Chaire de recherche Industrielle Alliance
sur les enjeux économiques
des changements démographiques
CEDIA.ca

18-07

Poverty Among the Elderly: The Role of Public Pension Systems

CAHIER DE RECHERCHE
WORKING PAPER

Philippe Jacques, Marie-Louise Leroux and Dalibor Stevanovic

Juin / June 2018

UNIVERSITÉ LAVAL
Faculté des sciences sociales
HEC MONTRÉAL
ESG UQÀM

La Chaire de recherche Industrielle Alliance sur les enjeux économiques
des changements démographiques est une chaire multi-institutionnelle
qui s'appuie sur un partenariat avec les organisations suivantes :

- Centre interuniversitaire de recherche en analyse des organisations (CIRANO)
- iA Groupe financier
- Retraite Québec

Les opinions et analyses contenues dans les cahiers de recherche de la Chaire
ne peuvent en aucun cas être attribuées aux partenaires ni à la Chaire elle-même
et elles n'engagent que leurs auteurs.

Opinions and analyses contained in the Chair's working papers cannot be attributed
to the Chair or its partners and are the sole responsibility of the authors.

© 2018 Philippe Jacques, Marie-Louise Leroux and Dalibor Stevanovic. Tous droits réservés. All rights reserved.
Reproduction partielle permise avec citation du document source, incluant la notice ©. Short sections may be
quoted without explicit permission, if full credit, including © notice, is given to the source.

Dépôt légal : Bibliothèque et Archives nationales du Québec et Bibliothèque et Archives Canada, 2018.
ISSN 2368-7207

Poverty Among the Elderly: The Role of Public Pension Systems*

Philippe Jacques† Marie-Louise Leroux‡ Dalibor Stevanovic§

June 19, 2018

Abstract

The objective of this paper is to measure the impact of first-pillar public pensions spending on the prevalence of poverty among the elderly. Using data from 27 European countries from 1995 to 2014, we estimate the elasticity of the poverty rate among individuals aged over 65 years to per capita public pension spending. We show the existence of a nonlinear relationship between these two variables. The elasticity is negative and statistically different from 0 only beyond a level of spending of 685 € per capita. At the average value of 2,819€, it is estimated that the elasticity is about -1.45. This nonlinear relation is robust to the treatment of possible endogeneity and to different robustness checks like the variation of the poverty line, and the inclusion of country-specific differences in public pension plans.

Keywords: Ageing, Poverty, Income Inequalities, Public Pension Systems, Panel Data.

JEL Codes: H55, I32, I38.

*We thank Raquel Fonseca, Pierre Pestieau as well as participants of the 2017 CRDCN conference in Montreal and participants to the Economic Department internal seminar at UQAM, for their comments and suggestions.

†Analysis Group, Montréal.

‡leroux.marie-louise@uqam.ca, Département des Sciences Economiques, ESG-UQAM (Montréal, Canada), CORE (Louvain-la-Neuve, Belgium) and CESifo (Munich, Germany).

§stevanovic.dalibor@uqam.ca, Département des Sciences Economiques, ESG-UQAM, CIRANO

1 Introduction

Research on public pension schemes is a major area of interest in economics, but also an important issue for public policy makers. In 2013, public expenditure on old age and survivor benefits in the OECD represented on average 8.2% of GDP (OECD, 2017). For the same year, public pension expenditure in the European Union represented 11.3% of GDP (European Commission, 2015). The structure of public pension systems (mostly Pay-As-You-Go), coupled with the decline in fertility and population ageing, is placing significant financial pressure on these programs. Indeed, the dependency ratio (defined as the ratio of persons aged over 64 years to the working-age population) in OECD countries reached 27.7 in 2015 and is expected to almost double (53.2) by 2050, with the undesirable consequence of increasing the number of recipients for always fewer contributors (OECD, 2017). As a result, several Pay-As-You-Go pension plans are now in a precarious financial situation, thus jeopardizing their viability. In response, several countries have undertaken structural reforms (such as increasing retirement age, decreasing replacement rates, privatizing pension systems) with the potential to alter income distribution and to increase the poverty rate among the elderly (OECD, 2017; Orenstein, 2011).

While important literature (see below) exists on the link between overall public spending and poverty reduction, few papers specifically focus on the interaction between public pension spending and the prevalence of poverty among the elderly. The aim of this paper is to remedy this problem using aggregated data and, to study how public pension spending and the structure of pension systems influence the poverty rate among the elderly. Indeed, at the origin of most pension systems was the willingness of governments to insure people against the risk of living long without the possibility to keep on working until the end of their life. No such consideration as intra-generational redistribution was a primary reason to implement public pension systems. However, with the development of these schemes, both inter- and intra-generational redistribution became a rising concern for most governments and thus, indirectly, how pensions could affect poverty among the elderly.

To answer our research question, we consider the first pillar of pension systems and we focus on *direct* public pension spending only. For instance, for the 15 OECD countries, the net replacement rate including only public schemes (i.e. the ratio of public pensions over income before retirement) for an average earner is 73%, implying that public pension schemes contribute for a large part to the income of the old (OECD, 2017).[1] On the other hand, the poverty rate is defined as the fraction of agents over age 65 having a disposable income

[1]The 15 OECD countries are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom.

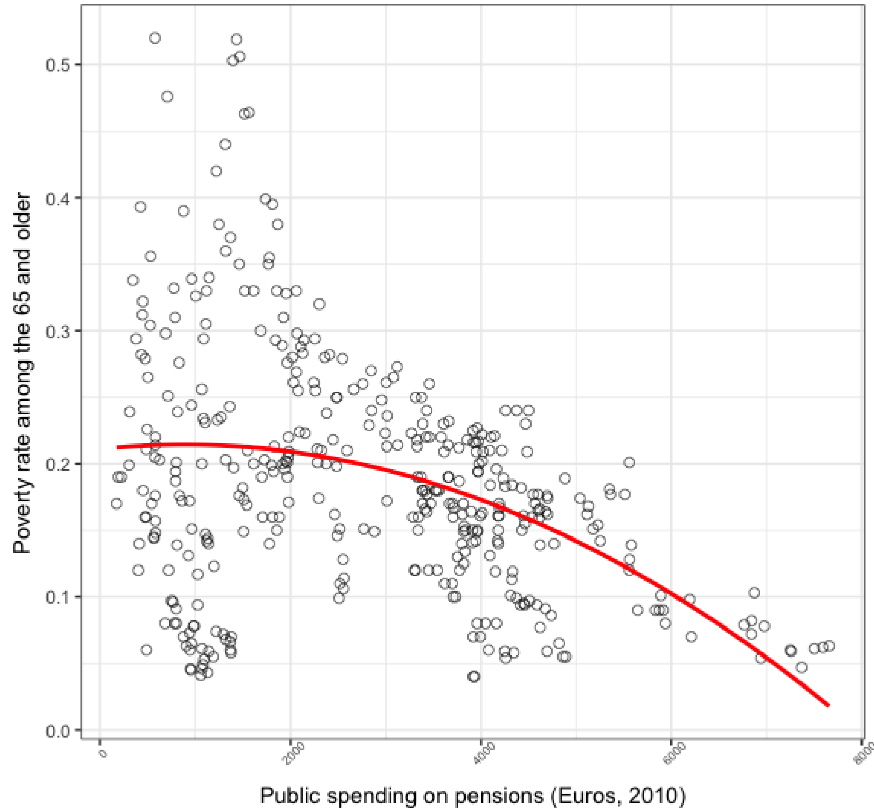


Figure 1: Public pensions spending and poverty rates among the elderly.

lower than 60% of the median national income. To study the relationship between these two variables, we use annual data collected from 27 countries in the European Union (see Table 7 in Appendix A). Figure 1 relates public pensions spending to the poverty rate of individuals aged 65 and over. Each point represents a country of the European Union in each year over the period 1995 to 2014.[2] The figure shows a non-linear and negative relationship between per capita pension expenditure and the poverty rate among the elderly. The objective of our paper is to investigate further this relationship.

To do so, we first regress the poverty rate over public pension spending and its square. We include control variables such as per capita GDP, the dependency and the unemployment ratios, the ratio of total government spending to GDP, the ratio of debt to GDP as well as the Gini coefficient. These controls account for country-specific socio-economic characteristics. We find that the relationship between public pension spending and poverty rates

[2]The red curve is the result of a linear regression with expenditures and squared expenditures as explanatory variables. The source and an exhaustive description of the variables are provided in Table 8 of Appendix B. On the top left of the graph are clustered countries such as Cyprus, Ireland and Latvia and at the bottom right, are Luxembourg and Denmark.

is significant and robust to different specifications. We then compute the elasticity of the poverty rate among individuals over 65 years to per capita public spending on pensions. The non-linear relationship between the two variables is confirmed and the elasticity is negative and statistically different from 0 only beyond a ratio of spending of 685€ per capita. At the EU-27 average value of 2,819€ of public pension spending, it is estimated that the elasticity is about -1.45. We verify that this relationship between the poverty rate and pension expenditure is not driven by some countries, by performing the leave-one-out method and also by estimating the model excluding some groups of countries. Our conclusions are preserved.

In order to verify the robustness to possible trend in time series, we estimate the baseline regression using data in first difference. Results are comparable. We then check for the presence of endogeneity, possibly due to simultaneity between poverty rate and pension expenditure. The estimates still do not greatly differ from those obtained in the baseline regression. The sensitivity analysis of our baseline results continues by using a more restrictive definition of the poverty threshold. Instead of considering 60% of median income as the poverty line, we use 50% and 40% as well as the average income instead of the median. In any case, the non-linear relation between the poverty rate and public pension spending is preserved but the elasticity of poverty is more strongly negative. We also account for potential differences in the structure of pension systems by first introducing a variable representing the fraction of public pension expenditure which are means-tested. Surprisingly, we obtain that this variable is not significant unless we use a very restrictive definition of the poverty rate (40% of median income being the poverty line) and our results do not change with respect to the baseline estimation. Hence, structural differences between pension plans do not appear to affect greatly their redistributive potential. Second, we separate countries depending on whether they have mandatory occupational plans or not. We find that the group of countries with occupational plans has a much higher elasticity of poverty to per capita public pension spending than the group without.

To our knowledge, no research paper has explicitly attempted to assess the aggregate impact of public pension spending on the prevalence of poverty among the elderly. As a matter of fact, most papers conduct country-specific analysis and use microdata to investigate the impact of different types of pension plans on poverty, individual savings or the decision to work or retire early. For instance, Milligan (2008) use micro data from Statistics Canada to compute poverty indexes for the elderly, draw their evolution over time and compare it with other age-groups. Similarly, Engelhardt and Gruber (2004) use US micro data to establish the causal relationship between Social Security benefits and poverty at the old age over the period 1968-2001. They find that the elasticity of poverty to benefits is around one so that Social Security generosity is associated with important changes in poverty of the elderly.

Yet, it did not have much impact on income inequality among the elderly. More recently, Fonseca et al. (2014) use the Survey of Health, Ageing and Retirement in Europe (SHARE) data to estimate the determinants of subjective well-being (poverty and depression) among older Europeans and find weak evidence that retirement is protective against poverty.

A second strand of the literature is interested in the link between public programs in general and poverty or income inequality in a given population or in population subgroups. For instance, Smeeding (2006) provides different measures of the poverty rates for countries included in the Luxembourg Income Study (LIS) between 1986 and 2000 and describes how these were affected by government spending. Poverty rates are obtained considering the whole population or only sub-groups. Using transnational data, Smeeding and Williamson (2001) also show, by studying the income composition of the elderly, that well-targeted public spending is associated with less poverty and less income inequality among the elderly. Although both studies highlight the government's important role in preventing poverty (like us), it is highly comparative and it is not able either to provide information on the macroeconomic determinants of poverty among the elderly. Lefebvre and Pestieau (2006) focus on links between several measurements of pension systems generosity and poverty alleviation among the elderly. While providing different measures of pension systems generosity is certainly relevant, the study only provides correlations between the different definitions of generosity and, between poverty and generosity of pension systems and again, it does not include any control variable so as to account for structural differences between countries.

In another study, van Vliet et al. (2012) explore the impact of the privatization of public pension schemes on the poverty rate and income inequality among people over 65 years. The basic premise is that public pension schemes tend to be more redistributive than private pension plans, so that a wave of privatization should increase poverty and income inequality among the elderly. Using data from the OECD and Eurostat for some 15 countries over the period 1995 to 2007, they find no robust macroeconomic relationship between the share of spending on private pensions and elderly poverty rates as well as no significant relationship between income inequality among those over 65 and the ratio of total pension expenditure over GDP. Again, only few control variables such as countries and years fixed effects, per capita GDP and the dependency ratio are included. However, given that the poverty rate is measured with respect to the median income in the economy, it is crucial to include additional factors such as government debt, employment and total government spending, since they capture a country's economic maturity and have the potential to impact income distribution and thus median income (see Barro, 2000). One exception in that literature is Caminada et al. (2012) which introduces demographics and macroeconomic controls but, contrary to us, the paper focuses on total social expenditure and poverty at the population

level.

Using aggregate data from 27 European countries from 1995 to 2014, this article thus attempts to remedy some of the issues raised above by quantifying the impact of public pensions spending on the prevalence of poverty among the elderly, while taking into account multiple country-specific demographic and economic factors that could affect the relationship between these two variables.

The paper is structured as follows. Section 2 presents the data and the empirical model. Section 3 presents some descriptive statistics as well as the results. Section 4 displays the results from the robustness checks we performed. The last section concludes.

2 Methodology

2.1 Data

The EU Statistics website (`http://ec.europa.eu/eurostat`) provides a unique database with standardized economic indicators from all member countries. The sample used in this project brings together a total of 27 countries and covers a period ranging from 5 to 19 years depending on the country, from 1995 to 2014.[3] The definition and the source of each variable used in our econometric models and commented below, are provided in Table 8 (Appendix B).

The poverty rate, our dependent variable, is computed as the fraction of individuals over age 65 living with a disposable income lower than 60 % of the median national disposable equivalent income.[4] In the following we define this threshold as the poverty line and denote it "PL median 60". Clearly, the definitions of poverty thresholds and thus of poverty rates vary with time and between countries, this is why we decided to adopt a relative measure rather than an absolute one.[5]

Also, we follow Eurostat which establishes that the threshold income at which a person is considered at risk of becoming poor is 60 % of median national income and, we set the poverty line in our baseline regression at 60 % of the median income. We also use the median income as it is a better measure of the central tendency of income distribution and

[3] Countries are listed in Table 7 in Appendix A.

[4] Equivalent disposable income is the total income of a household available to consume or save, after taxes and transfers, divided by the number of individuals in the household. Each individual is transformed into an adult equivalent.

[5] About the interest of considering relative poverty rates (i.e. a threshold defined in relation to the median or mean income of each country for a given year) rather than absolute ones, see Bourguignon (2003). This is quite standard in the litterature; see Cantillon (2011), Caminada et al. (2012), Caminada and Goudswaard (2012) and van Vliet et al. (2012) which also opt for a relative indicator to measure poverty.

it is less sensitive to non-symmetric distributions than the average.[6] Although not perfect, this indicator remains relevant for our research, as it allows to measure the impact of the generosity of pension schemes on the income of the elderly.[7] Yet, as robustness checks, in the last part of the paper, we also present results making the poverty line vary. The analyses will be produced by setting the poverty line at 60% of average income (PL mean 60), 50 % median and average income (PL median 50; PL mean 50) and then at 40 % median and average (PL median 40; PL mean 40).

In our study, the main explanatory variable is per capita public spending devoted to pensions (in constant-2010 Euros) and it accounts for the generosity of public pension schemes. This indicator is defined as any Old Age Security benefit, the corresponding financial flows of which are controlled by public administrations. This covers the following social benefits: invalidity pension, early retirement due to incapacity for work, retirement, early retirement, partial retirement pension, bereavement allowance (also known as survivor's benefits) and early retirement for reasons related to the labor market.[8] Note however that one caveat of this variable is that it does not reflect that in some countries (like for instance, Denmark and Netherlands), contributing to a private pension plan (occupational or not) is mandatory and that it may represent an important part of the income of retirees. Therefore, we consider here only *direct* public intervention. We come back on this point in the robustness section (Section 4.4) when we introduce a variable capturing structural differences between public pension systems.

Another important explanatory variable is what we call the "redistribution index". This variable is computed as the ratio of means-tested pension expenditure over total public pension expenditure. These expenditures therefore specifically target the least well-off individuals and thus, accounts for the different degrees of redistributivity of pension schemes across countries. This variable is defined between 0 and 1 so that a value close to 0 (resp. to 1) indicates that pension systems are not very (resp. highly) redistributive.[9]

We also include the following control variables in our analysis, to account for countries socio-economic specificities:

- the log of GDP per capita in constant-2010 Euros (gdp_capita);

[6]Using the mean to obtain a poverty rate tends to overestimate poverty since the mean is more sensitive to extreme values. Tables 9 and 10 in Appendix C show that the poverty rate is always lower when using the median.

[7]Marchand and Smeeding (2016) point out that this type of aggregate indicator is not able to account for all poverty dimensions, for instance, such as depth and duration of poverty.

[8]For a complete definition, see Eurostat (2014): `http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Expenditure_on_pensions`.

[9]For a complete definition of means-tested, see Eurostat (2014): `http://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Means-tested_benefits&oldid=324037`

- the dependency ratio (old_dep) defined as the ratio of individuals aged 65 and over, and the working-age population (i.e. aged 15-64);
- the unemployment ratio (unemp);
- the ratio of total government spending to GDP (gov_exp);
- the ratio of debt to GDP (debt_to_gdp);
- the Gini index (gini_net).

As noted in Caminada et al. (2012) and van Vliet (2010), including these variables enable to account for the economic and demographic changes which took place in Europe during the period, and which may have modified the distribution of income as well as the size of public pension services. Related to this point, one could also argue that the poverty rate (our dependent variable) may vary as the result of the variation of the median income across time and between countries. However, this issue is accounted for in our specifications since we include control variables which proxy the economic cycle as well as country fixed effects.

2.2 Method

In order to determine the relationship between the poverty rate and public pension spending, we use a fixed effect model so as to eliminate country-specific characteristics. Our first (baseline) specification models the prevalence of poverty among individuals over 65 years old as follows:

$$log(y_{i,t}) = \beta_0 + \beta_1 log(x_{i,t}) + \beta_2 log(x_{i,t})^2 + Z_{i,t}\delta + \lambda_i + u_{i,t} \tag{1}$$

where $y_{i,t}$ is the poverty rate and $x_{i,t}$ represents per capita public pensions expenditure for a given country i at time t. $Z_{i,t}$ is the vector of control variables described in the previous section. λ_i is a fixed effect per country and $u_{i,t}$ is the idiosyncratic error term. We also introduce in (1) a non-linear term to approximate the non-linear relationship (which we observed in Figure 1) between per capita spending and the poverty rate.
Given the non linear relation between $x_{i,t}$ et $y_{i,t}$, we cannot directly obtain the elasticity of the poverty rate to public pension expenditure from the coefficient β_1. Instead, the elasticity is obtained by deriving the RHS of equation (1) with respect to $log(x_{i,t})$, which gives

$$\varepsilon(x_{i,t}) \equiv \frac{\partial log(y_{i,t})}{\partial log(x_{i,t})} = \beta_1 + 2\beta_2 log(x_{i,t}). \tag{2}$$

Hence, the elasticity of poverty to public pension spending is not constant but depends on the level of public pensions expenditure, $x_{i,t}$.

Our second specification intends to capture the impact of different public pension schemes and in particular, to understand better the impact of the redistribution index on the poverty rate. To do so, we denote by $w_{i,t}$ the fraction of public pension expenditure which are means-tested, or equivalently the redistributive index, and we cross it with both $log(x_{i,t})$ and $log^2(x_{i,t})$. This way, we allow for some heterogeneity in the marginal effect of public pensions spending depending on the size of the redistributive index for each country at different time periods. Our second regression then takes the following form:

$$\begin{aligned} log(y_{i,t}) &= \beta_0 + \beta_1 log(x_{i,t}) + \beta_2 log(x_{i,t})^2 + \beta_3 w_{i,t} \\ &\quad + \beta_4 w_{i,t} \times log(x_{i,t}) + \beta_5 w_{i,t} \times log(x_{i,t})^2 + Z_{i,t}\delta + \lambda_i + u_{i,t}. \end{aligned} \tag{3}$$

From this, the elasticity of the poverty rate is now equal to

$$\varepsilon_2(x_{i,t}, w_{i,t}) \equiv \frac{\partial log(y_{i,t})}{\partial log(x_{i,t})} = \beta_1 + 2\beta_2 log(x_{i,t}) + \beta_4 w_{i,t} + 2\beta_5 w_{i,t} \times log(x_{i,t}) \tag{4}$$

so that it is now also a function of the redistribution index. The results regarding this regression will be presented as a robustness check in Section 4.4.

3 Empirical analysis

3.1 Descriptive statistics

Appendix C presents descriptive statistics of per capita public pension expenditure and of the poverty rates (using different definitions of the poverty line) as well as of the redistribution index and of the control variables used in our analysis. These data are computed as the average over the period of available data for each of these countries.

First, looking at Tables 9 and 10, there is an important heterogeneity between countries for the two main variables (i.e. poverty rate and per capita pension expenditure). At the top of the per capita pension expenditure distribution are Luxembourg, Denmark and Sweeden, while at the bottom, we find Bulgaria and Romania. In the same way, the poverty rates (PL median 60) are the highest for Cyprus and Bulgaria, and the lowest for Luxembourg and the Netherlands. Looking at this table, we can already infer a negative relationship between poverty among the elderly and pension spending. Indeed, a country like Luxembourg has relatively high average expenditure (6676€) and a relatively low average poverty rate

(0.08). Similarly, Bulgaria has relatively low average expenditure (408€) and a relatively high average poverty rate (0.29) over the observation period.

Second, as anticipated, the poverty rates using the median for the poverty line are always higher than using the mean. One example is the poverty rate for France that equals 0.14 over the period using the median, while the rate is 0.23 using the mean income. Hence, using mean income instead of median income to calculate the poverty line would yield that a significantly larger share of the population is considered as poor. In the same way, the poverty rates are always smaller when we decrease the poverty line at 50% and 40%, meaning that fewer people are considered poor but in turn, it identifies a share of the population that is all the poorer (i.e. the depth of poverty may be higher).

We also provide in Appendix D, the evolution of poverty rates (evaluated at 60% of median income) and per capita pension spending for each country over the period (see Figures 4 and 5). These graphs suggest that there is no common trend between poverty rates and per capita public pension spending. However, we come back on this point in Section 4 on the robustness checks and estimate the model on data in first difference.

Tables 11 and 12 in Appendix C provide the mean and median values of the main control variables of our model. We observe that the countries with the highest dependency rates are Italy and Sweden (0.29 ad 0.28 respectively), while those with the lowest ones are Ireland and Cyprus (0.17 and 0.18 respectively). The other variables in these tables give an idea of the macro-economic situation of these countries. Luxembourg and Sweden have the highest per capita GDP while Bulgaria and Romania have the lowest ones. Unemployment rates are the lowest in Luxembourg and Austria and the highest in Greece and Poland. Government spending over GDP are the highest in France and the lowest in Bulgaria and Estonia. Romania and Luxembourg have the lowest ratio of debt over GDP while Greece, Italy and Belgium have a ratio above unity. Finally, the Gini coefficient computed over the whole population is the highest for Portugal and the lowest for Slovakia and Sweden.

The last column of Table 11 displays the redistribution index for each country. It shows many zero-values, meaning that most countries do not have redistributive pension systems according to the (restrictive) definition we use.

3.2 Baseline results

The results for the estimation of equation (1) are presented in the following Table 1.[10] First, let us mention that we are aware of a possible endogeneity problem. Indeed, the relation between poverty and pension expenditure may besimultaneous, i.e. pension expenditure

[10]Note that our results are robust to using Purchasing Power Standard instead of constant-2010 Euros.

might react to variations in poverty rate over time. We will address this question in Section 4.2.

VARIABLES	(1) log_risk_pov	(2) log_risk_pov	(3) log_risk_pov	(4) log_risk_pov	(5) log_risk_pov
log_pension_exp	-0.46*	3.64***	2.90**	2.83***	3.21**
	(0.23)	(1.10)	(1.10)	(0.98)	(1.46)
log_pension_exp_sqr		-0.30***	-0.30***	-0.27***	-0.27**
		(0.08)	(0.08)	(0.07)	(0.11)
log_gdp_capita			1.64***	0.79	
			(0.30)	(0.52)	
old_dep			0.69	2.30**	3.84**
			(1.13)	(0.95)	(1.75)
gini_net			1.16	1.41	0.94
			(1.15)	(0.92)	(1.26)
unemp				-3.38***	
				(1.09)	
gov_exp				1.86	-0.28
				(1.10)	(0.85)
debt_to_gdp				-0.39*	-0.78***
				(0.19)	(0.18)
Observations	388	388	388	388	388
Number of country	27	27	27	27	27
Adjusted R-squared	0.08	0.18	0.40	0.51	0.41
Dich. year	NO	NO	NO	NO	YES
F-test	4.070	9.306	24.43	21.89	502.5

Note: Standard errors (in parentheses) are robust to autocorrelation and heteroskedasticity. They were estimated using the Arellano method (1987).*** p<0.01, ** p<0.05, * p<0.1

Table 1: Baseline regression results.

Looking at the first two columns, we observe that per capita public pension expenditure as well as its square are significant, showing a clear relationship between poverty among the elderly and public pension expenditure. Moreover, the introduction of the non-linear term in column 2 increases significantly the adjusted R^2, which indicates the presence of a non-linear relation between public pension spending and the poverty rate. In addition, this relationship remains stable and significant despite the inclusion of several control variables (see columns 3 and 4). Also, the results in column 4 indicate that the effects on the poverty rate of the dependency rate, the unemployment rate and the ratio of debt to GDP are significant, while this is not the case for the Gini index. In column 5, we include a yearly fixed effect. In the following, we comment those results in details.

First, the magnitude of coefficients β_1 and β_2 change but their signs are constant across the specifications, as well as their significance. Since pension expenditure appear both linearly and non linearly in the above regression, we cannot directly see whether the relation between poverty among the elderly and pension expenditure is positive or negative. We leave this for the next section when studying the elasticity of poverty to pension expenditure.

Second, in column 4, we find a positive effect of the dependency ratio on the old-age poverty. This may be related to the fact that if the dependency ratio is higher, the number

of elderly persons is higher, leading to higher poverty rates.

Third, we find a negative relation between poverty and unemployment and, between poverty and debt to GDP. These two variables are proxies for the economic cycle meaning that when they increase, the economic situation may be worsening. If that is the case, this also means that median income should decrease and recalling that the poverty rate is computed as the fraction of the elderly with less than 60% of median income, the poverty rate should mechanically decrease.[11] A similar explanation could be given for the positive relationship between per capita GDP and the poverty rate in column 3: as the economy grows, the median wage tends to increase, so that more individuals would fall below the poverty line. This would be all the more true if growth benefits workers more than retirees.

The last column in the above table presents the results when instead of putting as controls per capita GDP and unemployment, we choose to have yearly fixed effects. We find similar results than in regression 4 but the adjusted-R^2 is lower so that in the rest of the analysis we decided to go on with the output of regression 4.

In Appendix E (see Table 13), we run the same regressions as in Table 1 but assuming away country-fixed effects. As expected, in that latter case, some control variables like GDP per capita, the Gini coefficient and government expenditure become significant, but since the adjusted-R^2 is smaller, we decided to keep country-fixed effects for the rest of our analysis.

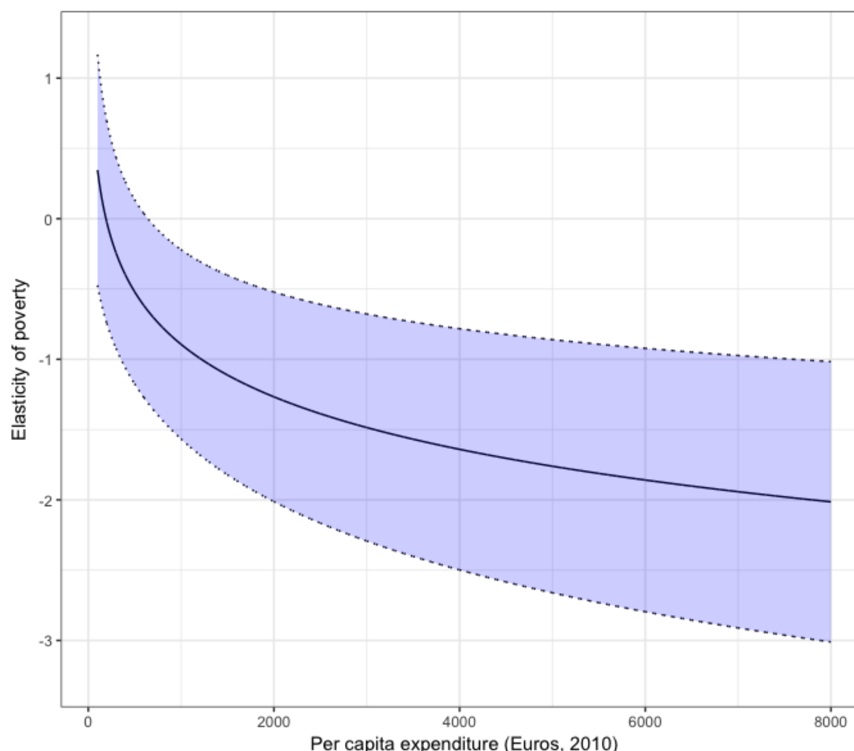
Finally, because new (and possibly poorer) countries entered the European Union during the period of 1995 to 2014, the number of observations increased over time. In order to verify that the regression results were robust to this phenomenon, the same regressions (available upon request) were performed using only the observations starting from the years 2000, 2001, 2002 and 2003. The results show that the relationship between poverty and pension expenditure is robust to that change in the sample size.

3.3 Elasticity of poverty among the elderly to pension spending

In order to obtain the elasticity of the poverty rate to public pensions spending defined by equation 2, we use the predicted values of β_1 and β_2 of specification (4) in Table 1 as this specification best represents the relationship between poverty among seniors and public pensions expenditure in terms of the adjusted R^2. Figure 2 plots the elasticity of the poverty rate and shows how it varies with per capita public pension spending.[12]

[11]Considering a relative measure for the poverty rate may be seen as drawback of our analysis for this specific reason. However, using absolute measures have other drawbacks such as making more difficult to compare countries with different economic situations.

[12]We vary per capita expenditure from 100€ to 8 000€ as the minimum par capita expenditure is 171.75€ and the maximum is 7 658.28€ in our sample.



Note : The shaded area represents a 95% confidence interval that was derived using the delta method.

Figure 2: Elasticity of old-age poverty rate to per capita public pension expenditure.

The elasticity of poverty among the elderly to per capita public pension spending is only significantly different from zero beyond a per capita spending ratio of about 685 €. This is a fairly low threshold, as the average of this variable for all countries and all years, is 2819.45€. This indicates that for low per capita pension expenditure, increasing expenditure by 1% will not have a significant impact on the poverty rate. Beyond 685€ per capita however, the more generous a country, the greater the impact of a 1% increase in expenditure on poverty reduction. Beyond a threshold of 1200€, the elasticity even becomes higher than 1 and, at the average per capita public pension spending of 2819.45€, it is equal to -1.45 (see Table 18 in Appendix H).[13] This indicates that at this value, a 1% change in spending on pensions would reduce the poverty rate by 1.45%. The elasticity seems to stabilize around 2 for very high per capita pension expenditure of 8000€.

A second interesting feature that emerges from this graph is the non linearity of the elasticity. This implies that increasing by 1€ per capita public pension spending increases (in absolute value) more the elasticity of the poverty rate when public spending are low than when these are higher. Equivalently, the marginal effect of that euro on the elasticity is higher

[13] 2819.45€ is computed as the average over the 1995-2014 period for each country, of per capita yearly public pension.

for low levels public pension expenditure than for higher ones. Therefore, concentrating ressources on those countries with lower per capita public spending expenditure has a higher marginal effect on poverty reduction than for countries with higher ones.[14] This is certainly something that the European policy makers should take into account.

It is also possible to look at each country individually. Table 2 below shows that most elasticities are above 1 and, that the countries with the largest per capita pension expenditures (Luxembourg and Denmark) are those with the most strongly negative elasticity. On the other hand, countries like Bulgaria, Romania and Lithuania, which have low levels of expenditure and high poverty rates also have the lowest elasticity in absolute value. It also shows that the elasticity of the poverty rate is negative and significantly different from zero for all the EU-27 countries. Thus, this result suggests that each country could reduce the poverty rate among seniors by adopting generous pension plans.

Finally, in Appendix F, we report additional calculations of the elasticity of poverty to public pension by removing successively countries (Table 14) or groups of countries (Table 15) in order to make sure that the average value for this elasticity (1.45) is not driven by outliers, i.e. by countries with low poverty and high public pension expenditure (like Luxembourg and Denmark) or by countries with high poverty rate and low pension expenditure (like Bulgaria and Romania). Our baseline result of 1.45 is robust to these alternative computations as we always find elasticities well above 1.

4 Robustness analysis

In the following, we first verify whether the common trends could have affected our results. In a second step, we address the possible endogeneity problem. Finally, we check whether our results are sensitive to a modification in the definition of the poverty line and whether different structures of pension systems between countries have an impact on the relationship between poverty and public pension spending.

4.1 Alternative specification in first differences

We estimate the same specifications as in the baseline regression model (Table 1) except that the variables are all expressed in first difference (i.e. growth rates). The objective of this estimation is to remove any stochastic trend that could affect the analysis. The results are presented in Table 3. There are no dramatic changes compared to our baseline results in

[14] In Appendix E, Figure 6 plots the elasticity of poverty assuming away country-fixed effects. We obtain the same pattern except that it becomes statistically significant around 400€ of per capita public pension expenditure and that it stabilises at lower (in absolute value) levels, around −1.70 at 8000€.

Country	PL median 60	Retirement spending per capita	Elasticity	95 % C.I.
AUT	0.14	5254	-1.79	(-2.70 ; -0.88)
BEL	0.16	4190	-1.67	(-2.53 ; -0.80)
BGR	0.23	492	-0.51	(-1.17 ; 0.14)
CRO	0.23	1101	-0.95	(-1.63 ; -0.27)
CYP	0.22	2093	-1.29	(-2.04 ; -0.54)
CZE	0.07	1377	-1.07	(-1.77 ;-0.37)
DEU	0.16	4014	-1.64	(-2.50 ; -0.78)
DNK	0.10	6194	-1.88	(-2.82 ; -0.93)
ESP	0.20	2485	-1.38	(-2.16 ; -0.61)
EST	0.33	1005	-0.90	(-1.57 ;-0.22)
FIN	0.16	4535	-1.71	(-2.59 ; -0.83)
FRA	0.09	4740	-1.73	(-2.62 ;-0.84)
GBR	0.18	3434	-1.56	(-2.39 ; -0.73)
GRC	0.15	2882	-1.46	(-2.26 ; -0.66)
HUN	0.04	956	-0.87	(-1.54 ; -0.20)
IRL	0.11	2563	-1.40	(-2.18 ;-0.62)
ITA	0.14	4175	-1.66	(-2.53 ; -0.80)
LTU	0.20	800	-0.77	(-1.43; -0.11)
LUX	0.06	7658	-1.99	(-2.98; -1.00)
LVA	0.28	830	-0.79	(-1.46 ; -0.13)
MLT	0.17	1542	-1.13	(-1.84; -0.41)
NLD	0.06	4251	-1.67	(-2.54 ;-0.8)
POL	0.12	1197	-0.99	(-1.68 ; -0.30)
PRT	0.15	2518	-1.39	(-2.17 ; -0.61)
ROU	0.16	582	-0.60	(-1.26 ; 0.05)
SVK	0.17	1980	-1.26	(-2.01 ; -0.52)
SWE	0.17	4602	-1.72	(-2.60 ; -0.83)

Note : C.I. means confidence interval. The elasticity is calculated based on the value of expenditures incurred for the public pension plan in the last year available for each country. The confidence intervals are calculated using the delta method.

Table 2: Country-specific elasticity of poverty rate to per capita pension spending in the last available year

terms of the relative magnitude of coefficients, except that the adjusted R^2 are much smaller, which is expected with data in first difference.

4.2 Endogeneity

One could expect that pension expenditures react to variations in the poverty rate, which yields the endogeneity problem in our benchmark equation 1. This is usually addressed with the instrumental variable approach. However, note that our problem is more complicated here as the variable prone to be endogenous, pension expenditures, enters in the equation also in a nonlinear way. If there is simultaneity between pension expenditure and the poverty

VARIABLES	(1) D.log_risk_pov	(2) D.log_risk_pov	(3) D.log_risk_pov	(4) D.log_risk_pov	(5) D.log_risk_pov
D.log_pension_exp	0.03	3.49*	3.12	5.52***	3.32
	(0.46)	(2.01)	(1.84)	(1.99)	(2.10)
D.log_pension_exp_sqr		-0.25*	-0.21*	-0.38***	-0.24*
		(0.13)	(0.12)	(0.12)	(0.13)
D.log_gdp_capita			0.99***	-0.95	
			(0.24)	(0.58)	
D.old_dep			-0.87	-1.17	1.12
			(2.89)	(2.75)	(3.24)
D.gini_net			3.15***	3.25***	2.78***
			(0.97)	(0.87)	(0.94)
D.unemp				-5.01***	
				(1.68)	
D.gov_exp				0.25	-0.16
				(0.85)	(0.69)
D.debt_to_gdp				-0.35	-0.48
				(0.24)	(0.37)
Observations	337	337	337	337	337
Number of countries	27	27	27	27	27
Adjusted R-squared	-0.00	0.00	0.07	0.15	0.13
Dich. year	NO	NO	NO	NO	YES
F-test	0.00355	2.450	10.39	9.750	7.559

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3: First Difference regressions

rate, and the model is linear in the former variable, the direction of the bias is known: public spending reacts positively to an increase in the poverty rate, hence we are likely to under-estimate the elasticity. When the square of the endogenous variable is also present, its nonlinear transformation is not necessary endogenous and the direction of the bias, if any, is not straightforward anymore.

To address this problem, we rely on Wooldridge (2002).[15] We treat pension expenditures and the square of pension expenditures as two endogenous variables. We apply the two stage least square (2SLS) method as follows. In the first step, we regress the first endogenous variable, i.e. per capita public spending, on the lagged values of: poverty rate, per capita public spending and controls (GDP per capita, dependency ratio, Gini index, unemployment rate, government's total spending ratio, and debt to GDP). Also in the first step, we regress the second endogenous variable, i.e. the square of per capita public spending, on the lagged values of: (poverty rate)^2, (per capita public spending)^2 and the same controls. In the second step, we use the predicted values obtained in the two previous regressions as the explanatory variables in the second stage least square estimation. We report the results of this regression in Table 4. The instruments are the one-year lagged values of the above variables.[16]

Although it is impossible to say that there is no endogeneity problem in the relationship, it does not change our results substantially as the above coefficients show. As anticipated,

[15]See in particular chapter 9, section 9.5.

[16]Table 16 in Appendix G reports results where instruments are the two-year lagged variables.

VARIABLES	(1) log_risk_pov	(2) log_risk_pov	(3) log_risk_pov	(4) log_risk_pov	(5) log_risk_pov
xlog_pension_exp_chap	-0.67**	2.87**	2.46**	2.19**	2.22*
	(0.26)	(1.06)	(1.06)	(0.94)	(1.12)
xlog_pension_exp_sqr_chap		-0.25***	-0.28***	-0.22***	-0.20**
		(0.08)	(0.07)	(0.07)	(0.09)
log_gdp_capita			1.67***	0.58	
			(0.31)	(0.41)	
old_dep			0.74	2.20*	3.36*
			(1.17)	(1.07)	(1.67)
gini_net			1.47	1.78*	1.43
			(1.25)	(1.01)	(1.19)
unemp				-3.22***	
				(1.03)	
gov_exp				1.66	-0.11
				(1.02)	(0.93)
debt_to_gdp				-0.46**	-0.85***
				(0.20)	(0.18)
Observations	337	337	337	337	337
Number of country	27	27	27	27	27
Adjusted R-squared	0.14	0.20	0.40	0.51	0.43
Dich. year	NO	NO	NO	NO	YES
F-test	6.846	8.543	18.03	13.50	84.49

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

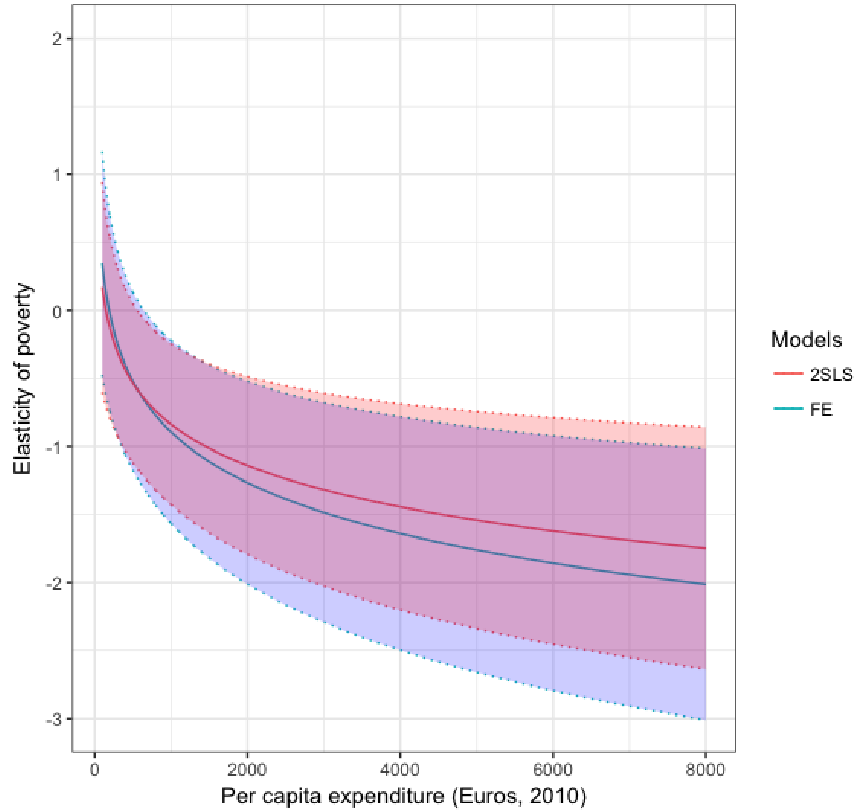
Table 4: Two-stage least square

if we compare only the first columns of Tables 1 and 4, the elasticity between poverty and public pensions is augmented. The value of the coefficient associated to public pensions in the above table is $-.68$ against $-.46$ in the baseline regression. Specification (4) yields an average elasticity value of -1.31 compared to -1.45 in the OLS case. Figure 3 below considers the new estimated elasticity obtained from specification (4). The elasticity seems to stabilize around -1.7 while it stabilized at -2 in the baseline regression. The elasticity is thus lower compared to what prevailed in the benchmark case.

4.3 Changing the definition of the poverty line

In Appendix H, Table 17 provides the results of regressions when instead of considering 60% of median income for the poverty line, we rather choose 50% or 40% of the median income. We also provide robustness checks when instead of using the median, we use mean income. As mentioned in Section 2.1, using the mean increases the number of agents who are considered as poor in comparison to the median. On the other hand, decreasing the poverty line by considering either 50% or 40% of median /mean income, restricts the number of people considered as poor but increases the severity of poverty.

Overall, the nonlinear relationship between poverty and public pension spending is preserved in most regressions (except for median 40 where both coefficients associated to per capita public pension expenditure are non significant). Table 18 also shows that the elas-



Note : The shaded area represents a 95% confidence interval that was derived using the delta method.

Figure 3: Elasticity of the poverty rate to per capita public pension expenditure.

ticity of poverty to pension expenditure evaluated at the mean level of per capita pension spending (2819€) increases when we restrict the threshold level from 60% to 50% and 40% and when we use the median instead of the mean.[17] As shown in Figure 7 (Appendix H), the non linear relationship is preserved. For low values of the expenditure ratio, the elasticity is zero and even positive. As spending increases, elasticity becomes negative, increases in absolute value, and then tends to stabilize. An interesting finding is that it seems that the lower the poverty threshold used, which thus includes fewer individuals but poorer ones, the greater the elasticity is. This suggests that the impact of pension expenditure on poverty is higher when we consider a smaller and poorer fraction of the population and thus confirms that public pension schemes are a particularly important lever for the poorest people.

[17]Recall that the relationship between poverty and per capita public pension spending is not significant for a poverty line set at 40% of median income.

4.4 Including country-specific characteristics of pension systems.

In this section, we study how structural differences in pension systems of European countries may impact the interaction between pension expenditure and old-age poverty.[18] A first way to do so is to include the redistribution index variable we constructed in our initial regression. Below, we thus estimate equation 3. In a second step, we test whether the obligation to contribute to an occupational plan (i.e. the second pillar of pension systems) could modify our results. In this last case, we remove country fixed effects.

Table 5 below adds the redistribution index (in bold) and presents the results of the regression of equation (3) for different definitions of the poverty line. Recall that this index is defined as the ratio of means-tested pension expenditure over total public pension expenditure. First, looking at column (1) of Table 5 and comparing it with the results of specification 4 in Table 1, we find no important changes. The same variables are still significant, the coefficients associated to these variables have the same sign and the nonlinear relationship between the two variables of interest is preserved. More importantly, the new terms are not significantly different from 0 so that the introduction of the expenditure ratio does not improve the explanatory power of our model. Effectively, the adjusted R^2 is similar (equal to 0.51) under specification (4) of both models.

	Dependent variable: log_risk_pov					
	Median 60	Median 50	Median 40	Mean 60	Mean 50	Mean 40
	(1)	(2)	(3)	(4)	(5)	(6)
log_pension_exp	2.85***	7.11***	6.44	3.93***	5.86***	8.06***
	(0.97)	(2.05)	(4.33)	(0.93)	(1.30)	(2.26)
log_pension_exp_sqr	−0.27***	−0.60***	−0.57*	−0.28***	−0.44***	−0.65***
	(0.08)	(0.15)	(0.33)	(0.06)	(0.09)	(0.17)
ratio_means	−16.73	57.26	−10.79	21.78	101.59	132.57*
	(67.62)	(77.23)	(84.84)	(47.38)	(61.83)	(64.80)
log_pension_exp_ratio	3.99	−20.33	−9.09	−6.26	−27.39*	−42.35**
	(17.56)	(19.41)	(20.33)	(12.15)	(15.77)	(15.96)
log_pension_exp_sqr_ratio	−0.24	1.59	1.21	0.43	1.81*	3.13***
	(1.13)	(1.22)	(1.23)	(0.77)	(1.00)	(0.99)
log_gdp_capita	0.77	0.94*	1.23*	−0.18	0.07	0.86*
	(0.56)	(0.48)	(0.67)	(0.22)	(0.35)	(0.45)
old_dep	2.50**	−0.10	−4.13	0.54	0.82	−3.26*
	(1.02)	(1.36)	(3.53)	(0.97)	(1.13)	(1.87)
gini_net	1.53	3.67**	4.25	5.25***	7.82***	8.94***
	(0.94)	(1.57)	(2.63)	(0.93)	(1.04)	(1.67)
unemp	−3.38***	−5.26***	−3.72**	−3.22***	−5.03***	−5.49***
	(1.13)	(1.29)	(1.73)	(0.53)	(0.96)	(1.19)
gov_exp	1.86	2.38**	2.95**	0.49	1.16	2.27**
	(1.11)	(1.11)	(1.41)	(0.43)	(0.91)	(1.02)
debt_to_gdp	−0.41*	0.07	0.04	−0.31**	−0.27	0.19
	(0.20)	(0.35)	(0.50)	(0.15)	(0.21)	(0.39)
Observations	388	349	349	355	355	355
Number of country	27	27	27	27	27	27
Adjusted R-squared	0.51	0.44	0.31	0.63	0.60	0.48
Dich. year	*NO*	*NO*	*NO*	*NO*	*NO*	*NO*
F-test	35.04	27.85	34.41	22.79	30.09	51.47

Note : The standard deviations (in parenthesis) are robust to autocorrelation and heteroskedasticity. They were estimated using the Arellano method (1987). The variables *ratio_means* and *ratio* represent the redistribution index.
*p<0.1; **p<0.05; ***p<0.01

Table 5: Regression results including the redistribution index

We also regressed equation (3) using alternative definitions for the poverty rate (i.e. by moving the poverty line). The results of these regressions are overall similar to those

[18] Note that, in some way, some of these differences are already taken into account when we include country fixed effects.

described earlier. The introduction of the redistribution index does not appear to explain better the relationship between public pensions spending and old age poverty. Only when we set the poverty line at 40% of the mean income (and to some extent at 50% of mean income) do we find that the introduction of the redistribution index has an impact on the poverty rate. The reason for this is that setting the poverty line at 40% of mean income tackles people in deeper poverty, while at the same time, means-tested expenditure are directly targeted toward these agents. Therefore, it is not surprising that the redistribution index as well as the cross effect of means-tested expenditure on pension expenditure are significant under this alternative (more restrictive) definition of the poverty rate.

A second way to account for different pension structures consists in separating countries between those with mandatory occupational and mandatory private components from those without these mandatory components, and to compute elasticities to the mean of per capita public spending. Indeed, in some countries (like for instance, in the Netherlands), the second pillar of pension systems accounts for a large part of the retirement income of individuals and is mandatory. Using the classification established by the EU for 2013 (European Commission, 2015), Table 6 reports the value of these elasticities between countries with a mandatory occupational pension plan and those without, as well as the value of the elasticities for countries with or without a mandatory private component.[19]

Category	Elasticity to the mean	95 % C.I.
occupational	-1.87	(-3.34 ; -0.40)
non-occupational	-1.02	(-1.63 ; -0.42)

Category	Elasticity to the mean	95 % C.I.
mandatory	-1.01	(-1.64 ; -0.38)
non-mandatory	-0.98	(-2.91 ; 0.95)

Table 6: Elasticity to the mean depending on whether: (i) countries have mandatory occupational pension plans; (ii) countries have mandatory private pension plans.

As shown from the above table, countries with occupational plans have a much higher elasticity of poverty to per capita public pension spending (equal to -1.87) than those without (equal to -1.02). To the opposite, there does not seem to be a sizeable difference between countries with or without private mandatory pension schemes. One of the reason may be

[19]Note that we could not obtain data over time so that we are not able to know whether some countries took reforms to promote or remove occupational pension plans and/or private pension plans. Hence, we do as if these structures had not changed across years. Countries with mandatory or quasi-mandatory occupational pension plans are Belgium, Denmark, Sweden, Estonia, Ireland, Cyprus, Malta, Netherland, Austria, Portugal. Countries with mandatory or quasi-mandatory private pension plans are Bulgaria, Estonia, Croatia, Latvia, Lithuania, Poland, Romania, Slovakia, Sweden. See European Commission, Ageing report (2015), pp. 58.

that, for most countries, private pension schemes usually account for a very small part of retirement income.

5 Conclusion

The objective of this article is to measure the impact of public pensions spending on the poverty rate of individuals over 65 years of age. More specifically, we estimate the elasticity of the old-age poverty rate to per capita public pensions spending. To be able to calculate this elasticity, we use a panel of 27 European countries over the period 1995 to 2014.

Three results of interest stem from this research. First, the regressions presented illustrate a *non-linear* relationship between public pension spending and the elasticity of poverty among the elderly. The elasticity is negative and statistically different from 0 only from a threshold of 685€ of per capita pension spending. As per capita pension spending increases, the elasticity becomes more strongly negative and stabilize around -2. At the average yearly value of public pension spending of 2819€, it is estimated that the elasticity is around -1.45. The nonlinear relationship is robust to the use of different specifications of our model and it is present even after controlling for the existence of a common trend and for possible endogeneity.

Second, the use of different definitions for the poverty rate shows that the elasticity of poverty is more strongly negative when using a lower poverty threshold. Thus, public spending on pension schemes would particularly help older individuals in deeper poverty.

Third, although economic theory suggests that structural differences between pension systems are likely to greatly affect their redistributive potential, we have not been able to find such evidence in our regressions and in the elasticities obtained when we introduced the redistribution index measuring the fraction of public pension spending which are means-tested. Only, do we find a difference in the size of elasticities between countries with or without mandatory occupational pension plans, suggesting that in countries with mandatory occupational plans, increasing public pension spending is a more important lever for reducing poverty. However, further research on the subject, together with better data capturing structural differences between pension systems, would be necessary in order to assert with certainty that the elasticity of poverty to per capita public pension spending is invariant to country-specific pension plans components.

Finally, at a time when most European countries are undergoing important structural pension reforms and when the European Union seeks to harmonize pension plans across countries, we believe that our study is important for policy makers as it sheds light on the importance of the first pillar of pension systems in reducing poverty rates among the elderly.

We show that the higher the amount of per capita pension spending, the higher the elasticity to poverty rates but on the other hand, when per capita pension spending are smaller, the marginal effect on the elasticity of poverty to pension expenditure is higher than when per capita pension spending are higher. In other words, the multiplier effect of public pension expenditure is higher. If one of the goals of the European Union is to make countries converge toward some pre-determined uniform poverty rate target, this is certainly something that should be taken into account.

Appendices

A Country list and abbreviations

Country	Classification Alpha-3
Italy	ITA
Ireland	IRL
Greece	GRC
Denmark	DNK
France	FRA
Czech Republic	CZE
Spain	ESP
Austria	AUT
Belgium	BEL
Portugal	PRT
Latvia	LVA
Hungary	HUN
Luxembourg	LUX
Germany	DEU
Lithuania	LTU
Netherlands	NLD
Slovakia	SVK
Romania	ROU
Bulgaria	BGR
Malta	MLT
Poland	POL
Cyprus	CYP
Estonia	EST
Croatia	CRO
Finland	FIN
Sweden	SWE
United Kingdom	GBR

Note: Classification iso-alpha, found on the Statistics Canada website.

Table 7: List of countries.

B Definition and source of variables

Name of variable	Variable label	Description	Source
Per capita pension expenditure	pen_exp	Sum of government pension payments per capita expenditure. (Euros constant from 2010)	Eurostat
Poverty rate (Median 60)	PL median 60	The poverty risk rate is defined as the share of people with an equivalent disposable income (after social transfer) below the poverty line of 60 per cent of disposable income national median after social transfers. Compiled for individuals 65 years and older.	Eurostat
Poverty rate (Median 50)	PL median 50	The poverty risk rate is defined as the share of people with an equivalent disposable income (after social transfer) below the poverty line, set at 50 per cent of median equivalent disposable income after social transfers. Compiled for individuals 65 years and older.	Eurostat
Poverty rate (Median 40)	PL median 40	The poverty risk rate is defined as the share of people with an equivalent disposable income (after social transfer) below the poverty line, set at 40 per cent of median equivalent disposable income after social transfers. Compiled for individuals 65 years and older.	Eurostat
Poverty rate (mean 60)	PL mean 60	The poverty risk rate is defined as the share of people with equivalent disposable income (after social transfer) below the poverty line of 60 per cent of the average disposable income after social transfers. Compiled for individuals 65 years and older.	Eurostat
Poverty rate (mean 50)	PL mean 50	The poverty risk rate is defined as the share of people with an equivalent disposable income (after social transfers) below the poverty line, set at 50 per cent of average disposable income after social transfers. Compiled for individuals 65 years and older.	Eurostat
Poverty rate (Medium 40)	PL mean 40	The poverty risk rate is defined as the share of people with an equivalent disposable income (after social transfer) below the poverty line of 40 per cent of average disposable income after social transfers. Compiled for individuals 65 years and older.	Eurostat
GDP per capita	gdp_capita	GDP per capita. (Euros constant from 2010)	Eurostat
Dependency rate	old_dep	Dependency rate. Ratio of population over 65 years of age to population aged 15-64	Eurostat
Unemployment rate	unemp	Average annual unemployment rate as a percentage of the labor force	Eurostat
Debt in relation to GDP	debt_to_gdp	Ratio of debt to GDP.	Eurostat
Gini index net	gini_net	Gini coefficient calculated on the net income of individuals	Eurostat
Total government expendi	gov_exp	Total government expenditure is expressed as a percentage of GDP. The main items of expenditure include the remuneration of civil servants, social benefits (social benefits and social transfers in kind for market output purchased by general government and non-profit institutions serving households), interest of public debt, subsidies and gross fixed capital formation	Eurostat
Redistribution index	ratio_means	Share of means-tested expenditure on total pension expenditure.	Calculations of the author

Table 8: Definition and source of variables.

C Descriptive statistics

	Years		Per capita pensions expenditure			Poverty rate (PL median 60)				Poverty rate (PL mean 60)			
Country	Minimum	Maximum	Mean	Median	Standard Deviation	N	Mean	Median	Standard Deviation	N	Mean	Median	Standard Deviation
AUT	1995	2014	4678	4620	408	19	0.18	0.17	0.03	19	0.24	0.23	0.03
BEL	1995	2014	3679	3614	273	19	0.22	0.22	0.02	19	0.32	0.32	0.04
BGR	2006	2014	408	433	69	9	0.29	0.28	0.06	9	0.42	0.42	0.07
CRO	2010	2014	1090	1087	15	5	0.26	0.26	0.03	5	0.34	0.34	0.03
CYP	2005	2014	1679	1650	240	10	0.39	0.43	0.12	10	0.54	0.55	0.06
CZE	2001	2014	1244	1296	141	11	0.06	0.06	0.01	10	0.15	0.15	0.02
DEU	1995	2014	3753	3820	212	17	0.14	0.14	0.02	16	0.20	0.21	0.03
DNK	2001	2014	5209	5363	599	13	0.17	0.18	0.04	12	0.25	0.25	0.02
ESP	1995	2011	2070	2043	240	16	0.22	0.22	0.06	15	0.32	0.32	0.04
EST	2000	2014	766	825	209	14	0.23	0.20	0.08	11	0.46	0.45	0.07
FIN	1996	2014	3815	3815	433	18	0.18	0.18	0.03	16	0.28	0.28	0.05
FRA	1995	2014	3987	3897	447	19	0.14	0.13	0.04	17	0.23	0.24	0.03
GBR	1995	2014	2947	2980	383	18	0.24	0.25	0.04	16	0.37	0.37	0.06
GRC	1998	2014	2570	2716	464	16	0.25	0.25	0.06	16	0.34	0.35	0.08
HUN	2000	2014	953	962	144	13	0.06	0.06	0.02	10	0.10	0.10	0.03
IRL	1998	2014	2004	2094	543	16	0.26	0.28	0.12	16	0.40	0.49	0.13
ITA	1995	2014	3925	3966	247	18	0.18	0.17	0.03	18	0.25	0.25	0.03
LTU	2000	2014	676	757	153	12	0.19	0.19	0.07	10	0.37	0.38	0.09
LUX	1995	2014	6676	6842	703	19	0.08	0.08	0.02	19	0.14	0.14	0.03
LVA	2000	2014	676	705	155	11	0.25	0.21	0.15	10	0.46	0.44	0.11
MLT	2000	2014	1379	1401	146	11	0.20	0.20	0.03	10	0.30	0.29	0.04
NLD	1995	2014	4315	4255	344	18	0.07	0.06	0.02	15	0.16	0.14	0.04
POL	2000	2013	1027	1026	123	11	0.11	0.12	0.03	9	0.21	0.22	0.04
PRT	1995	2014	1925	1998	423	18	0.27	0.27	0.08	18	0.43	0.46	0.07
ROU	2000	2014	447	565	173	11	0.19	0.18	0.05	8	0.28	0.25	0.08
SVK	2000	2014	1829	1830	145	13	0.20	0.20	0.01	10	0.24	0.24	0.01
SWE	2001	2014	4344	4425	289	13	0.15	0.16	0.03	11	0.21	0.22	0.04

Note : N indicates the number of years observed for a certain country. For the list of acronyms, see Appendix A, Table 7. The source and an exhaustive description of the variables are provided in Table 8 of Appendix B.

Table 9: Descriptive statistics (1).

	Poverty rate (PL median 50)				*Poverty rate (PL mean 50)*				*Poverty rate (PL median 40)*				*Poverty rate (PL mean 40)*			
Country	N	Mean	Median	Standard Deviation	N	Mean	Median	Standard Deviation	N	Mean	Median	Standard Deviation	N	Mean	Median	Standard Deviation
AUT	18	0.09	0.09	0.02	19	0.14	0.13	0.02	18	0.04	0.05	0.01	19	0.06	0.06	0.02
BEL	18	0.10	0.10	0.03	19	0.16	0.16	0.04	18	0.04	0.04	0.01	19	0.06	0.06	0.02
BGR	9	0.17	0.17	0.05	9	0.27	0.28	0.07	9	0.07	0.06	0.03	9	0.14	0.14	0.04
CRO	5	0.16	0.16	0.02	5	0.23	0.22	0.04	5	0.10	0.10	0.02	5	0.13	0.12	0.02
CYP	10	0.22	0.23	0.10	10	0.37	0.40	0.09	10	0.08	0.09	0.04	10	0.17	0.17	0.06
CZE	10	0.01	0.01	0.00	10	0.04	0.04	0.01	10	0.00	0.00	0.00	10	0.01	0.01	0.00
DEU	16	0.08	0.07	0.02	16	0.11	0.12	0.02	16	0.04	0.03	0.02	16	0.05	0.05	0.01
DNK	12	0.04	0.04	0.01	12	0.06	0.06	0.01	12	0.02	0.01	0.01	12	0.02	0.02	0.01
ESP	14	0.11	0.11	0.05	15	0.20	0.20	0.04	14	0.04	0.05	0.02	15	0.08	0.08	0.03
EST	11	0.08	0.07	0.04	11	0.25	0.24	0.08	11	0.02	0.02	0.01	11	0.06	0.06	0.02
FIN	16	0.05	0.06	0.01	16	0.11	0.11	0.03	16	0.01	0.01	0.00	16	0.02	0.02	0.01
FRA	17	0.07	0.07	0.03	17	0.12	0.12	0.03	17	0.03	0.03	0.02	17	0.05	0.04	0.02
GBR	16	0.13	0.13	0.02	16	0.22	0.22	0.04	16	0.05	0.05	0.01	16	0.10	0.10	0.02
GRC	15	0.15	0.15	0.07	16	0.24	0.24	0.07	15	0.08	0.07	0.05	16	0.13	0.13	0.07
HUN	12	0.03	0.02	0.01	10	0.04	0.03	0.02	12	0.01	0.01	0.01	10	0.01	0.01	0.01
IRL	15	0.10	0.08	0.04	16	0.22	0.26	0.10	15	0.04	0.04	0.02	16	0.07	0.07	0.02
ITA	17	0.09	0.10	0.02	18	0.15	0.14	0.03	17	0.04	0.04	0.01	18	0.06	0.06	0.01
LTU	10	0.08	0.08	0.04	10	0.21	0.21	0.07	10	0.03	0.03	0.01	10	0.07	0.07	0.03
LUX	18	0.03	0.03	0.01	19	0.06	0.06	0.02	18	0.01	0.01	0.01	19	0.02	0.02	0.01
LVA	10	0.14	0.09	0.12	10	0.29	0.26	0.14	10	0.05	0.04	0.05	10	0.14	0.08	0.11
MLT	10	0.10	0.10	0.02	10	0.15	0.14	0.03	10	0.05	0.05	0.02	10	0.07	0.07	0.02
NLD	15	0.03	0.03	0.01	15	0.05	0.04	0.02	15	0.02	0.02	0.01	15	0.02	0.02	0.01
POL	9	0.05	0.06	0.02	9	0.11	0.11	0.03	9	0.02	0.02	0.00	9	0.04	0.04	0.01
PRT	17	0.15	0.13	0.07	18	0.30	0.34	0.09	17	0.06	0.06	0.03	18	0.15	0.16	0.06
ROU	8	0.12	0.10	0.05	8	0.18	0.15	0.07	8	0.06	0.04	0.04	8	0.09	0.07	0.05
SVK	10	0.11	0.11	0.01	10	0.15	0.15	0.01	10	0.03	0.03	0.01	10	0.05	0.05	0.01
SWE	11	0.05	0.05	0.01	11	0.07	0.07	0.01	11	0.02	0.02	0.00	11	0.02	0.02	0.00

Note : N measures the number of years observed per country for each indicator. For the list of acronyms, see Appendix A, Table 7. The source and an exhaustive description of the variables are provided in Table 8 of Appendix B.

Table 10: Descriptive statistics (2).

	GDP per capita				*Dependency rate*				*Unemployment rate*				*Government spending on GDP*			
Country	N	Mean	Median	Standard Deviation	N	Mean	Median	Standard Deviation	N	Mean	Median	Standard Deviation	N	Mean	Median	Standard Deviation
AUT	19	33052	33600	2953	19	0.24	0.24	0.02	19	0.05	0.05	0.01	19	0.52	0.52	0.02
BEL	19	31489	32500	2534	19	0.26	0.26	0.01	19	0.08	0.08	0.01	19	0.52	0.51	0.03
BGR	9	5155	5200	300	9	0.27	0.26	0.01	9	0.10	0.10	0.03	9	0.37	0.37	0.03
CRO	5	10340	10300	151	5	0.27	0.27	0.00	5	0.15	0.16	0.02	5	0.48	0.48	0.01
CYP	10	22810	23200	1487	10	0.18	0.18	0.01	10	0.08	0.06	0.05	10	0.41	0.42	0.03
CZE	11	14563	15000	1155	11	0.22	0.21	0.02	11	0.07	0.07	0.01	11	0.42	0.42	0.01
DEU	17	30376	30800	2612	17	0.28	0.29	0.04	17	0.08	0.08	0.02	17	0.46	0.46	0.03
DNK	13	44261	44200	1217	13	0.24	0.24	0.02	13	0.06	0.06	0.02	13	0.54	0.54	0.03
ESP	16	21875	22650	2198	16	0.24	0.24	0.01	16	0.14	0.13	0.05	16	0.41	0.40	0.03
EST	14	11121	11500	1881	14	0.25	0.26	0.02	14	0.10	0.10	0.04	14	0.37	0.37	0.03
FIN	18	32627	34050	3608	18	0.24	0.24	0.03	18	0.09	0.09	0.02	18	0.52	0.52	0.04
FRA	19	29615	30300	1894	19	0.25	0.25	0.01	19	0.09	0.09	0.01	19	0.54	0.53	0.02
GBR	18	27916	29050	2596	18	0.25	0.24	0.01	18	0.06	0.06	0.01	18	0.41	0.41	0.04
GRC	16	19343	19200	2229	16	0.28	0.28	0.02	16	0.14	0.11	0.07	16	0.50	0.47	0.05
HUN	13	9661	9900	865	13	0.24	0.24	0.01	13	0.08	0.08	0.02	13	0.49	0.50	0.01
IRL	16	36162	36400	3593	16	0.17	0.17	0.01	16	0.08	0.06	0.04	16	0.39	0.35	0.09
ITA	18	26733	26650	1244	18	0.29	0.30	0.03	18	0.09	0.10	0.02	18	0.49	0.49	0.02
LTU	12	8941	9400	1903	12	0.25	0.25	0.02	12	0.12	0.13	0.05	12	0.38	0.37	0.04
LUX	19	71484	75800	9728	19	0.21	0.21	0.00	19	0.04	0.05	0.01	19	0.42	0.43	0.02
LVA	11	8990	9200	1454	11	0.26	0.26	0.02	11	0.12	0.12	0.04	11	0.38	0.37	0.03
MLT	11	15836	15900	1162	11	0.22	0.20	0.03	11	0.07	0.06	0.00	11	0.42	0.42	0.01
NLD	18	35627	36950	3218	18	0.22	0.21	0.02	18	0.05	0.05	0.02	18	0.45	0.45	0.03
POL	11	8590	8900	1346	11	0.19	0.19	0.01	11	0.12	0.10	0.04	11	0.44	0.44	0.01
PRT	18	16066	16350	1020	18	0.26	0.26	0.03	18	0.09	0.09	0.03	18	0.46	0.45	0.03
ROU	11	5790	6300	1200	11	0.22	0.24	0.02	11	0.07	0.07	0.01	11	0.38	0.38	0.02
SVK	13	16938	17500	1575	13	0.23	0.23	0.02	13	0.07	0.06	0.02	13	0.48	0.47	0.05
SWE	13	38469	39400	2098	13	0.28	0.27	0.01	13	0.07	0.08	0.01	13	0.52	0.52	0.01

Note : N measures the number of years observed per country for each indicator. For the list of acronyms, see Appendix A, Table 7. The source and an exhaustive description of the variables are provided in Table 8 of Appendix B.

Table 11: Descriptive statistics (3).

	Debt to GDP				*Gini net*				*Redistribution index*			
Country	N	Mean	Median	Standard Deviation	N	Mean	Median	Standard Deviation	N	Mean	Median	Standard Deviation
AUT	19	0.71	0.68	0.08	19	0.26	0.26	0.01	19	0.03	0.02	0.00
BEL	19	1.06	1.04	0.12	19	0.27	0.27	0.01	19	0.05	0.05	0.00
BGR	9	0.17	0.16	0.04	9	0.34	0.35	0.02	9	0.00	0.00	0.00
CRO	5	0.73	0.71	0.12	5	0.31	0.31	0.01	5	0.00	0.00	0.00
CYP	10	0.68	0.61	0.21	10	0.30	0.30	0.02	10	0.00	0.00	0.00
CZE	11	0.34	0.34	0.08	11	0.25	0.25	0.00	11	0.00	0.00	0.00
DEU	17	0.67	0.65	0.09	17	0.28	0.28	0.02	17	0.00	0.00	0.00
DNK	13	0.41	0.44	0.07	13	0.25	0.25	0.02	13	0.42	0.66	0.34
ESP	16	0.54	0.56	0.11	16	0.33	0.33	0.01	16	0.09	0.09	0.01
EST	14	0.06	0.05	0.02	14	0.34	0.33	0.02	14	0.00	0.00	0.00
FIN	18	0.45	0.43	0.08	18	0.25	0.26	0.02	18	0.04	0.02	0.08
FRA	19	0.70	0.64	0.13	19	0.29	0.29	0.01	19	0.06	0.06	0.00
GBR	18	0.54	0.44	0.20	18	0.32	0.32	0.01	18	0.08	0.08	0.01
GRC	16	1.25	1.07	0.31	16	0.34	0.34	0.01	16	0.03	0.04	0.01
HUN	13	0.69	0.72	0.11	13	0.27	0.26	0.03	13	0.00	0.00	0.00
IRL	16	0.59	0.44	0.36	16	0.31	0.31	0.01	16	0.19	0.19	0.02
ITA	18	1.12	1.12	0.10	18	0.32	0.32	0.01	18	0.03	0.03	0.00
LTU	12	0.28	0.26	0.10	12	0.34	0.35	0.02	12	0.00	0.00	0.00
LUX	19	0.12	0.08	0.06	19	0.28	0.28	0.01	19	0.00	0.00	0.01
LVA	11	0.28	0.37	0.16	11	0.36	0.36	0.01	11	0.00	0.00	0.00
MLT	11	0.66	0.68	0.03	11	0.28	0.27	0.01	11	0.05	0.05	0.00
NLD	18	0.59	0.59	0.09	18	0.27	0.27	0.01	18	0.01	0.00	0.00
POL	11	0.48	0.47	0.07	11	0.32	0.31	0.02	11	0.00	0.00	0.00
PRT	18	0.78	0.68	0.28	18	0.36	0.36	0.01	18	0.02	0.02	0.01
ROU	11	0.27	0.26	0.09	11	0.33	0.34	0.03	11	0.01	0.01	0.01
SVK	13	0.39	0.27	0.19	13	0.23	0.24	0.01	13	0.01	0.01	0.01
SWE	13	0.43	0.41	0.05	13	0.24	0.24	0.01	13	0.00	0.00	0.01

Note : N measures the number of years observed per country for each indicator. For the list of acronyms, see Appendix A, Table 7. The source and an exhaustive description of the variables are provided in Table 8 of Appendix B.

Table 12: Descriptive statistics (4).

D Common trend in public pension expenditure and in poverty rates.

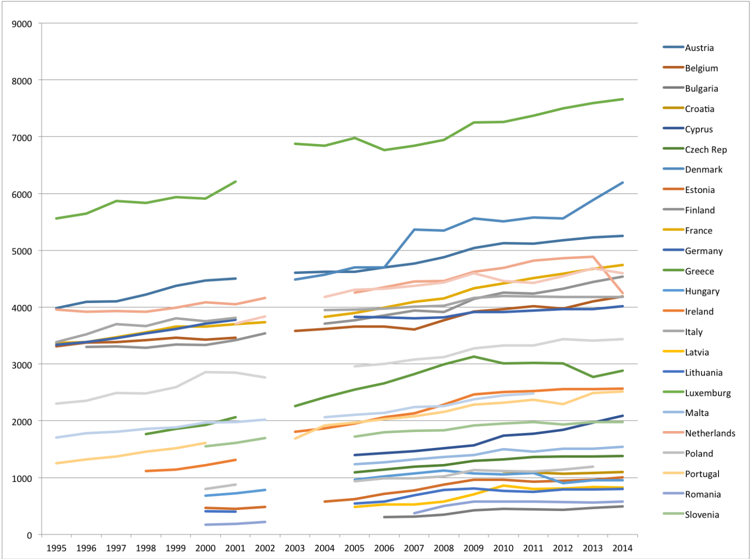


Figure 4: Evolution of per capita pension expenditure by country from 1995 to 2014.

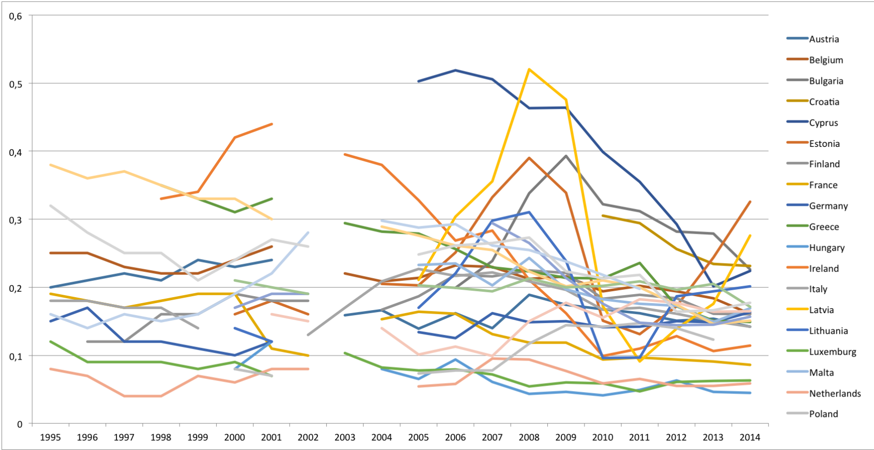


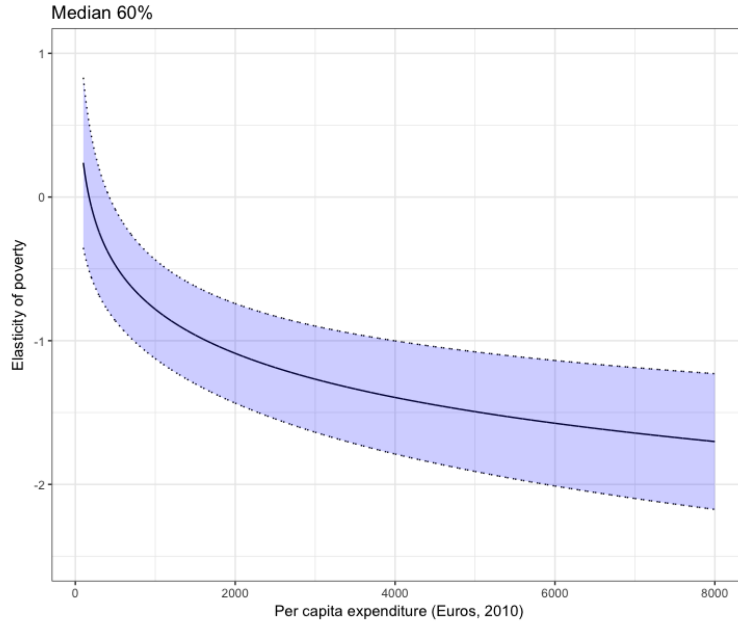
Figure 5: Evolution of poverty rates by country from 1995 to 2014.

E Baseline regression without country-fixed effects

VARIABLES	(1) log_risk_pov	(2) log_risk_pov	(3) log_risk_pov	(4) log_risk_pov	(5) log_risk_pov
log_pension_exp	-0.16***	2.51***	2.28***	2.28***	2.50***
	(0.03)	(0.56)	(0.66)	(0.68)	(0.67)
log_pension_exp_sqr		-0.18***	-0.20***	-0.22***	-0.17***
		(0.04)	(0.05)	(0.05)	(0.04)
log_gdp_capita			0.81***	1.01***	
			(0.12)	(0.17)	
old_dep			4.14***	3.93***	3.25***
			(0.79)	(0.75)	(0.89)
gini_net			4.16***	6.15***	4.12***
			(0.79)	(0.92)	(0.96)
unemp				-3.62***	
				(0.64)	
gov_exp				2.54***	-0.51
				(0.86)	(0.63)
debt_to_gdp				0.11	-0.00
				(0.09)	(0.10)
Observations	388	388	388	388	388
Adjusted R-squared	0.05	0.10	0.28	0.33	0.24
Dich. year	NO	NO	NO	NO	YES
F-test	20.70	18.33	30.47	32.28	8.317

Note : Standard errors (in parentheses) are robust to autocorrelation and heteroskedasticity. They were estimated using the Arellano method (1987). $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

Table 13: Baseline regression results with no country fixed effects.



Note : The shaded areas represent a 95% confidence interval, derived using the delta method.

Figure 6: Elasticity of the poverty rate to public pension expenditure using the baseline regression with no fixed effects.

F Robustness: Leave out countries or group of countries.

	Left-out country	Elasticity at the mean	Lower	Upper
1	Austria	-1.46	-2.25	-0.67
2	Belgium	-1.46	-2.25	-0.66
3	Bulgaria	-1.49	-2.3	-0.69
4	Croatia	-1.45	-2.25	-0.65
5	Cyprus	-1.46	-2.29	-0.63
6	Czech Republic	-1.46	-2.26	-0.66
7	Denmark	-1.4	-2.28	-0.52
8	Estonia	-1.49	-2.3	-0.68
9	Finland	-1.49	-2.3	-0.68
10	France	-1.36	-2.13	-0.59
11	Germany	-1.44	-2.25	-0.62
12	Greece	-1.4	-2.23	-0.56
13	Hungary	-1.51	-2.31	-0.7
14	Ireland	-1.59	-2.51	-0.67
15	Italy	-1.46	-2.29	-0.64
16	Latvia	-1.06	-1.47	-0.64
17	Lithuania	-1.58	-2.42	-0.74
18	Luxembourg	-1.48	-2.25	-0.7
19	Malta	-1.48	-2.29	-0.67
20	Netherlands	-1.48	-2.31	-0.65
21	Poland	-1.42	-2.25	-0.58
22	Portugal	-1.45	-2.28	-0.63
23	Romania	-1.43	-2.25	-0.62
24	Slovenia	-1.44	-2.31	-0.57
25	Spain	-1.5	-2.34	-0.66
26	Sweden	-1.49	-2.29	-0.69
27	United Kingdom	-1.43	-2.25	-0.62

Table 14: Elasticity to the mean by excluding successively the above countries.

	Left-out group	Elasticity at the mean	Lower	Upper
1	East	-1.22	-1.82	-0.62
2	Scandinavian	-1.51	-2.41	-0.60
3	South	-1.46	-2.435	-0.49

Table 15: Elasticity to the mean by excluding successively the above groups of countries

G Robustness: 2SLS with two-year lagged instruments.

VARIABLES	(1) log_risk_pov	(2) log_risk_pov	(3) log_risk_pov	(4) log_risk_pov	(5) log_risk_pov
xlog_pension_exp_chap	-1.04***	1.37	1.60	1.81	1.84
	(0.30)	(1.63)	(1.32)	(1.12)	(1.33)
xlog_pension_exp_sqr_chap		-0.17	-0.24**	-0.23**	-0.21*
		(0.11)	(0.09)	(0.09)	(0.10)
log_gdp_capita			1.79***	1.16**	
			(0.36)	(0.53)	
old_dep			1.72	3.07**	3.50**
			(1.34)	(1.26)	(1.61)
gini_net			0.31	0.82	0.20
			(1.44)	(1.22)	(1.30)
unemp				-2.09*	
				(1.02)	
gov_exp				2.20*	0.37
				(1.16)	(0.80)
debt_to_gdp				-0.42**	-0.79***
				(0.19)	(0.17)
Observations	301	301	301	301	301
Number of country	27	27	27	27	27
Adjusted R-squared	0.23	0.24	0.42	0.51	0.46
Dich. year	NO	NO	NO	NO	YES
F-test	11.78	8.390	14.33	11.22	43.68

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 16: Two-stage least square.

H Robustness: Changing the definition of the poverty line.

The following table presents specification (4) of the baseline scenario (see Table 1) when we make vary the poverty line at 40, 50 and 60% of the median or of the mean income for the computation of the poverty rate.

	Dependent variable: log_risk_pov					
	Median 60	Median 50	Median 40	Mean 60	Mean 50	Mean 40
	(1)	(2)	(3)	(4)	(5)	(6)
log_pension_exp	2.83 * **	5.36 * *	3.40	3.87 * **	5.27 * **	5.92 * **
	(0.98)	(1.97)	(3.42)	(0.89)	(1.20)	(2.03)
log_pension_exp_sqr	−0.27 * **	−0.44 * **	−0.28	−0.27 * **	−0.39 * **	−0.45 * **
	(0.07)	(0.14)	(0.26)	(0.06)	(0.08)	(0.14)
log_gdp_capita	0.79	0.65	0.74	−0.16	−0.01	0.55
	(0.52)	(0.49)	(0.77)	(0.20)	(0.33)	(0.50)
old_dep	2.30 * *	−0.48	−5.84*	0.52	1.26	−3.87 * *
	(0.95)	(1.21)	(3.26)	(0.82)	(0.98)	(1.87)
gini_net	1.41	4.35 * *	5.27*	5.35 * **	8.19 * **	10.18 * **
	(0.92)	(1.76)	(2.83)	(0.96)	(1.18)	(2.04)
unemp	−3.38 * **	−5.81 * **	−4.82 * *	−3.29 * **	−5.19 * **	−6.33 * **
	(1.09)	(1.34)	(1.95)	(0.52)	(0.93)	(1.24)
gov_exp	1.86	2.12*	2.49	0.46	1.06	1.86
	(1.10)	(1.17)	(1.62)	(0.42)	(0.89)	(1.11)
debt_to_gdp	−0.39*	0.03	−0.00	−0.29 * *	−0.29	0.18
	(0.19)	(0.37)	(0.55)	(0.14)	(0.20)	(0.41)
Observations	388	349	349	355	355	355
Number of countries	27	27	27	27	27	27
Adjusted R-squared	0.51	0.40	0.21	0.63	0.60	0.40
Dich. year	NO	NO	NO	NO	NO	NO
F-test	21.89	19.94	10.58	25.91	23.68	19.71

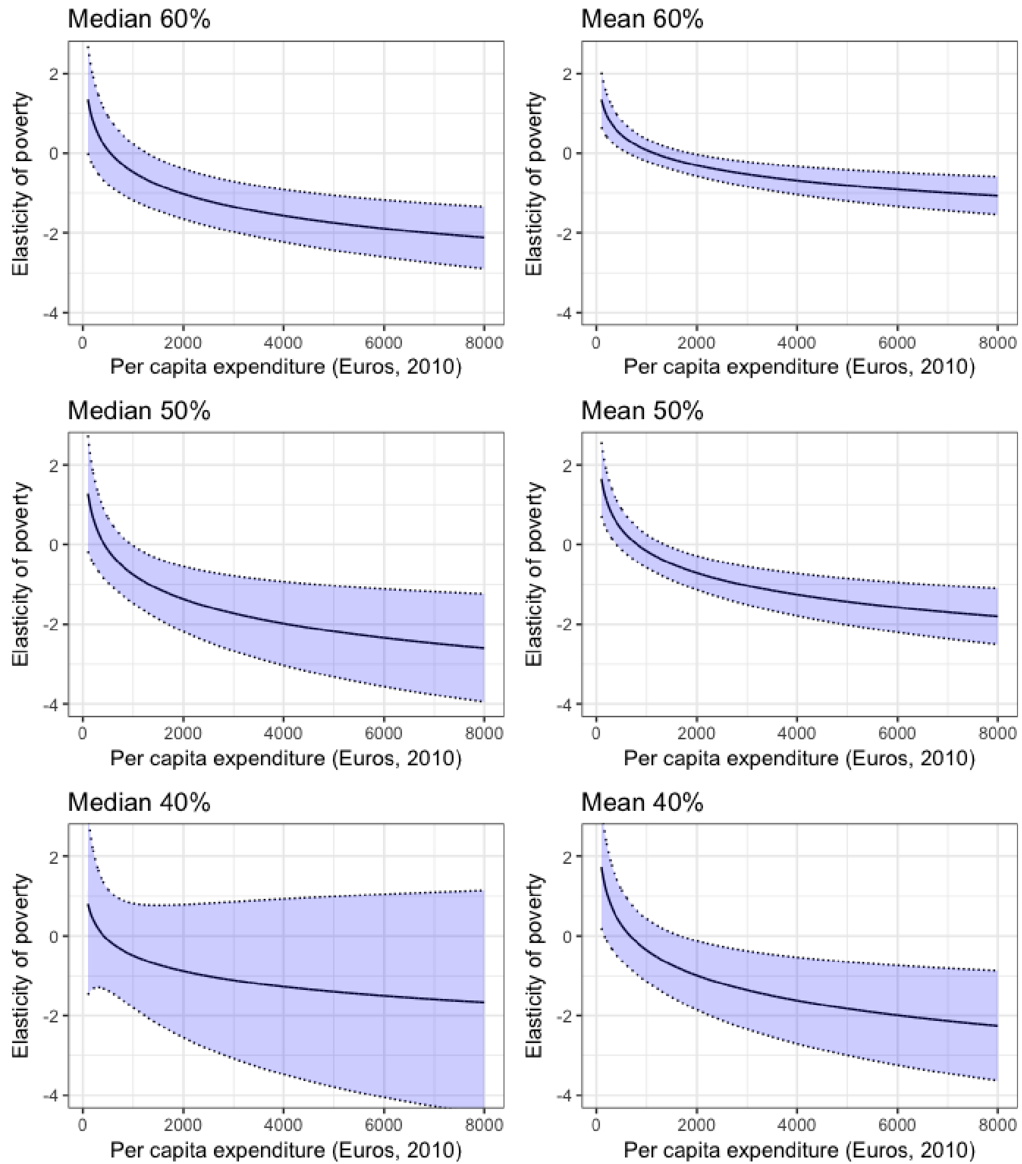
Note : The standard deviations (in parenthesis) are robust to autocorrelation and heteroskedasticity. They were estimated using the Arellano method (1987). *p<0.1; **p<0.05; ***p<0.01

Table 17: Robustness analysis: variation of the poverty line.

Poverty rate with threshold	Elasticity to the mean	95 % C.I.
PL median 60	-1.45	(-2.25 ; -0.65)
PL median 50	-1.67	(-2.59 ; -0.75)
PL median 40	-1.08	(-3.00 ; 0.84)
PL mean 60	-0.49	(-0.80 ;-0.19)
PL mean 50	-0.98	(-1.45 ; -0.51)
PL mean 40	-1.30	(-2.26 ; -0.35)

Note : C.I. means confidence interval.The confidence intervals were calculated using the delta method. The elasticity was calculated at the average value (all years and all countries) of the expenditure incurred for the public pension scheme, i.e. 2,819.45€.

Table 18: Elasticity to the mean per capita public pension expenditure.



Note : The shaded area represents a 95% confidence interval that was derived using the delta method.

Figure 7: Elasticities of the poverty rate according to different definitions of the poverty line.

References

[1] Arellano, M. (1987). Practitioners' Corner: Computing Robust Standard Errors for Within-Groups Estimators. Oxford bulletin of Economics and Statistics, 49(4), 431-434.

[2] Barro, R. J. (2000). Inequality and Growth in a Panel of Countries. Journal of economic growth, 5(1), 5-32.

[3] Bourguignon, F. (2003). The growth elasticity of poverty reduction: explaining heterogeneity across countries and time periods. Inequality and growth: Theory and policy implications, 1(1).

[4] Caminada, K., and Goudswaard, K. (2012). The relationship between alternative measures of social spending and poverty rates. International Review of Business and Social Sciences, 1(5), 08-25.

[5] Caminada, K., K. Goudswaard and F. Koster (2012). Social income transfers and poverty: A cross-country analysis for OECD countries. International Journal of Social Welfare, 21, 115-126.

[6] Cantillon, B. (2011). The paradox of the social investment state: growth, employment and poverty in the Lisbon era. Journal of European Social Policy, 21(5), 432-449.

[7] European Commission (2015). The 2015 Ageing Report: economic and budgetary projections for the 28 EU Member States (2013-2060). European Economy, 3-2015.

[8] Engelhardt, Gary V., et Jonathan Gruber. Social security and the evolution of elderly poverty. No. w10466. National Bureau of Economic Research, 2004.

[9] Fonseca, R., A. Kapteyn, J. Lee, G. Zamarro and K. Feeney (2014). A Longitudinal Study of Well-Being of Older Europeans: Does Retirement Matter?. Population Ageing, 7, 21-41.

[10] Lefèbvre, M., and Pestieau, P. (2006). The generosity of the welfare state towards the elderly. Empirica, 33(5), 351-360.

[11] Milligan, K. (2008). The evolution of elderly poverty in Canada. Canadian Public Policy, 34(4), S79-S94.

[12] Marchand, Joseph, et Timothy Smeeding. "Poverty and Aging." Handbook of the Economics of Population Aging, 1 (2016): 905-950.

[13] OECD (2017), Pensions at a Glance 2017: OECD and G20 Indicators, OECD Publishing, Paris.

[14] Orenstein, M. A. (2011). Pension privatization in crisis: Death or rebirth of a global policy trend?. International Social Security Review, 64(3), 65-80.

[15] Smeeding, T. (2006). Poor people in rich nations: The United States in comparative perspective. The Journal of Economic Perspectives, 20(1), 69-90.

[16] Smeeding, T. M., et Williamson, J. (2001). Income maintenance in old age: What can be learned from cross-national comparisons. Center for Retirement Research Working Papers, 45.

[17] StatCan (2017), List of countries - European Union (EU) 2013, Statistical classification, [online] Retrieved from : http://www23.statcan.gc.ca/imdb/p3VD.pl?Function=getVD&TVD=141329, consulted on February 20, 2017.

[18] van Vliet, O. (2010). Divergence within convergence: Europeanization of social and labour market policies. European Integration, 32(3), 269-290.

[19] van Vliet, O., Been, J., Caminada, K., et Goudswaard, K. (2012). Pension reform and income inequality among older people in 15 European countries. International Journal of Social Welfare, 21, S8-S29.
[20] Wooldridge, J. M. (2002). Econometric Analysis of Cross Section and Panel Data. MIT Press.