon that we can witness is the increase of income inequality, although that is not happening in every country. Income inequality has been increasing since 1990 in most developed countries and in some middle-income countries, including China and India (United Nations, 2020). There are many statistics on this subject and some of them may leave us speechless. Stiglitz (Stiglitz, 2015) claims that, after the Great Recession of 2007-2008, during the US economy recovery, 91 percent of the gains in income went to the top 1 percent.

Putting both phenomena together, aging and income inequality growth, makes the pension system an interesting and relevant object of study, mainly its role in determining income inequality. Although inequality among people with 65 years old and above has fallen over the past decade, Portugal remains one of European countries with higher levels of inequality for the population as a whole, and for this age group in particular (OECD, 2019). For this reason, the focus of this paper will be on the old-age pensions, mainly the old-age monetary social

benefits - paid by Social Security and also by *Caixa Geral de Aposentações* - and the monetary income from private pension plans.

Having all these said, we can divide our thesis focus into two research questions: the first one is “To what extent do pensions contribute to inequality in Portugal?” and the second one is “What changed between 2004 and 2019?”.

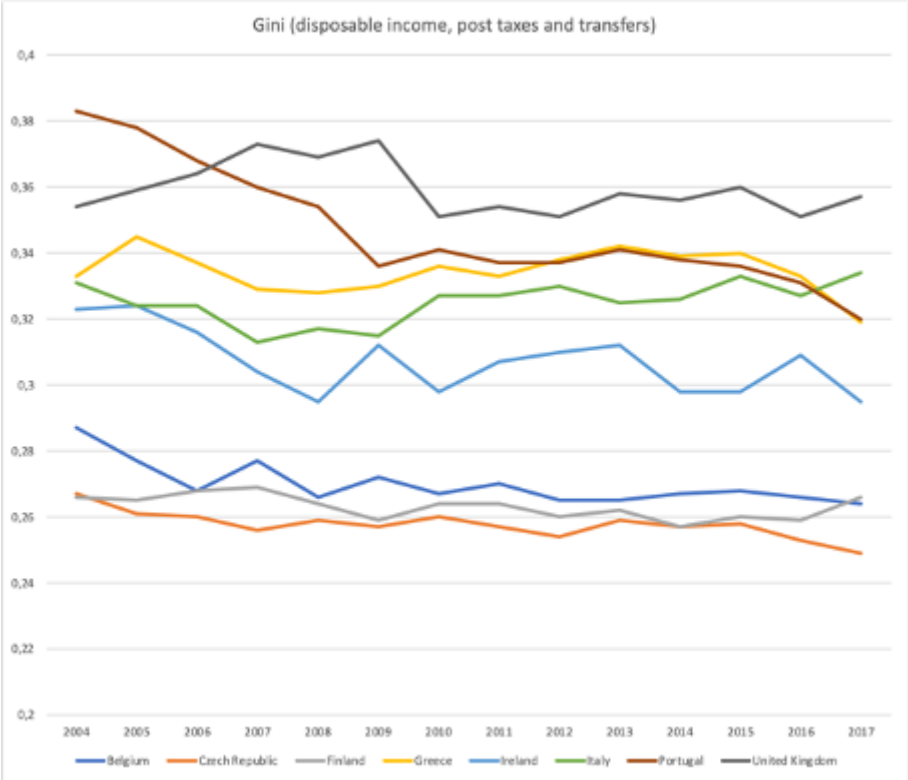
2. Literature Review

There are countless studies on income inequality using the Gini index. It can be described as an indicator that measures how equitably a resource is distributed in a population (Farris, 2010). In the context of our study, the resource is the income. It varies from zero (when every individual has the same proportion of income) to one (where only one person has all income). In Portugal, the Gini index in 1994 was at 0,37 and in 2018 it was at 0,319 (PORDATA, 2019).

One of the disadvantages in using this indicator relies on the fact that it is particularly sensitive to income changes in the middle part of the distribution (Farinha Rodrigues, Figueiras & Junqueira, 2016). Furthermore, very different income distributions can present the same Gini coefficient (Afonso, LaFleur & Alarcón, 2015). Other disadvantages of the Gini index are that it presents the limitation of not being easily decomposable or additive (a concept that will be discussed) and also the fact that it doesn't provide information on whether rising or falling inequality is caused by changes at the bottom, middle or top of the income distribution (Nations, 2020).

Figure 1 shows us the Gini index on disposable income, post taxes and transfers for some European countries and, as we can see, different countries present different trends. For example, Lithuania presents an increasing trend between 2004 and 2017: 0,349 in 2004 and 0,374 in 2017. Ireland, on the other hand, presents, like Portugal, a decreasing tendency with 0,323 in 2004 and 0,295 in 2017 (OECD Stat).

Figure 1 - Gini index on disposable income, post taxes and transfers for Belgium, Czech Republic, Finland, Greece, Ireland, Italy, Portugal and United Kingdom, from 2004 to 2017



Source: OECD Statistics, Income distribution database

https://stats.oecd.org/viewhtml.aspx?datasetcode=IDD&lang=en .

The Generalised Entropy measures constitute the only family of indicators (up to a transformation) that display additive decomposability as well as anonymity, the population principle, the principle of transfers, and scale invariance (Costa & Pérez-Duarte, 2019). The value of GE varies between zero and infinity. Just like the Gini index, when GE equals zero, all incomes are identical. The higher the value of GE, the higher the level of inequality. The value for GE depends on the parameter α, which represents the weight given to distances between incomes at different parts of the income distribution (Litchfield, 1999). The most common values for α are 0,1 and 2, although it can take any real value:

Table 1 - Generalised Entropy measures for different values of α

Indicator	GE(α)
Generalised Entropy (with $\alpha \neq 0$ and $\alpha \neq 1$)	$GE(\alpha)=\frac{1}{\alpha(\alpha-1)}\frac{1}{n}\sum_{i=1}^{n}\left(\left(\frac{y_i}{\mu}\right)^{\alpha}-1\right)$
Theil (α=1)	$GE(1)=\frac{1}{n}\sum_{i=1}^{n}\frac{y_i}{\mu}\ln\left(\frac{y_i}{\mu}\right)$
Mean Log Deviation (α=0)	$GE(0)=-\frac{1}{n}\sum_{i=1}^{n}\ln\left(\frac{y_i}{\mu}\right)$

Source: Costa & Pérez-Duarte, 2019

Note: y_i represents the equivalent income of person i, μ represents the sample average and the parameter α represents the weight given to distances between incomes at different parts of the income distribution (Litchfield, 1999).

When α=0 it means that more weight is given to distances between incomes in the lower tail of the distribution. In other words, the GE is more sensitive to changes that happen in the lower part of the income distribution. When α=1 equal weight across the income distribution is given. When α=2 more weight to gaps in the upper tail is given in a proportional way (Litchfield, 1999).

2.1. Decomposition Methods

In order to analyze changes in inequality in a more complete way, two different decomposition methods will be used: Decomposition by Income Source and Decomposition by Population Subgroup.

2.1.1. Decomposition by Income Source

Decomposition by income source is a decomposition method based on the idea that total income is usually made up of more than one source (Litchfield, 1999). In 1982, Shorrocks proposed an additive decomposition methodology of the total inequality by the different income sources that the household may have (Farinha Rodrigues, Figueiras & Junqueira, 2016). This decomposition enables a better understanding of the inequality since it allows the identification of the contribution of each different source of income to income inequality, independently of the index in consideration.

In this decomposition we start by assuming that each individual's income can be broken down into the sum of the different sources of income received. A similar idea can be applied to inequality: break down total income inequality into the part that each income source is responsible for (Brewer, Muriel, & Wren-Lewis, 2009). $s_k(Y)$ will be the inequality weight that income source k has in total income. In other words, it will be the contribution of income source k for total inequality. It is computed by[1]:

$$s_k(Y) = \frac{cov(Y^k, Y)}{\sigma^2(Y)}$$

2.1.2. Decomposition by Population Subgroup

In this decomposition, different types of population subgroups are considered and identified by their main source of income. In this decomposition the main focus is on inequality between the subgroups and also within each subgroup. These two decompositions will allow us to gather different insights and perspectives into what drives inequality (Brewer, Muriel, & Wren-Lewis, 2009).

If the index in question can be decomposed by population subgroups and expressed as a weighted sum of a within-group and a between-group component it means that it displays the property of additive decomposability (Shorrocks, 1980). Once again, we will follow the procedure used by Brewer, Muriel, and Wren-Lewis (2009). In their study, the authors considered that total inequality, I_{total}, can be broken down as being the sum of the inequality between the subgroups, $I_{between}$, and the inequality within the subgroups, I_{within}.

Since the measure of inequality chosen needs to have the property of additive decomposability, Brewer, Muriel, and Wren-Lewis (2009) worked with the particular case of the Generalised Entropy measures where α=0:

$$I_0 = -\frac{1}{n}\sum_{i=1}^{n} \ln\left(\frac{y_i}{\mu}\right) = \frac{1}{n}\sum_{i=1}^{n} \ln\left(\frac{\mu}{y_i}\right)$$

[1] See Shorrocks, 1982. In the equation: considering the income of individual i (i = 1, . .. , n) from source k (k = 1,. .. , K)

We can decompose I_0 into[2]:

$$I_0 = \sum_g \frac{n_g}{n} I_{0g} + \sum_g \frac{n_g}{n} \ln\left(\frac{\mu}{\mu_g}\right)$$

Another measure that we will use is the Theil index, an index of the same family as the MLD, Generalized Entropy Measure, where α=1. The Theil index can be decomposed[3] into:

$$I_1 = \sum_g \frac{n_g}{n}\frac{\mu_g}{\mu} I_{1g} + \sum_g \frac{n_g}{n}\frac{\mu_g}{\mu} \ln\left(\frac{\mu_g}{\mu}\right)$$

Once we have surveyed income inequality measures, in order to answer our two research questions: "To what extent do pensions contribute to inequality in Portugal?" and "What changed between 2004 and 2018?", we need to take a look into the Portuguese Pension System.

2.2. Portuguese Pension System

Portugal has essentially a Bismarckian[4] pension system (Rodrigues & Andrade, 2014). At the base of the public pension system is the Social Security (*Segurança Social*) system. This system serves the private sector employees and the employees who entered the public sector since 2006. The Social Security system has three pillars: the Contributory Regime (*Sistema Previdencial*), the Non-contributory Regime (*Sistema de Proteção Social de Cidadania*) and the Complementary Regime (*Sistema Complementar*). The civil servants scheme (*Caixa Geral de Aposentações*) is a Social Security sub-system that has a set of rules which allow it to be independent. CGA serves the public sector employees who entered the scheme before 2006. Since December 31st, 2005, the CGA has been closed to new entrants and it has been integrated into the Social Security edifice since 2009 (Botelho Azevedo, P. Manso & Nicola, 2019).

[2] where the first component represents the within component and the second represents the between component.

[3] Once again, the first component represents the within component and the second represents the between component (Mookherjee & Shorrocks, 1982).

[4] In this type of pension system, the individual pensions are directly connected to the individual contributions during lifetime (Scheubel,2013).

2.3. Old Age pensions

The old age pension is an amount paid on a monthly basis to substitute the labor pay. In Portugal, the pension values are a function of contributions paid by the pensioner, the number of years worked and the age at which a person asks to retire (old age pension of the contributory regime). The old age pension can be complemented with the Extraordinary Solidarity Supplement (*Complemento Extraordinário de Solidariedade*). The amounts paid between 2017 and 2020 can be seen in table 2.

Table 2 - Old age pension amounts in Portugal, 2017-2020 (monthly, in €)

	2017		2018		2019		2020	
	65-69	70+	65-69	70+	65-69	70+	65-69	70+
Old age social pension base amount	203,35		207,01		210,32		211,79	
Extraordinary solidarity supplement	17,70	35,38	18,02	36,02	18,31	36,60	18,44	36,86
Sum	221,05	238,73	225,03	243,03	228,63	246,92	230,23	248,65

Source: EUROMOD country report Portugal, November 2020

Regarding the eligibility conditions for an old age social pension, the minimum age was 66 years old and 3 months in 2017, 66 years old and 4 months in 2018 and 66 years old and 5 months in 2019 and 2020 (Rodrigues, C., Vicente, J. and Neves, D., 2020). Between 2003 and 2010, the proportion of people 65 and over whose main income source is pensions rose from 86 pp to 92 pp (Rodrigues & Andrade, 2014).

The type of pensions previously mentioned constitute the public (or state) part of the pensions system. Although there are very few employer based private pension plans in Portugal, it is possible to complement the retirement pension by joining a private pension fund which is usually linked to the employer, where the pension value is based on the combined contributions of the employee but also of the employer. Another possible way to complement the retirement pension value is to, for example, save for a retirement savings plan (*PPR - plano poupança reforma*).

2.4. Income Inequality

A study from 2016, that followed the methodology[5] proposed by Shorrocks (1982) - concluded that pensions contributed 22% for income inequality in 2006, 21% in 2009 and 32% in 2014 (table 3). Social Security Contributions and Direct Taxes had an equalizing effect, meaning that they contributed to reduce inequality. Pensions had the opposite effect: they contributed to an income inequality increase (Farinha, Figueiras & Junqueira, 2016).

Table 3 - Contribution of the different income sources for total inequality

Income Sources	2006	2009	2014
Market Incomes[6]	125%	124%	131%
Pensions	22%	21%	32%
Other Social Transfers	0%	-2%	2%
Social Security Contributions	-11%	-11%	-13%
Direct Taxes[7]	-37%	-33%	-52%
Equivalent Disposable Income	100%	100%	100%

Source: INE, ICOR 2007, 2010 and 2015. Author's calculations. (Farinha, Figueiras & Junqueira, 2016).

Historically, income taxes and cash transfers tend to reduce income inequality. In Portugal, the redistributive effect of cash transfers is especially low, meaning that their contribution to reduce

[5] Additive decomposition of total inequality by income sources, that allows to identify the contribution for inequality of each different income components, independently of what inequality index is being used (Farinha, Figueiras & Junqueira, 2016).

[6] Economic resources detained by individuals and households before the State's redistributive action.

[7] The same study concluded that direct taxes are the most effective redistributive instrument in decreasing inequalities. The significant increase in the tax burden in Portugal– especially during the crisis years – and the changes in the IRS (*Imposto sobre o rendimento das pessoas singulars*) reinforced the progressive nature of direct taxes. In 2014, approximately 70% of the IRS amount fell on the 5th quintile of the income distribution while only 1% fell in the first quintile (Farinha, Figueiras & Junqueira, 2016).

income inequality is very limited. This fact can be explained by the lower progressivity of cash transfers[8] (Joumard, Pisu and Bloch, 2012).

3. Data and Methodology

In this thesis, the attention falls on the main dataset ICOR (*Inquérito às Condições de Vida e Rendimento*), which has data on income and living conditions of the Portuguese households. This annual dataset allows for the analysis of the composition and distribution of the household income, living conditions (habitability, comfort, financial capacity, among others) and also the analysis of the impact that social transfers have on poverty and social exclusion. The European statistical database, called EU-SILC (Statistics on Income and Living Conditions) allows the calculation of structural indicators of social cohesion, under conditions of comparability between countries. In Portugal, the Survey on Living Conditions and Income of Families was implemented to collect this information under EU regulations. This is a sample survey with an annual periodicity and a primary data collection from Portuguese households (INE, Documento metodológico, 2019). The target population of this survey includes all the individuals living in the national territory (Azores and Madeira included). In the sample, the statistical units of observation are the households and the individual.

The sample is divided into four subsamples and, each year, one subsample is replaced by another one after having been observed four times. The households that leave the sample are replaced by others in the same area (the areas remain fixed over time). This dynamic system allows for longitudinal and cross-sectional studies, since no aggregate or individual remains in the sample for more than four consecutive years. All the four subsamples that comprise the annual ICOR sample are selected from a sampling base extracted from the *Ficheiro Nacional de Alojamentos* (FNA). Regarding the collection method, this is done through a face-to-face interview using a computer. The data collection takes place in the period between mid-March and June of the year n, where n is the year of the data collection and n-1 is the reference year of the income variables.

[8] These include family, housing, disability, unemployment and old-age pension benefits. A progressive cash transfer "accounts for a larger share of the low income groups' income" (Joumard, Pisu and Bloch, 2012).

To conduct the analysis, we used the ICOR datasets from INE (*Instituto Nacional de Estatística*) and focused on data from 2004 to 2019, the first and the last years in which information is available. These datasets were then analyzed using the statistical software STATA.

3.1. Data Treatment

- **Weight**

Household data had to be treated using household weights. Likewise, for individual data, these were treated using the individual's weight as well. With this technique it is possible to infer from the sample responses to the whole universe (which in this case is the total number of households and individuals in Portugal).

- **Equivalence Scales**

Some of the data collected is at the household level but our focus is at the individual level – mainly on the individual distribution of equivalent income (*distribuição individual do rendimento equivalente*). The individual distribution of equivalent income is obtained using the OECD-modified scale (adopted by EUROSTAT in the 1990s), which helps to assign to each household type in the population a value in proportion to its needs (OECD, Notes on Equivalence Scales). This scale assigns a value of 1 to the household head, 0,5 to each additional adult in the aggregate and 0,3 to each child (under 14 years old).

3.2. Decompositions

Our main goal was to analyze the datasets based on variables in gross terms. When we started the analysis, we realized that for the 2004 dataset (the first year in which the ICOR datasets were available) the only available variables were in net terms. For this reason, two analyses had to be done for each decomposition method. The first analysis is based on variables in net terms (which means that the income taxes and contributions to social security were left out) and considers that total income is the result from the sum of capital income, labor income, pensions income and other transfers income. This first analysis compares income inequality between 2004, 2009 and 2019. The second analysis is based on variables in gross terms and considers

that total income is the result from the sum of capital income, labor income, pensions income, other transfers income minus the income taxes. This analysis compares income inequality between 2009 and 2019 (the first and last years in which this data, in gross terms, is available). With this decomposition, our goal is to find the percentage contribution of income source k in total inequality.

The results were then confirmed in STATA using the command *ineqfac* (Jenkins, 1999a), which provides an exact decomposition of the inequality of total income into inequality contributions from each of the factor components of total income (Brewer, Muriel & Wren-lewis, 2009).

The second decomposition method is decomposition by population subgroup. The subgroups will be based on the main income source that each individual has, since different individuals may have different income sources. We will focus on inequality between the groups and also within each group. These two kinds of inequalities will allow us to gather different insights and perspectives into what drives inequality (Brewer, Muriel, & Wren-Lewis, 2009).

3.3. Variables

The variables included in the analysis were choosen from the ICOR datasets. These variables are the components of the different income sources: capital, labor, pensions, other transfers and income taxes. Regarding Capital, the main components are Property Income (*Rendimentos de propriedades)* and Capital Income *(Rendimentos de capital).* Regarding Labor, the components in consideration are: Monetary income from work for others (*Rendimentos monetários do trabalho por conta de outrem),* Non-Monetary income from work for others (*Rendimentos não monetários do trabalho por conta de outrem)* and Monetary income from self-employment (*Rendimentos monetários do trabalho por conta própria).* Regarding the main focus of this thesis, we have the income source Pensions, which has two main components: Monetary income from private pension plans (*Rendimento monetário de planos privados de pensões)* and Old-age monetary social benefits (*Prestações sociais monetárias por velhice).* In the fourth income source we have Income taxes, which is composed of only one variable: Income taxes and social security contributions *(Impostos sobre o rendimento e contribuições para a*

segurança social). At last, and since we need to take into account all sources of income, we have the income source Other transfers which includes nine different components: Income obtained by children under 16 (*Rendimentos obtidos por menores de 16 anos),* Child/family protection benefits (*Prestações para proteção à criança/família),* Other benefits to social exclusion support (*Outras prestações para apoio à exclusão social),* Social benefits in the context of housing (*Prestações sociais no âmbito da habitação)*, Monetary social benefits related to education (*Prestações sociais monetárias relacionadas com a educação),* Monetary social benefits for unemployment (*Prestações sociais monetárias por desemprego),* Monetary social survivors' benefits due to the death of the spouse (*Prestações sociais monetárias de sobrevivência por morte do cônjuge)*, Monetary social benefits due to illness or accident (*Prestações sociais monetárias por doença ou acidente)* and Monetary social benefits for disability protection (*Prestações sociais monetárias por proteção na invalidez).*

4. Results

4.1. Individual Distribution of Equivalent Income *(rendimento disponível por adulto equivalente)*

Table 4 shows the statistics for the Individual Distribution of Equivalent Income for the years 2004, 2009 and 2019. It is documented that the mean value of the equivalent income has an increasing trend. The variability of the individual distribution of the equivalent income, based on the coefficient of variation, increased from 2004 to 2009, but decreased from 2009 to 2019. The Interquartile range has an increasing trend between 2004 and 2019, meaning that the difference between p75 and p25 is increasing throughout these years.

Table 4 - Statistics for the variable "individual distribution of equivalent income"

	2004	2009	2019
Mean	8889,78	10395,63	11649,91
Standard error	37,15	46,51	27,00
95% Confidence Interval	[8816,97;8962,58]	[10304,46;10486,79]	[11596,99;11702,83]
Standard deviation	7329,9	8625,12	7782,01
Coefficient of variation	0,82	0,83	0,67
Interquartile range	5678,14	6350,74	6961,86

Source: Own calculations using data from *Inquéritos às Condições de Vida e Rendimento* (ICOR).

Table 5 shows the results for the Individual Distribution of Equivalent Income Inequality using ICOR data for 2004, 2009 and 2019. The indicators considered are: Gini Index, Atkinson Index and GE measures. The first result we can observe is that almost every inequality measure presents the same trend: a decrease throughout the years - observed in figure 2 - with the exception of A(2), which had a small increase from 2009 to 2019. When we compare the 2019 values with the 2004 values we can see that the Gini coefficient had a 5,20 pp decrease. The Atkinson indices had a 2,80 pp decrease, a 4,90 pp decrease, and a 12,30 pp decrease, for ε=0,5, ε=1 and ε=2, respectively. Regarding Generalised Entropy, we can see a decrease of 6,00 pp, a decrease of 6,60 pp and a decrease of 11,70 pp, for α=0, α=1 and α=2, respectively.

Furthermore, regarding the Atkinson index, it is noticed that the values are in accordance with what we find in the literature: the larger ε, the greater the aversion to inequality is, or the larger the value of the inequality index. The parameter ε measures the degree of inequality-aversion, or in other words, the relative sensitivity to transfers at different income levels (Atkinson, 1970). The larger ε the more weight we attach to transfers at the lower end of the distribution and less weight to transfers at the top. The Atkinson Index allows for an inequality measurement based on social welfare. It represents the percentage of total income that society would have to forego in order to have more equal shares of income between its citizens (Bellù, 2006).

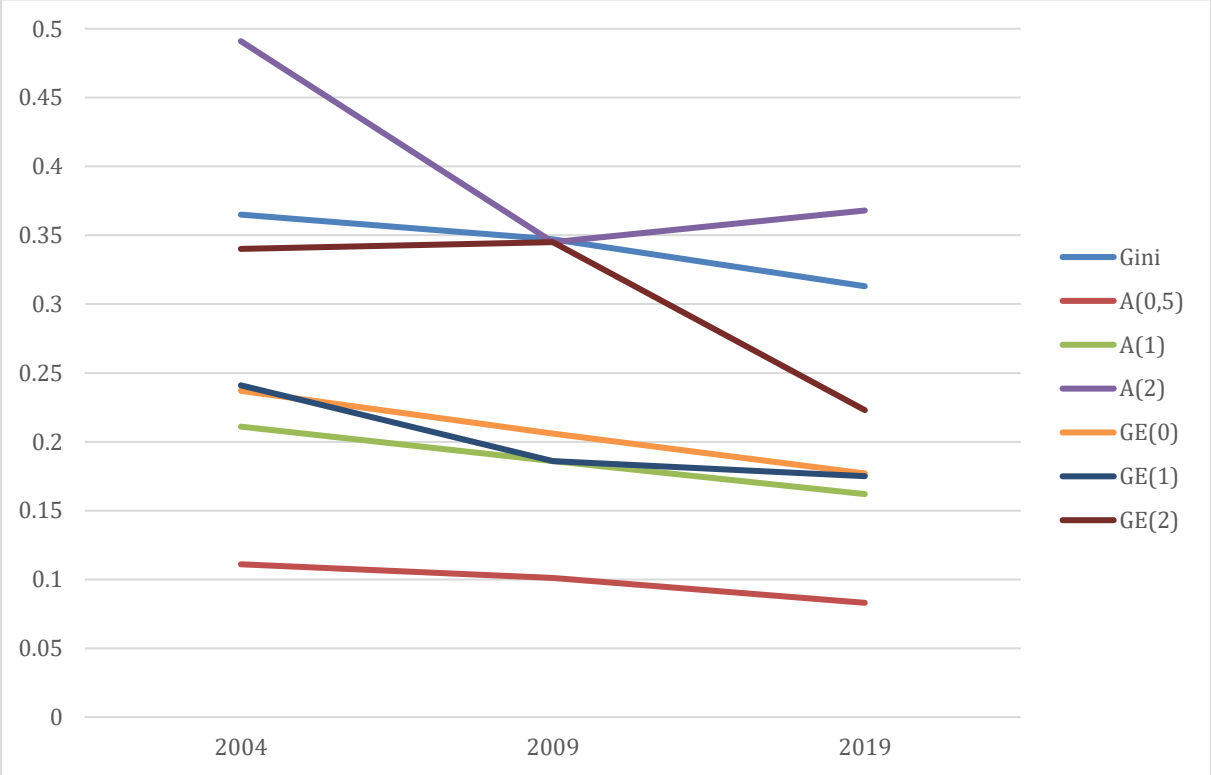
The same interpretation applies with respect to GE(α), where the larger α, the greater the sensitivity to income differences at the top of the income distribution rather than the bottom (Brewer, Muriel & Wren-lewis, 2009)

Table 5 - Gini, Atkinson and Generalised Entropy inequality measures on the Individual Distribution of equivalent income

Individual distribution of equivalent income	2004	2009	2019
Gini	0,365	0,347	0,313
Atkinson (ε=0,5)	0,111	0,101	0,083
Atkinson (ε=1)	0,211	0,186	0,162
Atkinson (ε=2)	0,491	0,345	0,368
Entropy (α=0)	0,237	0,206	0,177
Entropy (α=1)	0,241	0,186	0,175
Entropy (α=2)	0,340	0,345	0,223

Source: Own calculations using data from *Inquéritos às Condições de Vida e Rendimento* (ICOR).

Figure 2 - Gini, Atkinson and Generalised Entropy inequality measures evolution for Portugal



Source: Own calculations using data from *Inquéritos às Condições de Vida e* Rendimento (ICOR).

Table 6 shows the results for the Individual Distribution of Equivalent Income Percentile ratios using ICOR data for 2004, 2009 and 2019. Between 2004 and 2019 all percentile ratios present

the same decreasing trend, which represents a decrease in inequality. Focusing on the p90/p10 ratio, in 2004, the income of an individual in the 90thpercentile was 5,07 times higher than the income of an individual in the 10th percentile. In 2019, that difference fell to approximately 4,02 times.

Table 6 - Percentile Ratios for the Individual Distribution of equivalent income

Percentile ratios[9]	2004	2009	2019
p90/p10	5,07	4,48	4,02
p90/p50	2,34	2,20	1,96
P75/p25	2,20	2,09	1,99

Source: Own calculations using data from *Inquéritos às Condições de Vida e Rendimento* (ICOR).

4.2. Pensions – Descriptive Statistics

Tables 7 and 8 show the statistics for the variables "monetary income from private pension plans" and "old-age monetary social benefits" in net terms, respectively, before and after the elimination of the null observations. Regarding the monetary income from private pension plans variable, the percentage of non-null observations is smaller than 1 pp for the three years. In 2004 only 0,22 pp of the sample population had monetary income coming from a private pension plan, in 2009 that value was 0,35 pp and 0,42 pp in 2019. These results represent the weak adhesion of the Portuguese population to private and voluntary savings plans.

We can see that for the 3 years in consideration, the mean value for the monetary income from private pension plans is always smaller than the old-age monetary social benefits, even after the elimination of the null observations. Even for those who beneficiate from private pension plans, these are mainly a complement to social security benefits.

[9]For p90/p10: ratio of incomes received by individuals at the 90th percentile and the 10th percentile of the income distribution (Alves et all, 2020). A higher ratio means higher inequality.

Table 7 - Statistics for the variable "monetary income from private pension plans"

	% of population with positive values for this variable	Mean	Standard error	95% Confidence Interval	Standard deviation	Coeficient of variation	IQR
2004	0,22	8,89	1,53	[5,89;11,90]	302,3	34,00	0,00
2009	0,35	12,02	3,15	[5,84;18,19]	584,04	48,59	0,00
2019	0,42	16,06	1,50	[13,11;19,00]	433,04	26,96	0,00
After eliminating null observations:							
2004	100	3568,04	534,11	[2505,91;4630,17]	4924,21	1,38	7263,00
2009	100	4173,52	921,66	[2348,55;5998,49]	10096,23	2,42	3540,00
2019	100	3460,52	284,92	[2900,15;4020,90]	5345,66	1,54	3340,00

Source: Own calculations using data from *Inquéritos às Condições de Vida e Rendimento* (ICOR).
Note: Yearly data in net terms and euro currency.

Table 8 - Statistics for the variable "old-age monetary social benefits"

	% of population with positive values for this variable	Mean	Standard error	95% Confidence Interval	Standard deviation	Coeficient of variation	IQR
2004	17,44	989,55	17,38	[955,49;1023,61]	3429,23	3,47	0,00
2009	21,89	1220,28	20,46	[1180,18;1260,39]	3794,46	3,11	0,00
2019	20,88	1680,77	16,07	[1649,28;1712,27]	4631,69	2,76	0,00
After eliminating null observations:							
2004	100	6041,55	77,96	[5888,73;6194,37]	6424,88	1,06	3352,30
2009	100	7154,47	74,66	[7008,11;7300,83]	6477,76	0,91	4914,00
2019	100	9005,02	53,14	[8900,85;9109,19]	6998,72	0,78	6338,00

Source: Own calculations using data from *Inquéritos às Condições de Vida e Rendimento* (ICOR).
Note: Yearly data in net terms and euro currency.

4.3. Decomposition by income source

4.3.1. First Analysis (2004 vs. 2019 - net terms)

As previously mentioned, the first analysis will consider the chosen variables in net terms, leaving out the income taxes and contributions to social security. Table 9 shows us the share of the different income sources in total income for 2004, 2009 and 2019. From 2004 to 2019, Capital and Pensions increased their share in total income, representing in the latter year 3,53 pp and 18,32 pp respectively. On the other hand, Labor and Other transfers decreased their contributions to total income, with 71,38 pp and 6,77 pp respectively. The trend of the weight increase of Pensions, and the weight decrease of Labor in total income is in line with the demographic phenomenon – population aging - previously mentioned in this thesis, and also with the rise in the number of social security and *caixa geral de aposentações* pensioners (see table A4).

Table 9 - Share of the different income sources in total income (net terms)

	2004	2009	2019
Capital	2,13%	2,05%	3,53%
Labor	75,33%	74,87%	71,38%
Pensions	14,55%	15,27%	18,32%
Other transfers	7,99%	7,81%	6,77%
Total income	100%	100%	100%

Source: Own calculations using data from *Inquéritos às Condições de Vida e Rendimento* (ICOR).

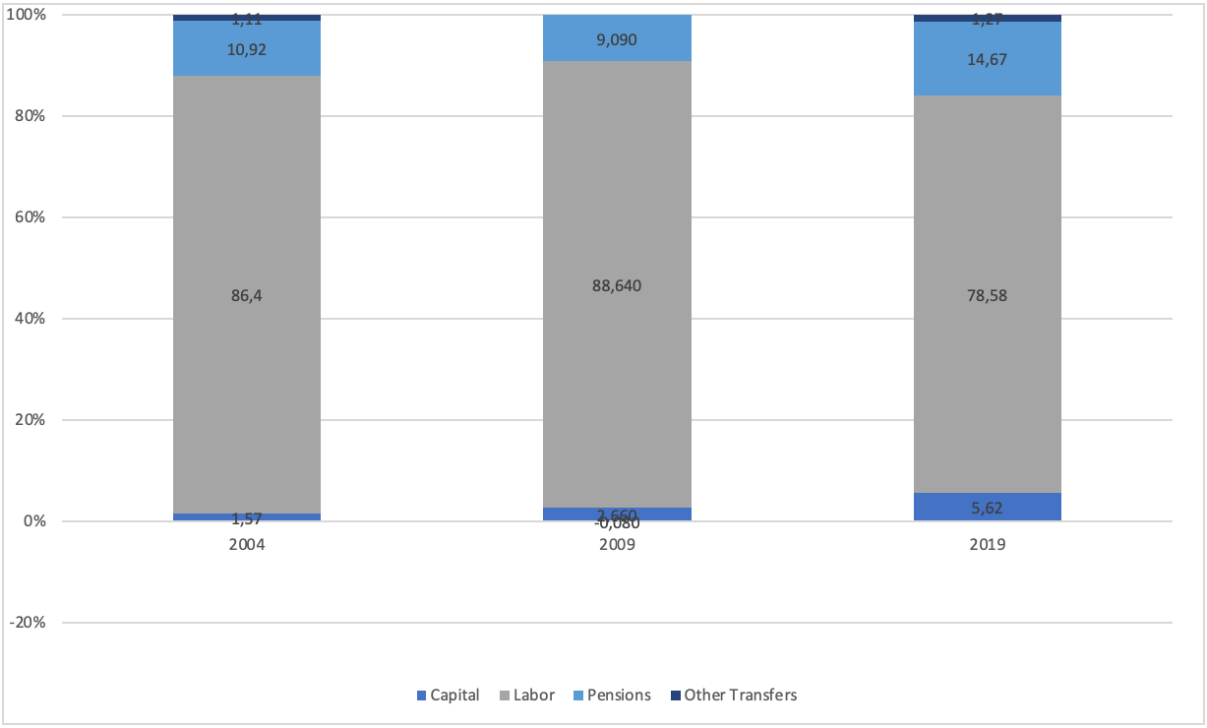
Table 10 shows the income decomposition into the four income sources (capital, labor, pensions and others). Comparing the 2004 values with 2019, the conclusion is that the percentage of the capital contribution to income inequality was 1,57 pp in 2004 and 5,62 pp in 2019, which represents an increase of 4,05 pp. Regarding labor, in 2004 its contribution to income inequality was 86,40 pp and 78,58 pp in 2019. It represents a decrease of 7,82 pp. Regarding pensions, in 2004 its contribution to income inequality was 10,92 pp and 14,67 pp in 2019, which represents an increase of 3,75 pp. Regarding other transfers, in 2004 the joint contribution to income inequality was 1,11 pp and 1,27 pp in 2019. It represents an increase of 0,16 pp.

Table 10 - Decomposition by Income Source in net terms – Shorrocks $s_k(Y)$

Income Source	Income Source contribution to Income Inequality (2004)	Income Source contribution to Income Inequality (2009)	Income Source contribution to Income Inequality (2019)
Capital	1,57%	2,66%	5,62%
Labor	86,40%	88,64%	78,58%
Pensions	10,92%	9,09%	14,67%
Other transfers	1,11%	-0,08%	1,27%
Total	100%	100%	100%

Source: Own calculations using data from *Inquéritos às Condições de Vida e Rendimento* (ICOR).

Figure 3 - 100% stacked column chart of the decomposition by Income Source in net terms



Source: Own calculations using data from *Inquéritos às Condições de Vida e Rendimento* (ICOR).

Table 11 shows the contribution for income inequality of the different income components of each income source. We can see that the components "Monetary social benefits related to education" and "Other benefits to social exclusion support" had an equalizing effect in the three years in consideration, meaning that they contributed to a decrease in income inequality. It was

expected that other social benefits (for example Monetary social benefits for unemployment or Monetary social benefits for disability protection) would also have an equalizing effect, since they are attributed to a part of the population who suffers from the inequality consequences the most. However, their contribution to income inequality is close to 0%, meaning that their increasing effect on income inequality is very small.

Regarding pensions, the results show that, in 2004, 2009 and 2019, the main contribution to income inequality comes from the old-age monetary benefits rather than from the component monetary income from private pension plans, which doesn't represent a surprise. According to a report published by the OECD, the public expenditure on old-age and survivors benefits as a percentage of gross domestic product is higher than the Private pensions-benefit expenditure and this fact can be one of the explanations for the result found (see appendix - table A5). From the population sample of this study, the conclusions were the same: in 2004 the mean income coming from old-age monetary benefits was approximately 110,23 times higher than the mean income coming from private pension plans. In 2009 that ratio dropped to 108,96, and in 2019 increased to 116,53.

Another result that needs more attention is the fact that, regarding the old-age monetary benefits contribution to income inequality, it dropped 2,05 pp from 2004 to 2009 and increased 5,72 pp from 2009 to 2019, reaching a higher level than in 2004. At the same time, the contribution to income inequality of monetary income from self-employment increased 18,13 pp from 2004 to 2009 and decreased 7,44 pp from 2009 to 2019. This can be explained by the 2008-2009 recession, which had its origin in the American financial crisis. This recession affected, among others, investment, trade and employment, which started to decrease from the second quarter of 2008 (Comité de datação dos ciclos económicos Portugueses, Fundação Francisco Manuel dos Santos).

Table 11 - Decomposition by Income Source in net terms (all components) - Shorrocks $s_k(Y)$

Component	Income Source contribution (%) to Income Inequality (2004)	Income Source contribution (%) to Income Inequality (2009)	Income Source contribution (%) to Income Inequality (2019)
Property Income	1,19	1,13	3,75
Capital Income	0,39	1,54	1,87
Monetary income from work for others	70,64	54,31	51,80
Non- Monetary income from work for others	1,10	1,54	1,43
Monetary income from self-employment	14,66	32,79	25,35
Monetary income from private pension plans	0,25	0,49	0,34
Old-age monetary social benefits	10,66	8,61	14,33
Child/familiy protection benefits	0,10	-0,10	-0,04
Social benefits in the context of housing	0,07	0,01	0,00
Monetary social benefits for unemployment	0,29	0,02	0,89
Monetary social benefits related to education	-0,01	-0,06	-0,08
Monetary social benefits for disability protection	0,07	-0,07	0,03
Other benefits to social exclusion support	-0,07	-0,17	-0,27
Monetary social survivors' benefits due to the death of the spouse	0,57	0,26	0,820
Monetary social benefits due to illness or accident	0,08	0,02	0,59
Income obtained by children under 16 years old	0,01	0,00	0,01
Total	100	100	100

Source: Own calculations using data from *Inquéritos às Condições de Vida e Rendimento* (ICOR).

It is important to decipher why an income source contributes a little (or a lot) to income inequality. To do so, the intensity ratios between each income source contribution to total inequality and its share in total income were calculated. An income source can have a small contribution to total inequality because it has a small share in total income, or because the correlation with total income is small. Table 12 shows these intensity ratios in net terms for the years 2004, 2009 and 2019. In 2004, labor was the income source that registered the largest intensity ratio – it was also the income source that registered the largest income source

contribution to income inequality and the largest share in total income. In 2009, the picture changes a bit, being capital the income source that had the largest intensity ratio – unlike labor, capital registered, in this year, the second smallest income source contribution to income inequality and the smallest share in total income. In 2019, the results for capital are the same as the previous year, but its intensity ratio increased by 0,29. For 2009 and 2019, even though labor and pensions have higher contributions to income inequality than capital, the intensity ratio for capital is higher than the intensity ratios of these two income sources.

Table 12 – Intensity ratios

	2004	2009	2019
Capital	0,74	1,30	1,59
Labor	1,15	1,18	1,10
Pensions	0,75	0,60	0,80
Others transfers	0,14	-0,01	0,19

Source: Own calculations using data from *Inquéritos às Condições de Vida e Rendimento* (ICOR).
Note: Intensity ratios between each income source contribution to total inequality and its share in total income (in net terms).

4.3.2. Second Analysis (2009 vs. 2019 - gross terms - including income taxes and social security contributions)

Regarding the share of each income source in total income - and having in mind that we are dealing with income taxes (which include social security contributions) as a negative source of income, - total income has the following composition: in 2009 Capital represented 2,51 pp of total income, Labor represented 105,97 pp, Pensions represented 17,59 pp, Other transfers 8,46 pp and Income taxes -34,53 pp. In 2019, the tax burden increased with income taxes representing -41,42 pp of total income. Capital, Pensions and Labor increased their share in total income, representing 4,79 pp, 22,77 pp and 106,33 pp respectively. In contrast, Other transfers decreased their contributions to total income, with 7,54 pp.

Table 13: Share of the different income sources in total income (gross terms)

	2009	2019
Capital	2,51%	4,79%
Labor	105,97%	106,33%
Pensions	17,59%	22,77%
Other transfers	8,46%	7,54%
Income taxes and social security contributions	-34,53%	-41,42%
Total income	100%	100%

Source: Own calculations using data from *Inquéritos às Condições de Vida e Rendimento* (ICOR).

Table 14 shows the decomposition by the five income sources (capital, labor, pensions, other transfers and income taxes – which include contributions to social security). From the ICOR datasets the conclusion is that the percentage of the capital contribution to income inequality is 2,26 pp in 2009 and 4,49 pp in 2019. It represents an increase of 2,23 pp. Regarding labor, in 2009 its contribution to income inequality was 105,43 pp and 97,83 pp in 2019. It represents a decrease of 7,6 pp. Regarding pensions, in 2009 its contribution to income inequality was 8,53 pp and 13,60 pp in 2019, which represents an increase of 5,07 pp. Regarding other transfers, in 2009 it didn't contribute to increase income inequality since it had a negative contribution of -0,02 pp. In 2019 this contribution was positive and has a value of 1,03 pp. It represents an increase of 1,05 pp. Regarding income taxes (and contributions to social security), we concluded that they had an equalizing effect in both years: they contributed to decrease income inequality by 16,02 pp in 2009 and 16,83 pp in 2019. This represents an increase of the equalizing effect by 0,81 pp between both years.

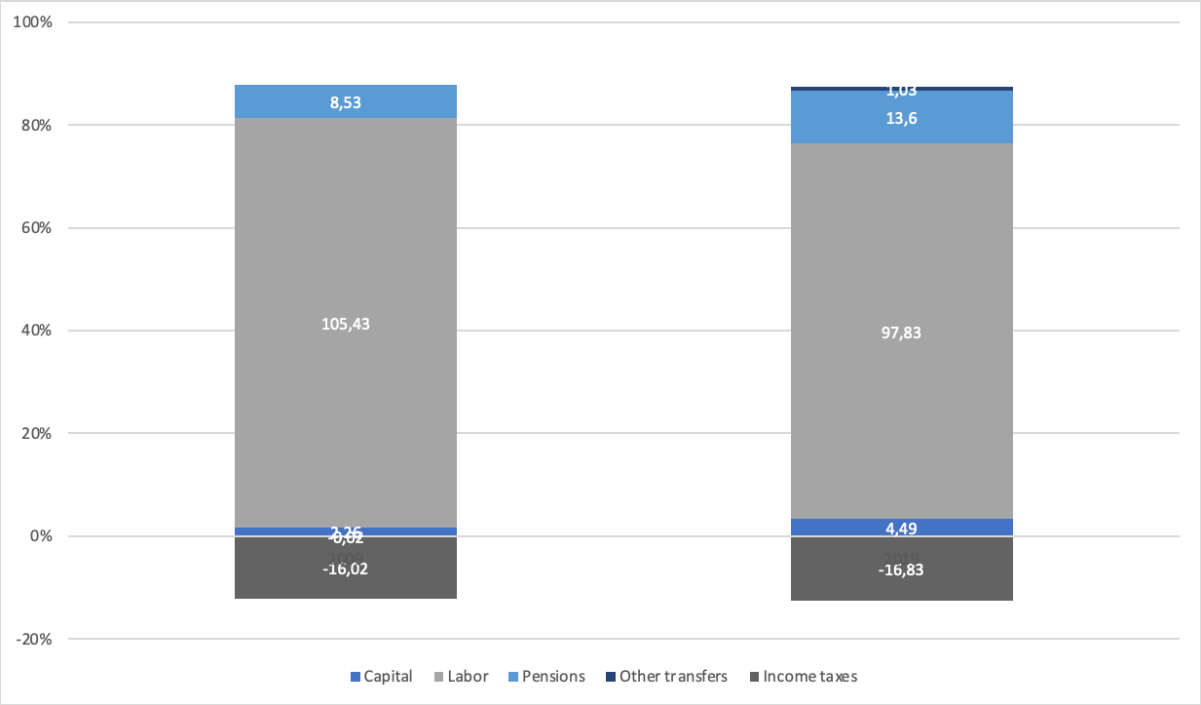
Table 14 - Decomposition by Income Source in gross terms - Shorrocks $s_k(Y)$

Income Source	Income Source contribution to Income Inequality (2009)	Income Source contribution to Income Inequality (2019)
Capital	2,26%	4,49%
Labor	105,43%	97,83%
Pensions	8,53%	13,60%
Other transfers	-0,02%	1,03%
Income taxes and social security contributions	-16,02%	-16,83%
Total	100%	100%

It shows the income source contribution (%) in total income inequality.

Source: Own calculations using data from *Inquéritos às Condições de Vida e Rendimento* (ICOR).

Figure 4: 100% stacked column chart of the decomposition by Income Source in gross terms



Source: Own calculations using data from *Inquéritos às Condições de Vida e Rendimento* (ICOR).

Table 15 shows us, once again, the contribution for income inequality of the different income components of each income source with the addition of income taxes and social security contributions as a negative source of income. We can see that the components “Monetary social benefits related to education”, “Other benefits to social exclusion support” and “Income taxes” had an equalizing effect in both years.

Regarding pensions, the results are in line with the previous net terms results: in both years the main contribution to income inequality comes from the old-age monetary benefits rather than from the component monetary income from private pension plans. The old-age monetary social benefits contribution to income inequality was 8,01pp in 2009 and 13,32pp in 2019 - which represents an increase of 5,31pp between both years.

In both analysis - net and gross - the conclusion is that the old age pension’s contribution to income inequality is rising. At the same time, income inequality throughout the years measured by the Gini, Atkinson and GE measures is decreasing.

Table 15 - Decomposition by Income Source in gross terms (all components) - Shorrocks $s_k(Y)$

Component	Income Source contribution (%) to Income Inequality (2009)	Income Source contribution (%) to Income Inequality (2019)
Property Income	0,87	2,95
Capital Income	1,38	1,54
Monetary income from work for others	72,08	69,43
Non- Monetary income from work for others	1,31	1,05
Monetary income from self-employment	32,04	27,35
Monetary income from private pension plans	0,52	0,28
Old-age monetary social benefits	8,01	13,32
Child/familiy protection benefits	-0,03	0,02
Social benefits in the context of housing	0,01	0,00
Monetary social benefits for unemployment	-0,01	0,52
Monetary social benefits related to education	-0,06	-0,06
Monetary social benefits for disability protection	-0,05	0,11
Other benefits to social exclusion support	-0,11	-0,15
Monetary social survivors' benefits due to the death of the spouse	0,22	0,52
Monetary social benefits due to illness or accident	0,01	0,06
Income obtained by children under 16 years old	0,00	0,01
Income taxes and social security contributions	-16,02	-16,83
Total	100	100

Source: Own calculations using data from *Inquéritos às Condições de Vida e Rendimento* (ICOR).

Table 12 shows the intensity ratios in gross terms for the years 2009 and 2019. In 2009, labor was the income source that registered the largest intensity ratio – it was also the income source that registered the largest income source contribution to income inequality and the largest share in total income. In 2019, the picture changes a bit once again, with capital being the income source that had the largest intensity ratio – although labor is second with a difference of only 0,02.

Table 16 – Intensity ratios

	2009	2019
Capital	0,90	0,94
Labor	0,99	0,92
Pensions	0,48	0,60
Others transfers	0,00	0,14
Income taxes and ss contributions	0,46	0,41

Source: Own calculations using data from *Inquéritos às Condições de Vida e Rendimento* (ICOR).
Note: Intensity ratios between each income source contribution to total inequality and its share in total income (in gross terms).

In 2004, the risk of poverty rate after social transfers stood at 19,4 pp. In 1019 that risk decreased to 16,2 pp (PORDATA). Through the decomposition of the total equivalent mean income into quintiles, the conclusion for 2004 is that 4,42 pp of the total equivalent mean income accounted for spending with pensions, while 50,13 pp of the total equivalent mean income accounted for spending with other transfers such as unemployment benefit, disability benefit or exclusion support benefit (table 17). Table 18 shows that in 2019, the spending with pensions increased to 20,49 pp in Q1, but, nonetheless, the total share of others transfers in the total equivalent mean income still represented the majority of the income of the population that belonged to this quintile. Although there is a significant amount of poverty in Portugal, this means that the problem is not worse in the pensionists' group but rather in the group that has others transfers as their source of income – especially if this is their main source of income.

Table 17 – Income sources shares in quintiles for 2004

	Q1	Q2	Q3	Q4	Q5
Total equivalent mean income	610,17	3313,54	5414,15	8103,96	19602,98
Mean pension income	26,97	1333,47	612,61	684,98	2731,97
Mean labor income	217,79	1208,54	4086,35	6606,50	15786,37
Mean capital income	59,52	69,87	86,98	181,71	392,79
Mean others transfers income	305,89	701,66	628,21	630,76	691,85
Total pension share	4,42%	40,24%	11,32%	8,45%	13,94%
Total labor share	35,69%	36,47%	75,48%	81,52%	80,53%
Total capital share	9,76%	2,11%	1,61%	2,24%	2,00%
Total others transfers share	50,13%	21,18%	11,60%	7,78%	3,53%
	100%	100%	100%	100%	100%

Source: Own calculations using data from *Inquéritos às Condições de Vida e Rendimento* (ICOR).

Note: Net variables. Mean income in yearly data and euro currency.

Table 18 – Income sources shares in quintiles for 2019

	Q1	Q2	Q3	Q4	Q5
Total equivalent mean income	1719,27	5847,50	8395,30	11419,70	23505,28
Mean pension income	352,27	2048,09	1082,68	1646,85	4193,07
Mean labor income	526,48	2693,68	6754,31	8883,56	17465,13
Mean capital income	159,63	144,19	116,20	241,90	1132,20
Mean others transfers income	680,88	961,54	442,12	647,39	714,87
Total pension share	20,49%	35,03%	12,90%	14,42%	17,84%
Total labor share	30,62%	46,07%	80,45%	77,79%	74,30%
Total capital share	9,28%	2,47%	1,38%	2,12%	4,82%
Total others transfers share	39,60%	16,44%	5,27%	5,67%	3,04%
	100%	100%	100%	100%	100%

Source: Own calculations using data from *Inquéritos às Condições de Vida e Rendimento* (ICOR).

Note: Net variables. Mean income in yearly data and euro currency.

4.4. Decomposition by population subgroups

In this decomposition, the different types of population subgroups are characterized by their main source of income: labor, pensions, capital and other transfers. Since different individuals may have different income sources, for this decomposition the population was divided into four mutually exclusive subgroups: subgroup number 1 is composed with the population that has labor as the main income source; subgroup number 2 is composed with the population that has capital as the main income source; subgroup number 3 is composed with the population that has pensions as the main income source and subgroup number 4 is composed with the population that has other transfers as the main income source.

Considering that the focus of this thesis are the old-age pensions, the total income of the subgroup that has these pensions as the main income source was deconstructed and documented in table 19. In 2004, pensions accounted for 90,59 pp of the total equivalent income in the subgroup that had pensions as the main income source. 4,66 pp of the total income in this group was coming from other transfers, 2,98 pp from labor and 1,77 pp from capital. In 2019, pensions accounted for 91,19 pp of the total equivalent income (an increase of 0,61 pp), 3,70 pp was coming from other transfers, 3,40 pp from capital, while the rest 1,17 pp from labor.

Table 19 - Total income composition for subgroup with pensions as primary income source

	2004		2019	
Labor	206,25	2,98%	173,07	1,71%
Capital	122,19	1,77%	343,92	3,40%
Pensions	6262,30	90,59%	9231,84	91,19%
Others	322,36	4,66%	374,50	3,70%
Total	6913,10	100,00%	10123,32	100,00%

Source: Own calculations using data from *Inquéritos às Condições de Vida e Rendimento* (ICOR).

Note: Net variables. Mean income in yearly data and euro currency.

Following Brewer et al.'s approach (2009), which considers:

$$I_{total} = I_{within} + I_{between}$$

where I_{within} represents inequality within the subgroups and $I_{between}$represents inequality between the subgroups. This decomposition takes advantage of the additive decomposability property of the mean log deviation. This inequality measure is a special case of the Generalized Entropy measures and considers α=0. Just like the previous authors, we rely on the methodology of Mookherjee and Shorrocks (1992) for the decomposition[10] of I_0:

$$I_0=\sum_g v_g I_{0g} + \sum_g v_g \ln\left(\frac{\mu}{\mu_g}\right)$$

Relying on the same methodology, the Theil index (where α=1), which also has the property of additive decomposability, will be computed and decomposed[11] as:

$$I_1 = \sum_g \frac{n_g}{n}\frac{\mu_g}{\mu} I_{1g} + \sum_g \frac{n_g}{n}\frac{\mu_g}{\mu} \ln\left(\frac{\mu_g}{\mu}\right)$$

Furthermore, it is possible to decompose ΔI_0 in order to see the influence that each factor has on the total change in inequality (equation 1). ΔI_0 can be decomposed into four components: the first component, $\sum_g \overline{v_g}\, \Delta I_{0g}$, represents the impact of the changes in within subgroup inequality. The second component, $\sum_g \overline{I_{0g}}\, \Delta v_g$, represents the effect of changes in the population shares on the within subgroup component. The third component, $\sum_g \overline{\ln\left(\frac{\mu}{\mu_g}\right)} \Delta v_g$ represents the effect of changes in the population shares on the between subgroup component. Finally, the fourth component, $\sum_g \overline{v_g}\, \Delta \ln\left(\frac{\mu}{\mu_g}\right)$represents the effect of the relative changes in the subgroup income means (Mookherjee and Shorrocks, 1992). The same interpretation can be done using the Theil index as the inequality measure (equation 2).

[10] The first part of the equation represents the inequality within the subgroups, and the second part of the equation represents inequality between the subgroups. v_g=$\frac{n_g}{n}$, where n_g represents the size of subgroup g and n represents the size of the population. μ_g represents the mean total income of subgroup g and μ_g the mean total income of the whole population.

[11] Once again, the first part of the equation represents the inequality within the subgroups, and the second part of the equation represents inequality between the subgroups (Mookherjee and Shorrocks, 1992).

$$\Delta I_0 = \sum_g \overline{v_g}\,\Delta I_{0g} + \sum_g \overline{I_{0g}}\;\Delta v_g + \sum_g \overline{\ln\left(\frac{\mu}{\mu_g}\right)}\Delta v_g + \sum_g \overline{v_g}\,\Delta \ln\left(\frac{\mu}{\mu_g}\right) \quad (1)$$

$$\Delta I_1 = \sum_g \overline{\left(\frac{n_g\mu_g}{n\mu}\right)}\Delta I_{1g} + \sum_g \overline{I_{1g}}\;\Delta\left(\frac{n_g\mu_g}{n\mu}\right) + \sum_g \overline{\frac{\mu_g}{\mu}\ln\left(\frac{\mu_g}{\mu}\right)}\Delta v_g + \sum_g \overline{v_g}\,\Delta\left(\frac{\mu_g}{\mu}\ln\left(\frac{\mu_g}{\mu}\right)\right) \quad (2)$$

Table 20 shows the results and calculations used to decompose inequality by population subgroup in the year 2004, using the mean log deviation as the inequality measure. The first thing to be noticed is that 57,87 pp of the population had labor as the main income source – whether this was monetary income from work for others, non-monetary income from work for others or monetary income from self-employment. 3,08 pp of the population had capital as the main income source, 17,41 pp had an old age pension (private plan or a social benefit) as the main income source, while the remaining 21,64 pp of the population had other transfers as the main income source.

In 2004, the value for the within component of inequality was 0,521 and for the between component was 0,153. This represents a total inequality value of 0,674. Furthermore, the subgroup that contributed to inequality the most was the subgroup that had capital as the main income source. Surprisingly, this subgroup, not only had a large within inequality, but also a much lower mean income than other subgroups. On the other hand, the subgroups that contributed to inequality the least, with a very small difference, were the subgroups that had labor and pensions as the main income sources.

Table 20 - Inequality decomposition by population subgroup for 2004 in net terms - MDL

Subgroup g	n_g	$\frac{n_g}{n}$	μ_g	$\frac{\mu}{\mu_g}$	$\ln\left(\frac{\mu}{\mu_g}\right)$	I_{0g}	$\frac{n_g}{n}\ln\left(\frac{\mu}{\mu_g}\right)$	$\frac{n_g}{n}I_{0g}$
Labor	20966	57,86%	9569,792	0,760	-0,274	0,304	-0,158	0,176
Capital	1116	3,08%	3197,275	2,276	0,822	1,433	0,025	0,044
Pensions	6310	17,41%	6913,099	1,053	0,051	0,307	0,009	0,053
Other transfers	7842	21,64%	2019,536	3,603	1,282	1,145	0,277	0,248
						Total	0,153	0,521

Source: Own calculations using data from *Inquéritos às Condições de Vida e Rendimento* (ICOR).

Note: Values for the Mean Log Deviation. Calculations with n = 36234 and μ = 7276,79 done in STATA.

$$I_0=\sum_g \frac{n_g}{n} I_{0g} + \sum_g \frac{n_g}{n} \ln\left(\frac{\mu}{\mu_g}\right)= 0{,}521 + 0{,}153= 0{,}674$$

Table 21 shows the same results as table 20 but for the year 2019. In this year 56,98 pp of the population had labor as the main income source, 3,75 pp of the population had capital as the main income source, 21,92 pp had an old age pension as the main income source, and the remaining 17,35 pp of the population had other transfers as the main income source.

The value for the within component of inequality with the mean log deviation measure is 0,399 and for the between component is 0,390. This represents a total inequality value of 0,093. Regarding the contribution to inequality of each different population subgroup, the conclusion for 2019 is similar to the conclusion for 2004: the subgroup that contributes to inequality the most is the subgroup that has capital as the main income source, while the subgroup that contributes to inequality the least is the one that has labor as the main income source.

Table 21 - Inequality decomposition by population subgroup for 2019 in net terms - MDL

Subgroup g	n_g	$\frac{n_g}{n}$	μ_g	$\frac{\mu}{\mu_g}$	$\ln\left(\frac{\mu}{\mu_g}\right)$	I_{0g}	$\frac{n_g}{n}\ln\left(\frac{\mu}{\mu_g}\right)$	$\frac{n_g}{n} I_{0g}$
Labor	42616	56,98%	12185,370	0,815	-0,205	0,209	-0,117	0,119
Capital	2807	3,75%	4611,941	2,152	0,766	1,538	0,029	0,058
Pensions	16394	21,92%	10123,320	0,980	-0,020	0,214	-0,004	0,047
Other transfers	12978	17,35%	3404,571	2,915	1,070	1,011	0,186	0,175
						Total	0,093	0,399

Source: Own calculations using data from *Inquéritos às Condições de Vida e Rendimento* (ICOR).

Note: Values for the Mean Log Deviation. Calculations with n = 74795 and μ = 9925,58 done in STATA

$$I_0=\sum_g \frac{n_g}{n} I_{0g} + \sum_g \frac{n_g}{n} \ln\left(\frac{\mu}{\mu_g}\right)= 0{,}399 + 0{,}093 = 0{,}492$$

Table 22 and table 23 show the results and calculations used to decompose inequality by population subgroup in the year 2004 and 2019, respectively, using the Theil index as the inequality measure. In 2004, the value for the within component of inequality was 0,360 and for the between component was 0,112. In 2019, the value for the within component decreased to 0,263 and the between component also suffered a decrease, to 0,071. This means that total inequality decreased from 0,472 in 2004 to 0,334 in 2019. Following once again the results documented with the MDL, the subgroup that contributes to inequality the most, in both years, is the subgroup that has capital as the main income source, while the subgroup that contributes

to inequality the least, in both years, is the subgroup number 1, the one that has labor as the main income source.

Table 22 - Inequality decomposition by population subgroup for 2004 in net terms – Theil index

Subgroup g	n_g	$\frac{n_g}{n}$	μ_g	$\frac{\mu_g}{\mu}$	$\ln\left(\frac{\mu_g}{\mu}\right)$	I_{1g}	$\frac{n_g}{n}\frac{\mu_g}{\mu}\ln\left(\frac{\mu_g}{\mu}\right)$	$\frac{\mu_g}{\mu}\frac{n_g}{n}I_{1g}$
Labor	20966	57,86%	9569,792	1,315	0,274	0,310	0,208	0,236
Capital	1116	3,08%	3197,275	0,439	-0,822	0,916	-0,011	0,012
Pensions	6310	17,41%	6913,099	0,950	-0,051	0,358	-0,008	0,059
Other transfers	7842	21,64%	2019,536	0,278	-1,282	0,876	-0,077	0,053
						Total	0,112	0,360

Source: Own calculations using data from *Inquéritos às Condições de Vida e Rendimento* (ICOR).

Note: Values for the Theil index. Calculations with n = 36234 and μ = 7276,79 done in STATA.

$$I_1 = \sum_g \frac{n_g}{n}\frac{\mu_g}{\mu} I_{1g} + \sum_g \frac{n_g}{n}\frac{\mu_g}{\mu}\ln\left(\frac{\mu_g}{\mu}\right) = 0{,}360 + 0{,}112 = 0{,}472$$

Table 23 - Inequality decomposition by population subgroup for 2019 in net terms – Theil index

Subgroup g	n_g	$\frac{n_g}{n}$	μ_g	$\frac{\mu_g}{\mu}$	$\ln\left(\frac{\mu_g}{\mu}\right)$	I_{1g}	$\frac{n_g}{n}\frac{\mu_g}{\mu}\ln\left(\frac{\mu_g}{\mu}\right)$	$\frac{\mu_g}{\mu}\frac{n_g}{n}I_{1g}$
Labor	42616	56,98%	12185,370	1,228	0,205	0,216	0,143	0,151
Capital	2807	3,75%	4611,941	0,465	-0,766	1,143	-0,013	0,020
Pensions	16394	21,92%	10123,320	1,020	0,020	0,232	0,004	0,052
Other transfers	12978	17,35%	3404,571	0,343	-1,070	0,674	-0,064	0,040
							0,071	0,263

Source: Own calculations using data from *Inquéritos às Condições de Vida e Rendimento* (ICOR).

Note: Values for the Theil index. Calculations with n = 74795 and μ = 9925,58 done in STATA

$$I_1 = \sum_g \frac{n_g}{n}\frac{\mu_g}{\mu} I_{1g} + \sum_g \frac{n_g}{n}\frac{\mu_g}{\mu}\ln\left(\frac{\mu_g}{\mu}\right) = 0{,}263 + 0{,}071 = 0{,}334$$

Decomposition of Change Over Time

Table 24 shows the changes in aggregate total inequality using the mean log deviation as the inequality measure. Between 2004 and 2019, the change in I_0 was -0,182, meaning that total inequality decreased. 66,98 pp of this change (composed by 52,26 pp plus 14,72 pp from table 24) is explained by the decrease in inequality within the subgroups, while the remaining 33,02 pp of the change (composed by 23,32 pp plus 9,70 pp from table 24) is explained by the decrease in inequality between the subgroups. In respect of the inequality within the subgroups, 78,03 pp of the change is explained by pure[12] changes in the within subgroup inequality, while 21,97 pp is explained by the changes in the population subgroup shares with higher within inequality. Regarding the inequality between the subgroups, 70,63 pp is explained by the reduction in the population share of those subgroups that have more extreme values of income, while 29,37 pp of this change can be explained by the relative changes in the mean income of each subgroup.

Table 24 – Change in aggregate inequality – mean log deviation

	----------Within component---------		----------Between component----------	
ΔI_0	$\sum_g \frac{\overline{n_g}}{n} \Delta I_{0g}$	$\sum_g \overline{I_{0g}} \Delta \frac{n_g}{n}$	$\sum_g \overline{\ln(\frac{\mu}{\mu_g})} \Delta \frac{n_g}{n}$	$\sum_g \frac{\overline{n_g}}{n} \Delta \ln(\frac{\mu}{\mu_g})$
-0,182	-0,095	-0,027	-0,042	-0,018
100%	52,26%	14,72%	23,32%	9,70%

Source: Own calculations using data from *Inquéritos às Condições de Vida e Rendimento* (ICOR).

Table 25 shows the changes in aggregate inequality using the Theil index as the inequality measure. From 2004 to 2019, I_1 decreased by 0,138. Following the same reasoning as the mean log deviation, the interpretation of the results is as it follows: 70,33 pp of this change (composed by 73,63 pp plus -3,30 pp from table 25) can be explained by the decrease in inequality within the subgroups, while the remaining 29,67 pp of the change (composed by -7,09 pp plus 36,77 pp from table 25) can be explained by the decreased in inequality between the subgroups. 104,69 pp of the change explained by the decrease in inequality within the subgroups is explained by pure changes in the within subgroup inequality, while -4,69 pp is due to the

[12] *Ceteris paribus* changes in inequality within each subgroup (Mookherjee and Shorrocks, 1992).

changes in the population subgroup shares with higher within inequality. Regarding the inequality between the subgroups, -23,91 pp is explained by the change in the population share of the subgroups that have more extreme values of income, while 123,91 pp can be explained by the relative changes in the mean income of each subgroup.

Table 25 – Change in aggregate inequality – Theil index

	----------Within component----------		----------Between component----------	
ΔI_1	$\sum_g (\overline{\frac{n_g \mu_g}{n\mu}})\, \Delta I_{1g}$	$\sum_g \overline{I_{1g}}\, \Delta(\frac{n_g \mu_g}{n\mu})$	$\sum_g \overline{\frac{\mu_g}{\mu} \ln(\frac{\mu_g}{\mu})} \Delta \frac{n_g}{n}$	$\sum_g \overline{\frac{n_g}{n}} \Delta\left(\frac{\mu_g}{\mu} \ln(\frac{\mu_g}{\mu})\right)$
-0,138	-0,102	0,005	0,010	-0,051
100%	73,63%	-3,30%	-7,09%	36,77%

Source: Own calculations using data from *Inquéritos às Condições de Vida e Rendimento* (ICOR).

Regarding the population subgroup that has an old-age pension as the main income source, in table 26 it is noticed that, in 2004, 9,50 pp of the spending with old-age pensions was received by the first quintile of the income distribution, 8,97 pp was received by the second quintile, 12,43 pp was received by the third quintile, 17,90 pp was received by the fourth quintile, while 51,19 pp was received by the top quintile.

In 2019, the spending percentage in each quintile suffered some changes: 8,28 pp of the spending with old-age pensions was received by the first quintile of the income distribution, 11,90 pp was received by the second quintile, 14,54 pp was received by the third quintile, 22,10 pp was received by the fourth quintile and 43,18 pp was received by the top quintile. Furthermore, for the specific case of the subgroup that has pensions as the main source of income, table 27 shows the results for the GE measures. In both years, the highest inequality is observed in the higher tale of the income distribution, although this inequality decreased between both years.

Table 26 – Quintiles for subgroup with pensions as primary income source

	Q1	Q2	Q3	Q4	Q5
2004					
Mean pension income of subgroup	2497,28	2919,52	3429,65	5617,17	16620,35
Shares of total old-age pensions	9,50%	8,97%	12,43%	17,90%	51,19%
2019					
Mean pension income of subgroup	3705,29	4954,88	6563,43	10004,43	20896,22
Shares of total old-age pensions	8,28%	11,90%	14,54%	22,10%	43,18%

Source: Own calculations using data from *Inquéritos às Condições de Vida e Rendimento* (ICOR).
Note: Mean pension income in euro currency, yearly data and net terms .

Table 27 - GE measures for subgroup with pensions as primary income source

Pensions	GE(-1)	GE(0)	GE(1)	GE(2)
2004	0,330	0,307	0,358	0,548
2019	0,241	0,214	0,232	0,307

Source: Own calculations using data from *Inquéritos às Condições de Vida e Rendimento* (ICOR).

5. Conclusion

In this thesis, the 2004, 2009 and 2019 ICOR (*Inquérito às Condições de Vida e Rendimento*) datasets were analyzed. These datasets have data on income and living conditions of the Portuguese households and allow for the analysis of the composition and distribution of the household income. First, it was possible to conclude that the inequality measures - Gini index, Atkinson and Generalised Entropy measures - on the Individual Distribution of Equivalent Income, present the same decreasing trend (with the exception of A(2), which had a small increase from 2009 to 2019).

Second, the inequality decomposition by income sources (where the first assumption is that each individual's income can be broken down into the sum of the different sources of income received), allowed to concluded that, in the first analysis - the one in net terms - the increase seen in pensions contribution to income inequality between 2004 and 2019 can be explained by

the increase in the weight of pensions in total income of the Portuguese families. Regarding the other income sources: between 2004 and 2019, the contribution to income inequality of capital and other transfers increased, while the contribution to income inequality of labor decreased. With the same analysis but done in gross terms it was possible to identify an increase in the tax burden between 2009 and 2019. The equalizing effect of income taxes and social security contributions increased - although this increase did not reach 1 pp. Between 2009 and 2019 the contribution to income inequality of pensions, capital and other transfers increased, while the labor contribution to income inequality decreased.

Directly answering the question "To what extent do pensions contribute to inequality in Portugal?", we can say that their contribution, if the pension system remains unaltered, will depend on the weight they have in total income. This means that considering the upward trend in the number of people with 65 years old and above in Portugal, we can expect an increase in the pensions contribution to income inequality in the years to come. It is important to mention that, although pensions contribute indeed to income inequality, this is not the income source that presents the largest intensity ratio. In 2004, labor was the income source that registered the largest intensity ratio – it was also the income source that registered the largest income source contribution to income inequality and the largest share in total income. In 2009, capital had the largest intensity ratio, even though it had the second smallest income source contribution to income inequality and the smallest share in total income. For 2009 and 2019, even though labor and pensions have higher contributions to income inequality than capital, the intensity ratio for capital was higher than the intensity ratios of these two income sources.

Third, the analysis of the total equivalent income in quintiles (seen in tables 17 and 18) allowed to conclude that, between 2004 and 2019, the total pension share in the first quintile increased by 16,07 pp. Nonetheless, in both years, other transfers have the higher share in the first quintile. As already mentioned in this thesis, even though there is a significant amount of poverty in Portugal, the problem is not worse in the pensionists' group but rather in the group that has others transfers as their source of income. At the other end of the income spectrum, in the fifth quintile, the total pension share increased between 2004 and 2019, but in both years, labor had the higher share in this quintile, although it had suffered a decrease.

Remembering that pensions are divided into non-contributory and contributory pensions, the contributory pensions, typical of a Bismarckian system, can be seen as an extension of labor

income. So, if pensions have a smaller intensity ratio of contribution to inequality than labor, this shows that there are already some redistributive components in the functioning of the pension system, although these components are not enough to invert the sign of the contribution to inequality of the labor income. If we were governed by a pure Bismarckian system, the contributions to income inequality of labor income and pensions income were expected to have a more similar intensity.

Fourth, and regarding the population subgroups - characterized in this thesis by their main source of income – between 2004 and 2019, although the share of the subgroup that had an old-age pension as the main income source increased, the inequality within that same subgroup decreased – this is true for both inequality measures used. Using the mean log deviation as the inequality measure, the decrease in total inequality between 2004 and 2019 was -0,182. The majority of this change, 67 pp of it, is explained by the decrease in inequality within the subgroups. 78,03 pp of this 67 pp is explained by pure changes in the within subgroup inequality, while 21,97 pp of that change is explained by the changes in the population subgroup shares with higher within inequality. Furthermore, 70,63 pp of the change explained by the decrease in inequality between the subgroups is explained by the reduction in the population share of those subgroups that have more extreme values of income, while 29,37 pp can be explained by the relative changes in the mean income of each subgroup. Using the Theil index as the inequality measure, the decrease in total inequality is smaller: -0,138. The majority of this decrease is also explained by the decrease in inequality within the subgroups. 104,69 pp of this decrease is explained by pure changes in the within subgroup inequality, while -4,69 pp is due to the changes in the population subgroup shares with higher within inequality. When it comes to the change that can be explained by the decrease in inequality between the subgroups: -23,91 pp is explained by the change in the population share of the subgroups that have more extreme values of income, while 123,91 pp can be explained by the relative changes in the mean income of each subgroup. Furthermore, for the specific case of the subgroup that has pensions as the main source of income, the results for the GE measures, showed that the highest inequality is observed in the higher tale of the income distribution, although this inequality decreased between 2004 and 2019.

On a final note, pensions contribute to inequality but to a lesser extent than that of the income from labor they replace, which is due not only to non-contributory pensions but also to partially redistributive pension formation rules.

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Appendix

Table A1 – Portugal's population 2005-2050 (in millions)

Portugal	2005	2015	2030	2050
Under 20 year-olds	2.2	2	1.6	-
20-64 year-olds	6.5	6.2	5.6	-
65 and older	1.8	2.2	-	3.2

Source: OECD. (2019). *Reviews of Pension Systems: Portugal.*

Table A2 – Number of pensions (old-age, disability and survivor) paid in 2000, 2010 and 2019 in Portugal

Pension	2000	2010	2019
Old-age	1.511.286	1.903.525	2.049.696
Disability	370.053	289.418	187.890
Survivor	598.926	703.131	717.169

Source: PORDATA. Last Accessed: 31-10-2020

Table A3 – Atkinson Indices for $\varepsilon = 0.5, 1 \; and \; 2$

ε	y_{EDE}	A(ε)
0,5	$(\frac{1}{N}\sum_i \; y_i^{0,5})^2$	$A(0,5)=1-\frac{\left(\frac{1}{N}\sum_i \; y_i^{0,5}\right)^2}{\mu} \Leftrightarrow A(0,5)=1-\frac{(Mean\ Square\ Roots)^2}{Arithmetic\ Mean}$
1	$\prod_i y_i^{\left(\frac{1}{n}\right)}$	$A(1)=1-\frac{\left(\frac{1}{N}\sum_i \; y_i^{0,5}\right)^2}{\mu} \Leftrightarrow A(1)=1-\frac{Geometric\ Mean}{Arithmetic\ Mean}$
2	$(\frac{1}{N}\sum_i \; y_i^{-1})^{-1}$	$A(2)=1-\frac{\left(\frac{1}{N}\sum_i \; y_i^{-1}\right)^{-1}}{\mu} \Leftrightarrow A(2)=1-\frac{Harmonic\ Mean}{Arithmetic\ Mean}$

Source: Costa, R., Pérez-Duarte, S., 2019, Statistics Paper Series - *Not All Inequality Measures Were Created Equal, The measurement of wealth inequality, its decompositions, and an application to European household wealth* - European Central Bank

Table A4 – Total number of pensions paid by SS and CGA

Year	Social Security	Caixa Geral de Aposentações	Total
2004	2.649.904	491.683	3.141.587
2009	2.859.269	564.064	3.423.333
2019	2.954.755	645.528	3.600.283

Source: PORDATA. Last Accessed: 28-03-2021

Table A5 - Public and private expenditures on old-age pensions in Portugal

	2000 Level (% of GDP)	2015 Level (% of GDP)
Public expenditure on old-age and survivors benefits	7,8	13,3
Private pensions-benefit expenditures	0,2	0,7

Source: OECD (2019), *Pensions at a Glance 2019: OECD and G20 Indicators*, OECD Publishing Paris, https://doi.org/10.1787/b6d3dcfc-en p.199 - 201

Table A6 - Results for the covariance of each income component (in net terms) with total income

	Covariance with total income 2004	Covariance with total income 2009	Covariance with total income 2019
property income	890714,00	1100000,00	3400000,00
capital income	289867,00	1500000,00	1700000,00
monetary income from work for others	53000000,00	53000000,00	47000000,00
non-monetary income from work for others	823211,00	1500000,00	1300000,00
monetary income from self-employment	11000000,00	32000000,00	23000000,00
monetary income from private pension plans	191205,00	474809,00	308166,00
old-age monetary social benefits	8000000,00	8400000,00	13000000,00
other benefits to social exclusion support	-53810,20	-166276,00	-240738,00
social benefits in the context of housing	50679,60	13047,30	-4015,56
monetary social benefits for unemployment	219249,00	18304,70	807780,00
child/family protection benefits	73970,70	-99178,70	-40094,60
monetary social survivors' benefits due to death of the spouse	425521,00	256556,00	539829,00
monetary social benefits due to illness or accident	60929,60	23439,30	127919,00
monetary social benefits due for disability protection	54817,70	-67004,50	24124,80
monetary social benefits related to education	-6431,53	-59917,30	-71032,30
income obtained by children under 16 years old	4340,06	2890,42	11531,30

Source: Own calculations using data from *Inquéritos às Condições de Vida e Rendimento* (ICOR).

Table A7 - Results for the covariance of each income component (in gross terms) with total income

	Covariance with total income 2009	Covariance with total income 2019
property income	1200000,0000	4200000,0000
capital income	1900000,0000	2200000,0000
monetary income from work for others	99000000,0000	99000000,0000
non-monetary income from work for others	1800000,0000	1500000,0000
monetary income from self-employment	44000000,0000	39000000,0000
monetary income from private pension plans	713943,0000	392296,0000
old-age monetary social benefits	11000000,0000	19000000,0000
other benefits to social exclusion support	-144868	-209356
social benefits in the context of housing	17045,1000	-3455,6100
monetary social benefits for unemployment	-15348,2000	744576,0000
child/family protection benefits	-46665,3000	25558,7000
monetary social survivors' benefits due to death of the spouse	296228,0000	744933,0000
monetary social benefits due to illness or accident	13645,8000	91889,3000
monetary social benefits due for disability protection	-72322,0000	151821,0000
monetary social benefits related to education	-77182,3000	-85230,6000
income obtained by children under 16 years old	3151,4600	13446,8
income taxes and social security contributions	-22000000,0000	-24000000,0000

Source: Own calculations using data from *Inquéritos às Condições de Vida e Rendimento* (ICOR).

Glossary

Property income

Definition: "Income received, during the income reference period, from renting a property (for example renting a dwelling - not included in the profit/loss of unincorporated enterprises-, receipts from boarders or lodgers, or rent from land) after deducting costs such as mortgage interest repayments, minor repairs, maintenance, insurance and other charges. The net income series corresponds to the gross income components but the tax at source or the social insurance contributions or both are deducted." (European Commission, 2020)

Capital income

Definition: "Interest (not included in the profit/loss of an unincorporated enterprise), dividends, profits from capital investment in an unincorporated business refer to the amount of interest from assets such as bank accounts, certificates of deposit, bonds, etc, dividends and profits from capital investment in an unincorporated business, in which the person does not work, received during the income reference period (less expenses incurred)." (European Commission, 2020)

Monetary income from work for others

Definition: "Monetary component of the compensation of employees in cash payable by an employer to an employee. It includes the value of any social contributions and income taxes payable by an employee or by the employer on behalf of the employee to social insurance schemes or tax authorities. The net income component corresponds to the gross income component but the tax at source, the social insurance contributions, or both, are deducted." (European Commission, 2020)

Non-monetary income from work for others

Definition: "Non-monetary income components which may be provided free or at reduced price to an employee as part of the employment package by an employer. The net income component corresponds to the gross income components but the tax at source, the social insurance contributions, or both, are deducted." (European Commission, 2020).

Monetary income from self-employment

Definition: "Income received, during the income reference period, by individuals, for themselves or in respect of their family members, as a result of their current or former involvement in self-employed work. Self- employed work covers those jobs where the remuneration is directly dependent upon the profits (or the potential for profits) derived from the goods and services produced (where own consumption is considered to be part of profits). The self-employed make the operational decisions affecting the enterprise, or delegate such decisions while retaining responsibility for the welfare of the enterprise. (In this context 'enterprise' includes one-person operations). The remuneration of hobbies shall be regarded as self-employment." (European Commission, 2020)

Monetary income from private pension plans

Definition: "Regular pensions from private plans refer to pensions and annuities received, during the income reference period, in the form of interest or dividend income from individual private insurance plans, i.e. fully organized schemes where contributions are at the discretion of the contributor independently of their employers or government. The net income component corresponds to the gross income components but the tax at source, the social insurance contributions or both (if applicable) are deducted." (European Commission, 2020)

Old-age monetary social benefits

Definition: "Refers to the provision of social protection against the risk linked to old age, loss of income, inadequate income, lack of independence in carrying out daily tasks, reduced participation in social life, and so on. Old age benefits cover benefits that provide a replacement income when the person retires from the labor market or which guarantee a certain income when a person has reached a prescribed age." (European Commission, 2020)

Income taxes and social security contributions

Definition: Tax on income refers to "taxes on income, profits and capital gains. They are assessed on the actual or presumed income of individuals, households or the tax-unit. They include taxes assessed on holdings of property, land or real estate when these holdings are used as a basis for estimating the income of their owners. Taxes related to pensions received from individual private plans should also be taken into account." **Social insurance contributions** refer to "contributions by employees', the self-employed and if applicable, the unemployed,

retired paid during the income reference period to either mandatory government or employer-based social insurance schemes (pension, health, etc.).” (European Commission, 2020)

Income obtained by children under 16

Definition: “Gross income received by all household members aged under 16 during the income reference period.” (European Commission, 2020)

Child/family protection benefits

Definition: “Benefits that: Provide financial support to households for bringing up children. Provide financial assistance to people who support relatives other than children”. (European Commission, 2020)

Others benefits to social exclusion support

Definition: “Social benefits in the function ‘social exclusion not elsewhere classified’ refer to the ‘socially excluded’ or to ‘those at risk of social exclusion’. General as this is, target groups may be identified (among others) as destitute people, migrants, refugees, drug addicts, alcoholics, victims of criminal violence.” (European Commission, 2020)

Social benefits in the context of housing

Definition: “Interventions by public authorities to help households meet the cost of housing. An essential criterion for defining the scope of a Housing allowance is the existence of a qualifying means-test for the benefit.” (European Commission, 2020)

Monetary social benefits related to education

Definition: “Grants, scholarships and other assistance for education that is received by students.” (European Commission, 2020)

Monetary social benefits for unemployment

Definition: “Benefits that: replace, in whole or in part, income lost by a worker due to the loss of gainful employment; Provide a subsistence (or better) income to persons entering or re-entering the labor market; Compensate for the loss of earnings due to partial unemployment; Replace, in whole or in part, income lost by an older worker who retires from gainful employment before the legal retirement age because of job cuts made by their employer for economic reasons; Contribute to the cost of training or re-training people looking for

employment; or Help unemployed persons meet the cost of travelling or relocating to obtain employment. The net income component corresponds to the gross income components but the tax at source, the social insurance contributions, or both, (if applicable) are deducted." (European Commission, 2020)

Monetary social survivors' benefits due to the death of the spouse

Definition: "Benefits that provide a temporary or permanent income to people below the retirement age who have suffered from the loss of their spouse, partner or next-of-kin, usually when the latter represented the main breadwinner for the beneficiary. Survivors eligible for benefit may be the spouse or ex-spouse of the deceased person, his or her children, grandchildren, parents or other relatives. In some cases, the benefit may also be paid to someone outside the family." (European Commission, 2020)

Monetary social benefits due to illness or accident

Definition*:* "Cash benefits that replace, in whole or in part, the loss of earnings during a temporary inability to work due to sickness or injury." (European Commission, 2020)

Monetary social benefits for disability protection

Definition*:* "Benefits that provide an income to persons below the standard retirement age whose ability to work and earn is impaired beyond a minimum level laid down by legislation by a physical or mental disability." (European Commission, 2020)