

Poverty Among the Elderly: The Role of Public Pensions Systems

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Introduction (1)

- Rapid population aging and declining fertility put more pressure on the viability of pension systems.

Dependency ratio should reach 28% in 2060 against 18% in 1975 (European Commission, 2009)

⇒ need for reforms which may affect income distribution and poverty among the elderly

- **Objective of the paper:**

- ▶ Estimate the aggregate relation between public pension spending and the prevalence of poverty among the elderly.
- ▶ Show how the redistributive structure of the pension system affects poverty.
- ▶ Take into account some macro country-specific data.

Introduction (2)

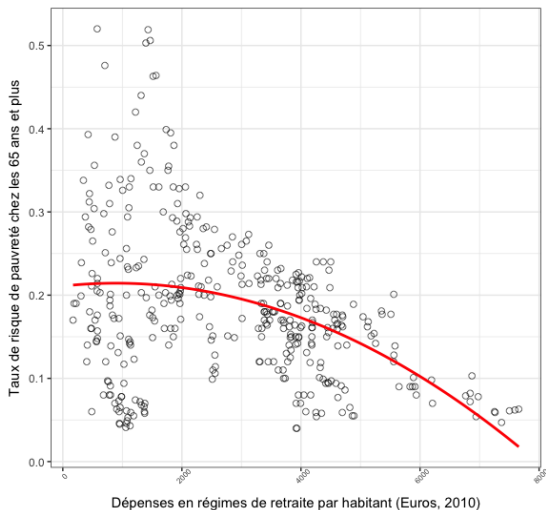


Figure: Public spending on pensions and poverty rates (PL median 60)

Introduction (3)

- **Our methodology:**

- ▶ Concentrate on public spending for retirement.
- ▶ Use data from 27 countries from the EU from 1995-2014.
 - We estimate the elasticity of the poverty rate among individuals over 65 years of age to per capita public spending on pensions.
 - We perform robustness checks introducing variables representing the degree of redistributivity of the system, varying the poverty line in the poverty rate, and testing for endogeneity.

- **Results:**

- Non linear relation between the elasticity of the poverty rate and retirement public spending.
- The elasticity is negative and statistically different from 0 only beyond per capita spending of 685 euros. At the average value of € 2,819, it is estimated that the elasticity is about -1.45.

Introduction (4)

Litterature:

- Most papers concentrate on *one country at a time* and use *microdata* to study the impact of different pension plans on poverty, individual savings or the decision to work or retire quickly
Milligan, 2008; Engelhardt and Gruber, 2006.
- Some macro papers which concentrate on the link between public (SS) programs, poverty or income inequalities (among the elderly or other sub-group of population)
 - 1 Smeeding, 2006; Smeeding and Williamson, 2001; Lefebvre and Pestieau, 2006;
 - 2 Caminada 2012: effect of social expenditure on poverty.
 - 3 van Vliet et al., 2012: the impact of the privatization of public pension schemes on the poverty rate and income inequality among people over 65 years of age
 - 4 Fonseca et al. 2014: effect of retirement on poverty and well-being.

Data and measures (1)

- 27 countries for a period ranging from 5 to 19 years depending on the country.

The observations cover the period 1995 to 2014.

- *Dependent variable: the poverty rate* is the fraction of individuals over age 65 living with a disposable income lower than 60 % of the median national disposable equivalent income.
60% median income threshold is the *poverty threshold /line*.

Data and measures (2)

- *Explanatory variable*: The generosity of public pension schemes is measured by *per capita public spending devoted to pension schemes* (measured Euros-2010)
 - Includes invalidity pension, early retirement due to incapacity for work, retirement, early retirement, partial retirement pension, survivor's benefits and early retirement for reasons related to the labor market.
- *The redistribution index*: the ratio of retirement expenditure which targets the least well-off individuals on total pensions expenditure.
 - reflects different characteristics of pension systems across countries and degree of redistributivity.

Data and measures (3)

Control variables:

- the GDP per capita in euros in 2010 (gdp_capita) ;
- the dependency ratio (old_dep) ;
- the unemployment ratio (unemp) ;
- the ratio of total government spending in relation to GDP (gov_exp) ;
- the ratio of debt to GDP (debt_to_gdp) ;
- the Gini index (gini_net).

Method (1)

Fixed effect model:

- 1st regression

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

- The elasticity of the poverty rate to public pension expenditure is defined as:

$$\varepsilon(x_{i,t}) \equiv \frac{\partial \log(y_{i,t})}{\partial \log(x_{i,t})}$$

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

Method (2)

- 2nd regression

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

and

$$\varepsilon_2(x_{i,t}, w_{i,t}) \equiv \frac{\partial \log(y_{i,t})}{\partial \log(x_{i,t})}$$

$$\text{with } \frac{\partial \log(y_{i,t})}{\partial \log(x_{i,t})} = \beta_1 + 2\beta_2 \log(x_{i,t}) + \beta_4 w_{i,t} + 2\beta_5 w_{i,t} \times \log(x_{i,t}).$$

Descriptive statistics

Country	Years		Per capita pensions exp.			Poverty rate (PL median 60)				Poverty rate (PL mean 60)			
	Min	Max	Mean	Med	SD	N	Mean	Med	SD	N	Mean	Med	SD
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

Descriptive statistics (2)

- Important heterogeneity between countries for the two variables, the poverty rates and per capita public expenditure on pensions.
- Confirms that using mean income instead of median income to calculate the poverty line means that a significantly larger share of the population is considered to be poor
The average poverty rate for France is 0.14 over the period using the median, while the mean rate is 0.23 using average income.
- The number of observations per country varies according to the definition of poverty used.

Results (1)

Dependent variable: Log Poverty rate (PL median 60)

	(1)	(2)	(3)	(4)	(5)
log_pension_exp	-0.46* (0.05)	3.64*** (0.00)	2.90** (0.01)	2.83*** (0.01)	3.21** (0.04)
log_pension_exp_sqr		-0.30*** (0.00)	-0.30*** (0.00)	-0.27*** (0.00)	-0.27** (0.02)
log_gdp_capita			1.64*** (0.00)	0.79 (0.14)	
old_dep_1			0.69 (0.55)	2.30** (0.02)	3.84** (0.04)
gini_net			1.16 (0.32)	1.41 (0.13)	0.94 (0.46)
unemp				-3.38*** (0.00)	
gov_exp				1.86 (0.10)	-0.28 (0.74)
debt_to_gdp				-0.39* (0.10)	-0.78*** (0.00)
Observations	388	388	388	388	388
Number of countrynum	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

Table: Baseline Regression Results.

Note : Robust pval in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Results (2)

- Presence of a non-linear relation between the log of per capita pension expenditure and the poverty rate.
→ stable and significantly different from zero despite the addition of several control variables.
- *(+)* relation with dependency ratio: the higher the number of elderly persons, the higher the poverty rate.
- *(+)* relation with total government spending may be explained by the fact that they have a greater impact on the median income than on the income of the elderly.
- *(-)* relation with unemployment rate, which represents economic cycle and with debt to GDP.

→ **keep specification 4 for the rest of the analysis.**

Results (3)

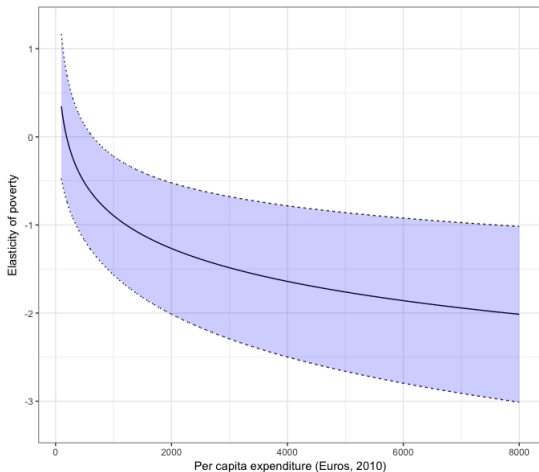


Figure: Elasticity of the poverty rate (PL median 60) to per capita public pension expenditure.

Results (4)

- This elasticity is only significantly different from 0 beyond a per capita spending ratio of about 685 euros.
→ 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. This effect diminishes, however, and the elasticity seems to stabilize at plus or minus 2% for high per capita pension expenditure.
- At the average value of € 2,819.45, the elasticity is -1.45.
- **Robustness checks:** by eliminating one by one country or by eliminating groups of countries → No sizeable difference.

Robustness analysis

- **Regressions for different poverty thresholds (40, 50 and 60% of median or mean income) of the poverty rate.**
 - The nonlinear relationship is present in all regressions (only at 40% of the median income, this is not significant)
 - same pattern for the elasticity of poverty to per capita public pension spending ... *except that the elasticity gets higher when the poverty line becomes lower.*
 - spending on public pensions is a more important lever for the poorest elderly people.

Robustness analysis (2)

Table: Elasticity to the mean when varying the poverty line.

Poverty rate with threshold	Elasticity to the mean	I.C. at 95 %
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 : I.C. means confidence interval. 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. The confidence intervals were calculated using the delta method.

Robustness analysis (3)

- **The structure of pension plans varies greatly across countries**
→ Include *Redistribution index*, the ratio of pension expenditure that is specifically directed towards the poor, relative to total expenditure (means-tested divided by total expenditure).
- The variables that were already included in model (1) have same sign. The nonlinear relationship between the two variables of interest remains significant.
- The new terms are not significantly different from 0 (except for reg. Mean 60).
→ *The introduction of the expenditure ratio does not improve the explanatory power of our model.*

Robustness analysis (4)

	<i>Dependent variable:</i>					
	Median 60 (1)	Median 50 (2)	Median 40 (3)	Mean 60 (4)	Mean 50 (5)	Mean 40 (6)
log(pen_exp)	2.85*** (0.97)	7.11*** (2.05)	6.44 (4.33)	3.93*** (0.93)	5.86*** (1.30)	8.06*** (2.26)
log ² (pen_exp)	-0.27*** (0.08)	-0.60*** (0.15)	-0.57* (0.33)	-0.28*** (0.06)	-0.44*** (0.09)	-0.65*** (0.17)
ratio_means	-16.73 (67.62)	57.26 (77.22)	-10.79 (84.83)	21.78 (47.38)	101.59 (61.83)	132.57** (64.80)
log(pen_exp)*r_m	3.99 (17.56)	-20.33 (19.41)	-9.10 (20.33)	-6.26 (12.15)	-27.39* (15.77)	-42.35*** (15.96)
log ² (pen_exp)*r_m	-0.24 (1.13)	1.59 (1.22)	1.21 (1.23)	0.43 (0.77)	1.81* (1.00)	3.13*** (0.99)
log(gdp_capita)	0.77 (0.56)	0.94** (0.48)	1.23* (0.67)	-0.18 (0.22)	0.07 (0.35)	0.86* (0.45)
old_dep	2.50** (1.02)	-0.10 (1.36)	-4.13 (3.53)	0.54 (0.97)	0.82 (1.13)	-3.26* (1.87)
gini_net	1.53 (0.94)	3.67** (1.57)	4.25 (2.63)	5.25*** (0.93)	7.82*** (1.04)	8.94*** (1.67)
unemp	-3.38*** (1.13)	-5.26*** (1.29)	-3.72** (1.73)	-3.22*** (0.53)	-5.03*** (0.96)	-5.49*** (1.19)
gov_exp	1.86* (1.11)	2.38** (1.11)	2.95** (1.41)	0.49 (0.43)	1.16 (0.91)	2.27** (1.02)
debt_to_gdp	-0.41** (0.20)	0.07 (0.35)	0.04 (0.50)	-0.31** (0.15)	-0.27 (0.21)	0.19 (0.39)
Dich. Year	No	No	No	No	No	No
Observations	388	349	349	355	355	355
Adjusted R ²	0.47	0.39	0.25	0.60	0.57	0.43
F statistic	34.50***	23.87***	14.01***	50.90***	46.27***	27.92***

Table: Introducing the redistribution index

Robustness analysis (5)

Endogeneity problem:

- If any, we estimate a *lower bond* for the relation between poverty and pension expenditures.
- To solve this problem, we rely on *Wooldridge (2001)*:
 - 1- Regress 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).
 - 2- Regress (per capita public spending)² on the lagged values of (poverty rate)², (per capita public spending)² and same controls
 - 3- Use the predicted values as the explanatory variables in the second step regression.

Robustness analysis (6)

Dependent variable: Log Poverty rate (PL median 60)

	(1)	(2)	(3)	(4)	(5)
log_pension_chap	-0.66** (0.02)	3.20*** (0.01)	2.87** (0.02)	2.40** (0.03)	2.41* (0.05)
log_pension_chap_sqr		-0.27*** (0.00)	-0.31*** (0.00)	-0.23*** (0.00)	-0.22** (0.03)
log_gdp_capita			1.73*** (0.00)	0.49 (0.22)	
old_dep_1			0.76 (0.52)	2.07* (0.06)	3.30* (0.06)
gini_net			1.39 (0.27)	1.75* (0.09)	1.37 (0.26)
unemp				-3.36*** (0.00)	
gov_exp				1.33 (0.18)	-0.33 (0.72)
debt_to_gdp				-0.45** (0.04)	-0.84*** (0.00)
Observations	337	337	337	337	337
Number of countrynum	27	27	27	27	27
Adjusted R-squared	0.13	0.20	0.40	0.51	0.43
Dich. year	NO	NO	NO	NO	YES
F-test	6.635	8.485	18.67	13.45	80.16

Table: Two-stage least square

Note : Robust pval in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Robustness analysis (7)

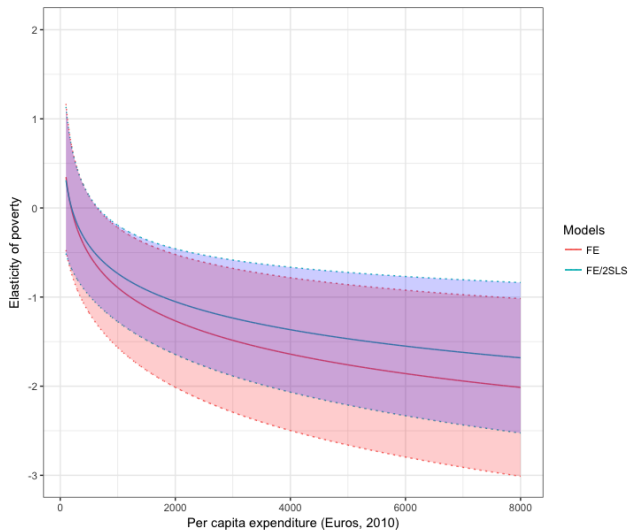


Figure: Elasticity of the poverty rate (PL median 60) to per capita public pension expenditure.

Conclusion

- Explore the link between poverty among the elderly and the level of public spending on pensions at the aggregate level.
 - There exists a negative and non linear relation between these two variables.
 - there exists a threshold beyond which increasing public pension spending becomes effective into reducing poverty
- Apparently no impact of the redistributive structure of pension system
 - to dig more.
- *What else? comments more than welcome*