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Pension reform and income inequality among the elderly in 15 European countries *

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Abstract

The ageing of populations and hampering economic growth increase pressure on public finances in many advanced capitalist societies. Consequently, governments have adopted pension reforms in order to relieve pressure on public finances. These reforms have contributed to a relative shift from public to private pension schemes. Since private social security plans are generally less redistributive than public social security, it can be hypothesized that the privatization of pension plans has led to higher levels of income inequality among the elderly. Existing empirical literature has mainly focused on cross-country comparisons at one moment in time or on time-series for a single country. This study contributes to the income inequality and pension literature by empirically analysing the distributional effects of shifts from public to private pension provision in 15 European countries for the period 1995-2007, using pooled time series cross-section regression analyses. Remarkably, we do not find empirical evidence that shifts from public to private pension provision lead to higher levels of income inequality or poverty among elderly people. The results appear to be robust for a wide range of econometric specifications.

JEL-codes: H53, H55, and I32
Key words: income inequality, pension reform, public/private-mix, retirement, welfare state

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1. Introduction

The ageing of populations has triggered pension reform in many industrialized countries over the past decades. Plans to alleviate the pressure of ageing on public finances have resulted in a trend towards more private pension provision (OECD, 2009; Orenstein, 2011). In the pension literature, remarkably little attention has been paid to the distributive effects of these reforms for the elderly. Since private social security arrangements generally entail less income redistribution than public social security (Goudswaard and Caminada, 2010), it could be expected that shifts from public to private in the pension provision lead to higher levels of income inequality and poverty among elderly people (Arza, 2008). This would imply a trade-off between alleviating the pressure on public finances on the one hand and income inequality among the elderly on the other. The empirical literature in this field exists mainly of either cross-national studies at one moment in time (for example Smeeding and Williamson, 2001) or descriptive analyses for a single country (for example Milligan, 2008). As a consequence, relatively little insight has been gained about how pension reforms have influenced income inequality and poverty among the elderly in advanced capitalist countries over the past decades.

The aim of this study is to examine the relationship between the developments in pension systems and the variation in income inequality and poverty among the elderly across countries and over time. First, we will analyze to what extent reforms have resulted in a trend towards relatively more private pension provision across advanced capitalist countries. To that end we use the most recent release of the OECD Social Expenditure database (2010). Indeed, in the pension systems of many countries there have been shifts from public to private in the period 1995-2007, but there is substantial variation across countries. Subsequently, it will be examined to what extent these shifts have influenced income inequality levels and poverty rates among the elderly, based on a number of pooled time series cross-section regression analyses. Our focus on annual macro data for a relatively short period implies that this paper does not contain an integral income redistribution analysis based on the discounted values of lifetime income, contributions paid and benefits received. The main result of our analysis is that a relatively higher private share of pension provision in a country is not associated with higher levels of income inequality or poverty in that country. With respect to inequality and poverty, the analysis mainly relies on EU ECHP/SILC data (Eurostat, 2011a), but the results appear to be robust for other data and for a wide range of econometric specifications.

This paper is structured as follows. In section 2 the relationship between pension reform and income inequality among elderly people is introduced. Section 3 describes the data, measures and method used in this study. Section 4 presents descriptive statistics, the results of the regression analyses and the sensitivity analyses. In section 5 some explanations for our findings will be discussed and the paper closes with the conclusions in section 6.

2. Pension reforms

2.1 Public and private pensions

In an era of ageing populations, relieving public finances is one of the most important drivers of pension reform. An increase in the number of pensioners relative to the labour force leads to increasing budgetary pressure. Budgetary problems as a consequence of cyclical shocks, such as the recession of 2008-2009, may increase the pressure to reform (public) pension systems even further. However, even though the pressure to reform pensions is high, pension reforms are in reality often unruly. Since pensions are based on long-term contracts, reforms are complicated by institutional path dependency (Myles and Pierson, 2001). Changes as higher statutory pension ages or reductions of pension benefits are often controversial from a political viewpoint and therefore difficult to realize. Hence, many countries have chosen for a

different approach to pension reform. This approach, which is often labeled 'pension privatization', entails shifts from public pension provision to a mix of public and private pension provisions and a change from the defined benefit to the defined contribution system (OECD, 2009; Orenstein, 2011).[1] In Germany, for instance, the 2001 pension reform consisted of a reduction of the public pension levels and the introduction of state-subsidized, voluntary private pension schemes (Natali and Rhodes, 2008). Based on a comparative case study, Arza (2008) shows that this is the type of pension reform that has also been opted for in Italy, Sweden, Poland and the United Kingdom.

The relevant question here is how relative shifts in the pension provision would affect the income distribution among elderly people. Public pension plans are generally based on income-related funding and flat rate benefits, which relatively strongly benefit lower income groups. Therefore, public pensions are expected to generate a more equal income distribution and less poverty among the elderly. In a number of OECD countries, the level of public pension benefits is such that a relatively small percentage of pensioners falls below the poverty line. Private pension plans, in contrast, are based on a link between contributions paid and benefits received and therefore are not expected to contain elements of (ex ante) income redistribution. A private pension insurance is actuarially fair as a rule. This means that each individual is provided with benefits whose actuarial value is equal to his contributions, given the chance of the insured event occurring. This is the case for individual private pension insurances that have a defined contribution character. However, private earnings-related pension schemes (in the second pillar) may not be actuarially fair and may contain elements of redistribution. This is often the case when (supplementary) private schemes are negotiated by social partners in collective labour contracts. These schemes are mandatory for (a group of) workers. Defined benefit pension schemes, for example, generally redistribute resources both within generations (for instance through redistributive elements such as thresholds or ceilings) and across generations (risk sharing, back service). Also, tax advantages (to households or to employers) can be used to stimulate the provision of private pensions. This is often the case in supplementary pension programs, where contributions are tax exempt (Yoo and De Serres, 2004). The fiscal advantages related to, for example, supplementary private pension plans are positively related to income levels in most countries and thus favor the rich (Goudswaard and Caminada, 2010). In general, as Ferrarini and Nelson (2003, pp. 14-15) showed, social insurance is less equalising after taxation in all countries.

In summary, it seems plausible that private pension schemes will generate less income redistribution from rich to poor than public programs, although at this stage their distributional impact in a cross-country analysis is not fully clear. In other words, there are good reasons to expect that relative shifts from public to private pensions lead to higher income inequality among the elderly.

2.2 Earlier findings

Much literature analyses the relationship between social security and income inequality in general. Based on a cross-national study at the macro level Smeeding and Williamson (2001) conclude that high levels of public social spending are associated with low levels of income inequality and poverty. Caminada and Goudswaard (2005) and Goudswaard and Caminada (2010) compare the redistributive effects of public and private social security. Taking a broad definition of social security and based on an international comparative analysis, they conclude that the redistributive effect of private social security is smaller than that of public social security. However, Caminada et al. (2011) find no significant effects of private social expenditure on poverty rates.

1 A shift from public to private pension provision alleviates the pressure on public finances, but it does not solve financing problems of the pension system. If a deficit of the pension system is considered as unsustainable, the only solution to make it sustainable is reducing benefits, increasing contributions, or both, either publicly or privately (Barr and Diamond, 2009).

Interestingly, the findings for pensions seem to be less ambiguous than for social security in general. A number of cross-sectional studies indicate that income inequality among elderly people is lower as larger shares of the income of the elderly exist of public pension benefits (Brown and Prus, 2004; Weller, 2004; Fukawa, 2006). The number of studies on the income effects of private pensions is considerably smaller, but Schirle (2009) found for Canada that a larger private share in the pension provision is associated with an increasing income inequality among elderly people. Combining the results of the studies on public and private pensions, it seems plausible that a shift from public to private leads to more income inequality among the elderly.

Comparable effects of shifts in the public/private-mix of pensions have been found for poverty among elderly people. Based on country-specific analyses over time, Oshio and Shimizutani (2005) and Milligan (2008) concluded that a larger public share in the pension provision is related to less poverty among elderly people. Hughes and Steward (2004) found that increases in the private share are associated with an increase in the poverty rate among elderly people.

From a methodological perspective, the empirical literature on pension reform and income inequality can be divided into two types of studies. The first type consists of cross-sectional studies, comparing a number of countries in a certain year (Brown and Prus, 2004; Weller, 2004; Fukawa, 2006). In these studies, the effects of pension reform cannot be analysed over time. The second type of studies is mainly focused on developments over a longer period but, for a single country (Schirle, 2009; Milligan, 2008, Myles, 2000; Oshio and Shimizutani, 2005). In these studies, it is quite difficult to examine whether the findings also hold for other comparable pension reforms in other countries. Therefore, in this study the dimension time will be incorporated into a cross-sectional analysis.

3. Data, measures and method

3.1 Public and private pension expenditure

Most comparative studies on welfare states rely on social expenditures as indicator to analyse welfare state reforms across different countries. In order to examine changes in the public/private-mix of pension provision, we use data from the most recent OECD Social Expenditure Database (2010). This database contains social expenditure data on both public and private pension schemes. In this database, programmes are classified as social when two conditions are simultaneously satisfied (Adema and Ladaique, 2009; Adema, 2010). First, they have to be intended to serve a social purpose, such as old-age.[2] Second, they have to involve either inter-personal redistribution or compulsory participation. Hence, purely private old-age plans which are the result of direct market transactions by individual people are not included.[3] The distinction between public and private social security is based on the institution that controls the financial flows, namely public agencies or private bodies.

Our study analyses public and private social pension expenditure, both expressed as percentage of GDP and as millions of U.S. dollars (constant (2000) prices, ppp) per pensioner. A relevant measure is the share of private social pension expenditure as percentage of total social pension expenditure. This measure provides a good indication of shifts in the public/private-mix. The measure for private social pension expenditure indicates the total of expenditures on mandatory and voluntary pension schemes.[4] Furthermore, the indicators include expenditures

2 According to Adema and Ladaique (2009), other policy areas with a social purpose are: survivors, incapacity related benefits, health, family, active labour market policies, unemployment, housing and a category of other social security areas.

3 Neither are alternative old-age provisions such as home ownership included.

4 The OECD Social Expenditure Database also provides the possibility to present expenditures on mandatory and voluntary private pension separately. However, since the classification of private pension spending into mandatory and voluntary pension schemes is not unequivocal, we mainly use the total of these two catego-

on incomes of people who retired at the statutory retirement age and of early retirees.[5] Expenditures on survivor pensions are not included in the indicators.

In a cross-national analysis at the macro-level, expenditure indicators have some limitations (Van Vliet, 2010). First, differences in expenditure patterns may be driven by differences in demographic trends across countries. When increases in pension expenditure fall short of increases in the number of retirees, this may have negative consequences for the incomes of elderly people and for the income inequality among the elderly. To control for the ageing of populations, we include a control variable measuring the percentage of population aged 65 and above.[6] For this measure we use data from Eurostat (2011b). Second, expenditures do not indicate institutional differences in pension systems, such as a pay-as-you-go versus a funded system, or a defined benefit versus a defined contribution system. Third, the variation in the tax treatment of contributions and benefits across countries is not taken into account. Ideally, we would use net expenditure on pensions, after tax, but international standardized data for such an indicator are unfortunately not available for a longer period. Despite these limitations, pension expenditures can give an indication of shifts from public to private pensions.

3.2 Income inequality and poverty among the elderly

For income inequality and poverty among the elderly, the study relies on two indicators provided by Eurostat (2011a). Income inequality among the elderly is measured by the S80/S20 ratio of people aged 65 and over. This indicator is constructed by dividing the total disposable income of the top twenty percent incomes of elderly by the total equivalised disposable income of the bottom twenty percent incomes of people aged 65 and over. A higher value of this indicator implies a higher inequality among the elderly. Although this indicator gives a good indication of income inequality at the extremes of the distribution, it neglects shifts between other quintiles. Therefore, the *Gini-coefficient* and the *Atkinson index* may be preferred measures of income inequality. However, data on income inequality among elderly measured by either the Gini coefficient or the Atkinson index are not available for a reasonable number of years.[7]

Poverty among the elderly is measured by the percentage of people aged 65 and over who live below the poverty line of 60% of median equivalised (disposable) income of the total population. This poverty line of 60% is also officially used as poverty measure by the European Union. A higher value of this indicator implies a higher rate of poverty among elderly. Note that this indicator is a relative poverty line and can therefore be seen as a detailed representation of income inequality for the lower part of the income distribution.

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ries. As a robustness check, we also analysed the income effects of mandatory and voluntary pension schemes separately, which did not alter the results (reported below). Note that the classification into public, mandatory private and voluntary private pensions coincides with the classification into first, second and third pillar pensions respectively.

5 Expenditures on public pensions also include spending on some other services for the elderly (see Vandenbroucke and Vleminckx, 2011).

6 Note that people aged 65 and over is used as a proxy for the number of pensioners. Although the age of 65 is the statutory age of receiving pensions for men in most countries used in this analysis (except for Denmark (67 until 2002, after that 65), France (60), Ireland (66), Italy (respectively 60, 62, 64 until 2002, after that 65) and Norway (67), in reality the average age of retirement is lower than the statutory age in all described countries. Moreover, the statutory pension age may differ for women (ISSA, 2011).

7 However, we employed a number of regressions with Gini-coefficients as robustness check. The results are discussed in Section 4.

3.3 Method

To examine the relationship between pension reform and income inequality among the elderly, we run a number of pooled time series cross-section regression analyses. Our estimations take the following form:

$$Q_{it} = \alpha + \beta' X_{w,it} + \delta' Z_{w,it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

In Equation 1, *Q* represents the dependent variables of income inequality (S80/S20) or poverty (PL 60) among the elderly. Variables describing the pension system, public pension expenditures, private pension expenditures and total pension expenditures (all as a percentage of GDP) and the private share of pension expenditures (private pension expenditures as percentage of total pension expenditures), are represented in *X*. The control variables ageing (share of people aged 65 and over relative to total population) and GDP per capita are represented in *Z*. For the latter variable we use data from the OECD (2011).[8] Recognising that the variation in income inequality and poverty among the elderly may be related to unobserved country- and year-specific effects, country (*i*) and year (*t*) dummies are modeled by μ and λ, respectively. The error-term ε follows an AR(1)-process to correct for autocorrelation. In addition, we use panel-corrected standard errors to correct for panel-heteroskedasticity and simultaneous spatial correlation (Beck and Katz, 1995).

Constrained by data availability, the study covers 15 European countries – Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Sweden and the United Kingdom - for the years 1995 up till 2007. In the dataset, a number of observations is missing. This is in particular the case for the income inequality and poverty data and especially for Scandinavian countries. However, all countries are included in the regression analyses. Several sensitivity tests, which are discussed below, indicate that results do not suffer from the missing data.

4. Empirical analysis

4.1 Descriptive statistics

Table 1 illustrates the developments in pension expenditures for the included countries from 1995 up till 2007. On average, social expenditures as a percentage of GDP on both public and private pensions have been increased. Hence, total pension expenditure as a percentage of GDP has increased too. Furthermore, the data show an increase in the private share of total pension expenditure, albeit to a limited extent. Private spending as a share of total pension expenditure rose on average from 14.3 percent in 1995 to 14.9 percent in 2007.[9] This indicates a relative shift from public to private in the pension provision. More interestingly, there is substantial variation in the developments of private pension expenditure as a share of total pension expenditure across countries. In Belgium for instance, social expenditures on private pensions increased more than expenditures on public pensions. This has resulted in a shift from public to private in the total pension expenditure.[10] In other countries, such as Denmark, Ireland, Italy, the Netherlands, Sweden and the UK, shifts in the public/private-mix are the result of opposing trends in public and private pension expenditure. Indeed, there is a negative correlation between yearly changes in private and public pension expenditure of -0.22 which is significant at the 1 percent level.[11]

8 Real GDP per capita in constant (2000) prices ppp.

9 This is an unweigted average of the countries

10 This trend fits well with the trend that is reported in Peeters et al (2003), which is based on data from national sources.

11 This in line with the partial substitution effect that has been found for total public and total private social expenditure (Van Vliet, 2011).

Table 1. Pension expenditures in European countries, 1995-2007

	Public pension expenditure as percentage of GDP			Private pension expenditure as percentage of GDP			Total pension expenditure as percentage of GDP			Private pension expenditure as percentage of total pension expenditure		
	1995	2007	Change 95-07	1995	2007	Change 95-07	1995	2007	Change 95-07	1995	2007	Change 95-07
Austria	10.0	10.7	0.7	0.4	0.5	0.1	10.4	11.3	0.8	3.7	4.7	0.9
Belgium	7.0	7.1	0.1	1.3	2.8	1.5	8.3	9.9	1.6	15.5	28.4	12.8
Denmark	8.4	7.3	-1.1	1.8	2.2	0.3	10.2	9.5	-0.7	18.0	23.0	5.0
Finland	8.5	8.4	-0.1	0.3	0.2	-0.1	8.8	8.6	-0.2	3.4	2.2	-1.1
France	10.6	11.1	0.5	0.1	0.2	0.1	10.7	11.2	0.5	1.0	1.5	0.5
Germany	8.0	8.7	0.7	0.7	0.7	0.1	8.6	9.4	0.8	7.6	7.9	0.3
Greece	9.2	10.0	0.9	0.4	0.4	0.0	9.5	10.4	0.9	3.8	3.5	-0.3
Ireland	2.9	3.1	0.2	1.1	0.9	-0.2	3.9	4.0	0.1	26.8	22.4	-4.4
Italy	9.3	11.7	2.4	2.8	1.3	-1.5	12.2	13.1	0.9	23.4	10.1	-13.3
Luxembourg	8.2	4.8	-3.4	0.6	0.3	-0.3	8.8	5.2	-3.7	6.8	6.6	-0.2
Netherlands	5.5	5.3	-0.3	2.6	3.5	0.9	8.1	8.8	0.7	31.9	40.2	8.4
Norway	7.1	6.2	-0.8	0.6	0.6	-0.1	7.7	6.8	-0.9	8.2	8.5	0.3
Portugal	6.0	9.2	3.2	0.2	0.2	0.0	6.2	9.4	3.2	2.7	1.8	-0.8
Sweden	9.8	9.0	-0.8	1.9	2.1	0.2	11.7	11.1	-0.7	16.3	19.0	2.7
United Kingdom	5.5	5.8	0.3	4.7	4.5	-0.2	10.2	10.3	0.0	46.2	43.8	-2.5
Mean	7.7	7.9	0.2	1.3	1.4	0.1	9.0	9.3	0.2	14.3	14.9	0.6

Note: Figures for Luxembourg (1995) are based on linear extrapolation.
Source: OECD Social Expenditure Database (OECD, 2010) and own calculations.

Table 2 shows a general trend towards less income inequality and less poverty among the elderly in the period 1995-2007.[12] In 2007, the average income inequality among elderly (mean 12 countries) has decreased by almost 18 percent compared to 1995. A decreasing trend over time is also shown by the poverty rate among the elderly which has decreased by almost 9 percent on average. There is some variation in trends between countries still. Greece and Portugal, for example, have shown a huge decline in poverty rates among elderly over time. However, Finland and Ireland have faced a relatively large increase in poverty among elderly in the same period. These trends are robust with respect to the poverty lines applied (50, 60 or 70 percent of median equivalised income). Nevertheless, different patterns of poverty can be seen within countries. Germany and the Netherlands, for example, have shown a decrease in poverty rates among elderly when using poverty line of 50 percent while both countries have shown an increase in poverty rates in the same period when using a poverty line of 60 and 70 percent. These observations imply that relatively more elderly live at risk of poverty in 2007 compared to 1995, but less elderly find themselves at the absolute bottom of the income distribution.

Table 2. Trends in social outcomes among elderly people, 1995-2007

	Income inequality among the elderly (S80/S20)			Poverty among the elderly (PL 60)		
	1995	2007	Change 95-07	1995	2007	Change 95-07
Austria	4.0	3.2	-0.8	20.0	14.0	-6.0
Belgium	4.9	3.4	-1.5	25.0	23.0	-2.0
Denmark	-	2.7	-	-	17.7	-
Finland	3.0	2.9	-0.1	12.0	21.6	9.6
France	4.8	4.0	-0.8	19.0	13.1	-5.9
Germany	4.9	4.2	-0.7	15.0	16.2	1.2
Greece	7.6	4.8	-2.8	35.0	22.9	-12.1
Ireland	3.9	3.4	-0.5	19.0	28.3	9.3
Italy	4.6	4.7	0.1	18.0	21.9	3.9
Luxembourg	4.1	3.2	-0.9	12.0	7.2	-4.8
Netherlands	4.2	3.2	-1.0	8.0	9.5	1.5
Norway	-	2.8	-	-	14.1	-
Portugal	6.6	6.0	-0.6	38.0	25.5	-12.5
Sweden	-	2.8	-	-	9.9	-
United Kingdom	4.9	4.4	-0.5	32.0	27.6	-4.4
Mean (all countries)	4.8	3.7	-1.1	21.1	18.2	-2.9
Mean (12 countries)	5.2	4.3	-0.9	23.0	21.0	-2.0

Note: Mean 12 countries excluding Denmark, Norway and Sweden.
Source: Eurostat SILC-database (Eurostat, 2011a) and own calculations.

[12] These results should be interpreted with caution, because there is a disruption in the time series of inequality and poverty indicators presented in Table 2. Until 2001, data were provided by the European Community Household Panel survey (ECHP). Since 2005 all EU-15 countries provide data from the new European Union Statistics on Income and Living Conditions (EU-SILC). During the transitional period poverty indicators were provided by national sources which were harmonized ex-post as closely as possible with EU-SILC definitions by Eurostat. Despite the fact that most EU-SILC variables are defined in the same way as the corresponding ECHP variables, some differences arise. The transition from ECHP to EU-SILC possibly explains the large number of missing observations in this period. See for more details Eurostat (2005).

4.2 Regression results

The social outcomes presented above suggest that there is no evidence that an increasing share of private pensions leads to higher income inequality and poverty among elderly. In Belgium for instance, the country with the largest relative shift from public to private, income inequality and poverty among the elderly decreased. In Italy, the country with the largest relative shift from private to public, an increase in income inequality and poverty rates among the elderly can be observed. In order to take our analysis beyond the descriptive statistics, we continue with regression analyses on the 15 European countries over the years 1995-2007.

The results of the regression analyses are presented in Table 3A and Table 3B. The effects of public pension expenditure as percentage of GDP on income inequality among the elderly are negative, but not significant. Model 7 indicates that public pension expenditure as percentage of GDP is negatively and significantly related to poverty among the elderly. Consistent with our expectations based on the literature, this suggests that higher social spending on public pensions is associated with lower poverty rates among the elderly. However, the results in Models 9 and 11 indicate that there is only weak evidence for this relationship.

With respect to private pension expenditure as percentage of GDP, the results do not indicate a positive effect of private pension expenditure on income inequality. In contrast, the negative coefficients suggest that private pension expenditure as a percentage of GDP is negatively related to income inequality among the elderly. Model 2 indicates also a negative coefficient for private pension expenditure as percentage of total pension expenditure, but the Models 3 and 5 show a positive effect for the private share of the pension provision, albeit not significant. However, when pension expenditure is expressed in dollars per pensioner, to exclude any denominator effect of GDP, the results indicate a negative effect for the private pension expenditure as a share of total pension expenditure again. This implies that higher spending on private pensions in general, and a shift from public to private pensions in particular, are *not* associated with higher income inequality among the elderly. Turning to poverty, all measures for private pension provision are not significantly related to poverty among the elderly.

The results for total pension expenditure are comparable to the case of public pension expenditures. Total pension expenditure as a percentage of GDP, which consists of the sum of public and private pension expenditure, is negatively and significantly correlated with poverty among the elderly, while no significant correlation can be observed between total pension expenditures and income inequality among the elderly.

As to graying populations, the results indicate that the effect of graying on income inequality and poverty among the elderly is limited. It seems that the percentage of the population aged 65 and over is slightly negatively correlated with income inequality among the elderly, while no correlation can be observed between this variable and poverty among the elderly. The results suggest that there is no clear linkage between GDP per capita and income inequality among the elderly. However, GDP per capita is positively and significantly associated with poverty rates among the elderly.

In concise, the results of the regression analyses suggest that higher private expenditure for pensions as a percentage of GDP, per pensioner and as a share of total pension expenditure are not associated with higher levels of income inequality among the population aged 65 and above. Furthermore, the regression analyses indicate a poor linkage between private provisions of pension schemes and poverty rates among the elderly. Taken together, these results do *not* provide evidence for the expectation that shifts from public to private pension provision are associated with higher levels of income inequality.

Table 3A. Panel data regressions of pension expenditures and income inequality (s80/s20) among the elderly (65+)

	(1)	(2)	(3)	(4)	(5)	(6)
Public pension expenditures (% GDP)	-0.13 (0.12)		-0.07 (0.12)		-0.19 (0.13)	
Private pension expenditures (% GDP)	-0.45*** (0.17)		-1.22** (0.52)		-0.87** (0.42)	
Private share (% total pension expenditures)		-3.41** (1.52)	9.20 (5.85)		3.58 (4.77)	-6.82*** (2.52)
Total pension expenditures (% GDP)				-0.20 (0.13)		
Public pension expenditures per pensioner (/100)						-0.01* (0.01)
Private pension expenditures per pensioner (/100)						-0.01 (0.01)
Population aged 65 and over (% total)	-0.22** (0.11)	-0.22* (0.12)	-0.26** (0.11)	-0.18 (0.11)	-0.34*** (0.13)	
GDP per capita (/1000)					-0.09*** 0.03	0.00 (0.03)
Constant	8.96*** (2.14)	7.62*** (1.78)	8.99*** (2.02)	9.03*** (2.23)	13.74*** (2.92)	7.12*** (1.12)
Observations	135	135	135	135	135	135
Adj. R-squared	0.84	0.84	0.84	0.84	0.85	0.83
Rho	0.41	0.42	0.35	0.48	0.36	0.39

OLS regressions; unstandardized coefficients; panel-corrected standard errors in parentheses; Prais-Winsten transformation (AR (1) disturbances).
* Significant at the .10 level; ** at the .05 level; *** at the .01 level.
Each regression also includes country and year dummies (not shown here).
Countries included: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Sweden, and the United Kingdom.
Data sources: Income inequality (Eurostat, 2011); Pension expenditure: OECD Social Expenditure Database (2010).

Table 3B. Panel data regressions of pension expenditures and poverty (PL 60) among the elderly (65+)

	(7)	(8)	(9)	(10)	(11)	(12)
Public pension expenditures (% GDP)	-1.50* (0.83)		-1.13 (0.91)		-0.29 (1.14)	
Private pension expenditures (% GDP)	-1.09 (0.82)		-4.04 (3.31)		-5.23 (3.84)	
Private share (% total pension expenditures)		2.61 (11.96)	40.38 (48.43)		65.32 (56.73)	-0.95 (39.82)
Total pension expenditures (% GDP)				-1.34* (0.70)		
Public pension expenditures per pensioner (/100)						-0.11 (0.07)
Private pension expenditures per pensioner (/100)						-0.01 (0.15)
Population aged 65 and over (% total)	-0.54 (0.80)	-0.78 (0.76)	-0.70 (0.80)	-0.61 (0.78)	-0.02 (0.64)	
GDP per capita (/1000)					0.81** (0.34)	1.08*** (0.30)
Constant	42.75*** 11.58	30.42*** (11.49)	41.05*** (11.46)	42.37*** (11.67)	1.38 (16.85)	12.50 (15.06)
Observations	154	154	154	154	154	154
Adj. R-squared	0.79	0.78	0.79	0.79	0.80	0.80
Rho	0.63	0.66	0.63	0.64	0.63	0.59

OLS regressions; unstandardized coefficients; panel-corrected standard errors in parentheses; Prais-Winsten transformation (AR (1) disturbances).
* Significant at the .10 level; ** at the .05 level; *** at the .01 level.
Each regression also includes country and year dummies (not shown here).
Countries included: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Sweden, and the United Kingdom.
Data sources: Poverty (Eurostat, 2011); Pension expenditure: OECD Social Expenditure Database (2010).

4.3 Sensitivity analyses

Since the results are not in line with our expectations based on both theoretical and empirical literature on pension reform and income inequality, we perform a variety of robustness checks. First, we examine the dependence of the results on different specifications of the empirical model. Estimations without correction for autocorrelation or panel-corrected standard errors do not alter the result that shifts towards more private pensions are not correlated with higher income inequality or poverty levels among the elderly. With respect to the most important independent variable, the share of private pension expenditure as percentage of total pension expenditure, it should be noted that the variation within countries over time is rather small. In combination with country fixed-effects, this reduces in itself the chance to find any significant effects for this variable. Therefore, we ran the analyses also without country fixed-effects, which did not alter the results. In addition, we applied the Mundlak random effects specification[13] (Mundlak, 1978) to correct for the small variation over time in the independent variable, showing that our results are robust (shown in Table A1 of the Annex). Other specifications that we applied, such as first differences, log-transformations, lagged variables or the exclusion of year fixed-effects did not change the results. Neither do the results change if an independent variable as graying is excluded (Table A2) or if a measure for a country's wealth such as GDP per capita is included (Table A3).

To further probe the robustness of our results, we take into account that our analyses are based on unbalanced panels owing to a number of missing observations. This is especially the case for Scandinavian countries with regard to the inequality and poverty indicators. This could lead to biased results, since Denmark, Finland, Norway and Sweden have below average poverty and inequality levels. Therefore, we also ran regressions in which the number of observations is extended. Table A4 shows the regression results where both the dependent and the independent variables are linearly inter- and extrapolated. In Table A5 only the dependent variables are linearly inter- and extrapolated. Since extrapolation is associated with more uncertainty than interpolation, we also show the regression results for only interpolated dependent variables in Table A6. Tables A7 and A8 show the regression results of interpolated data for dependent variables using more sophisticated techniques such as cubic- and cubic spline interpolation respectively.[14] All tables show that our results are not biased by the missing observations. This is also confirmed by the results of regression analyses in which the group of Scandinavian countries is omitted (Table A9). These results are in line with the findings of Gustafsson and Johansson (1999), who found that the group of Scandinavian countries do not influence the results of regression analyses on income inequality and social expenditure very strongly. Moreover, the results are neither affected by excluding the countries one by one in the regression analyses (not reported). We also tested to what extent the results are driven by the countries with the largest shifts in the public/private-mix, namely Belgium, Italy and the Netherlands. Regressions without these three countries yielded similar results.

Finally, we examine the sensitivity of the results for the use of alternative indicators and data sources. With regard to poverty, the results of estimation of poverty lines among the elderly of 50 and 70 percent are comparable with the results of the poverty line of 60 percent (Table A10). Subsequently, Table A11 presents our main empirical specification for four different indicators for income inequality among the elderly based on data from the OECD (2008).[15]

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13 The empirical specification takes the form: $Q_{it} = \alpha + \beta X_{w,it} + \phi \overline{X}_{w,i} + \delta Z_{w,it} + \mu_i + \lambda_t + \varepsilon_{it}$. Interpretation of the model is similar to equation (1) except that $\overline{X}$ is the country-specific average of pension expenditure variables over time and $\mu_i \sim N(0, \sigma^2)$.

14 We use several inter- and extrapolation techniques such as linear inter- and extrapolation, cubic interpolation and cubic spline interpolation. For applications of linear interpolation, see for example L'horty and Rault (2003), Clarke et al. (2008), Stern (2005) and Toroj (2008). An example of cubic spline interpolation in economics, which is based on polynomial instead of linear methods, can be found in Nanda and Ross (2008).

15 The main advantage of these OECD data is the availability of more sophisticated income inequality indicators. However, the most important disadvantage of these data is that at most 6 data points per country are

Our results with respect to the linkage between the share of private pension expenditure and income inequality among the elderly appear to be robust for Gini coefficients before and after taxes and transfers, the standard coefficient of variation and the mean log deviation. Additionally, the replication of the results presented in Table 3 with Gini coefficients[16] and poverty lines[17] among the elderly from the Luxembourg Income Study (LIS, 2011) confirm our empirical results. As to the independent variable, the measures for private pension expenditure can be disaggregated into mandatory and voluntary private pension expenditure. The results of the regression analyses with the disaggregated measure do not differ from the results with the aggregated measures (Table A12). In summary, the combined evidence of these robustness checks suggest that our results are robust with respect to different specifications, variables and data sources.

5. Discussion

A number of tentative explanations is conceivable for our main finding that shifts towards relatively more private pensions are not related to higher levels of income inequality among the elderly. The level of supplementary pension benefits is often strongly related to the income level during working life. A more private pension provision therefore leads to a higher supplementary pension for higher incomes than for lower incomes. But it could be possible that even though the absolute increase in private pension benefits is smaller for lower incomes than for higher incomes, the relative increase for lower incomes is much larger than for higher incomes. This is illustrated by Myles (2002) in a study on pension reform in Canada in the beginning of the 1990s. Burtless (2006) also states that the effects of changes in the public/private-mix of pensions on replacement rates - the income from pensions relative to income from work in the past - vary along the income distribution. A possible scenario is that the coverage of private pensions has increased and that this is mainly the case for lower income groups. This can be an explanation for the fact that we did not find a relationship between shifts in the public/private-mix of pensions and income inequality and poverty among the elderly. Hence, further research at the macro-level could be focused on specifying the effects of pension reform for different quintiles of the income distribution.

In addition, it should be noted that the analyses in this study do not account for determinants of income at the individual level. On the one hand, this concerns general personal characteristics which determine income such as education. On the other hand, current individual pension benefits are determined by long-term effects such as previous wages, contributions paid and macro-economic conditions in the past. It is hardly possible to capture this time dimension in a macro-level analysis. Another factor that might influence pension benefits and incomes of elderly people is the prevalence of deficiencies in contributions paid in the past (Esping-Anderson and Myles, 2006). Future empirical research based on micro-data, in which it is possible to control for individual characteristics, may provide more insight into the relationship between pension reform and income inequality.

Finally, the use of pension expenditure data at the macro-level implies some restrictions. Much information can be lost in classifying pension programmes into pillars (Whitehouse, 2002). Moreover, as mentioned above, shifts in pension expenditure can only give a rough indication of changes in institutional characteristics of pension systems.

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available in the waves from mid 1970s till mid 2000s. Another advantage is that these data are available for a longer period and a larger group of countries than the Eurostat (2011a) data. Our results also hold for this larger country group and longer period (see Table A11).

16 The Gini coefficient among the elderly is provided by Wang and Caminada (2011) who constructed this indicator from the micro data.

17 The 40, 50 and 60 percent poverty lines among the elderly are taken from the LIS Key Data (2011).

6. Conclusion

In many industrialized countries, public pension systems have been reformed in order to alleviate the pressure on public finances resulting from ageing populations. This has often led to shifts in the pension provision from public to private. The average magnitude of these shifts remains limited, but in a number of countries there have been substantial changes. Since private pensions are probably less redistributive than public pensions, these shifts could be hypothesized to lead to more income inequality among retirees. This study contributes to the income inequality and pension literature by empirically analyzing the income effects of shifts in the public/private-mix of pensions in 15 European countries for the period 1995-2007, using pooled time series cross-section regression analyses. The most important finding is that shifts in the pension provision from public to private do not (yet) seem to entail higher levels of income inequality or poverty among people aged 65 and older. Intriguingly, this finding is not in line with expectations in the literature on pension reform and income inequality (Hughes and Stewart, 2004; Weller, 2004: Oshio and Shimizutani, 2005; Fukawa, 2006; Arza, 2008; Milligan, 2008) and with literature on the redistributive effects of public and private social security in general (Caminada and Goudswaard, 2005; Goudswaard and Caminada, 2010). A tentative explanation for this finding is that more people in lower income deciles have been covered by private pension plans. As a result, the increases in the pension benefits of people with lower incomes were relatively larger than for people with higher incomes.

The policy implication of our findings seems to be that the pressure of the pension expenditures on public finances can be alleviated without serious consequences for income inequality or poverty among elderly people. However, this policy implication should be taken with much caution, even though the results are robust for other data sources and a broad range of alternative econometric specifications. As suggested before, our results could be explained by increases in the coverage of private supplementary pension schemes rather than policy reforms. A higher coverage of private programs also causes a shift from public to private, but will probably have a rather different distributional impact compared to cutting public pension benefits. In addition, empirical research at the macro-level goes along with a number of limitations with respect to institutional characteristics of pension systems and individual characteristics of pensioners.

Finally, it should be noted that our analysis does not include the years after 2007. This implies that we have no prospect of the income effects of the pension reforms which are triggered by the credit crisis at the beginning of the twenty-first century. The results of this study provide no reason to expect that recent reforms in many European countries will lead to more income inequality and higher poverty rates among the elderly. Future research should provide more insight into the answer to this question.

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Annex: Sensitivity analyses

Table 3 of the main text presents the results of panel data regressions of pension expenditures and social outcomes among the elderly (65+). Tables A1 to A13 below present the result of several robustness checks:

Table A1. Panel data regressions of pension expenditures and social outcomes among the elderly (65+) *using Mundlak Random Effects*

Table A2. Panel data regressions of pension expenditures and social outcomes among the elderly (65+) *excluding graying* (population aged 65 and over, % total)

Table A3. Panel data regressions of pension expenditures and social outcomes among the elderly (65+) *including GDP per capita*

Table A4. Panel data regressions of pension expenditures and social outcomes among the elderly (65+) *with linearly inter- and extrapolated dependent and independent variables*

Table A5. Panel data regressions of pension expenditures and social outcomes among the elderly (65+) *with linearly inter- and extrapolated independent variables*

Table A6. Panel data regressions of pension expenditures and social outcomes among the elderly (65+) *with linearly interpolated independent variables*

Table A7. Panel data regressions of pension expenditures and social outcomes among the elderly (65+) *with cubically interpolated independent variables*

Table A8. Panel data regressions of pension expenditures and social outcomes among the elderly (65+) *with cubically spline interpolated independent variables*

Table A9. Panel data regressions of pension expenditures and social outcomes among the elderly (65+) *excluding Scandinavian countries*

Table A10. Panel data regressions of pension expenditures and *different poverty lines (PL 50, PL 70)* among the elderly (65+)

Table A11. Panel data regressions of pension expenditures and income inequality among the elderly (65+) *using income distribution variables of OECD (2010) instead of Eurostat (2011)*

Table A12. Panel data regressions of pension expenditures and social outcomes among the elderly (65+) *using a decomposition of private pension expenditures into mandatory and voluntary expenditures*

Table A1. Panel data regressions of pension expenditures and social outcomes among the elderly (65+) ***using Mundlak Random Effects***

	Income inequality (s80/s20) among the elderly (65+)			Poverty (PL 60) among the elderly (65+)		
	(1)	(2)	(3)	(4)	(5)	(6)
Public pension expenditures (% GDP)	-0.08 (0.17)			-2.30** (1.09)		
Private pension expenditures (% GDP)	-0.46*** (0.14)			-1.68 (1.13)		
Private share (% total pension expenditures)		-3.67* (1.96)			-6.02 (8.83)	
Total pension expenditures (% GDP)			-0.17 (0.19)			-2.32** (1.05)
Population aged 65 and over (% total)	-0.15 (0.20)	-0.13 (0.16)	-0.13 (0.20)	-0.10 (1.23)	-0.56 (1.13)	-0.25 (1.17)
Constant	5.13*** (1.95)	6.54** (2.81)	4.84*** (1.86)	25.23 (18.01)	28.06 (18.72)	25.08 (17.33)
Country dummies	No	No	No	No	No	No
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
AR(1) disturbances	No	No	No	No	No	No
Observations	135	135	135	154	154	154
R-squared: within	0.30	0.28	0.27	0.14	0.07	0.14
Rho	0.74	0.82	0.78	0.83	0.82	0.86

OLS regressions; unstandardized coefficients; panel-corrected standard errors in parentheses; Prais-Winsten transformation.
* Significant at the .10 level; ** at the .05 level; *** at the .01 level.
The country-specific averages of the pension variables are not reported.

Table A2. Panel data regressions of pension expenditures and social outcomes among the elderly (65+) ***excluding graying***

	Income inequality (s80/s20) among the elderly (65+)			Poverty (PL 60) among the elderly (65+)		
	(1)	(2)	(3)	(4)	(5)	(6)
Public pension expenditures (% GDP)	-0.18 (0.14)			-1.63** (0.79)		
Private pension expenditures (% GDP)	-0.41** (0.18)			-1.02 (0.84)		
Private share (% total pension expenditures)		-2.99** (1.25)			3.93 (11.05)	
Total pension expenditures (% GDP)			-0.23 (0.14)			-1.43** (0.70)
Population aged 65 and over (% total)						
Constant	6.25*** (1.48)	4.37*** (0.11)	34.23*** (7.50)	36.13*** (8.24)	18.86*** (1.46)	34.23*** (7.50)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
AR(1) disturbances	Yes	Yes	Yes	Yes	Yes	Yes
Observations	135	135	135	154	154	154
Adj. R-squared	0.84	0.83	0.84	0.79	0.78	0.79
Rho	0.42	0.42	0.47	0.62	0.65	0.64

OLS regressions; unstandardized coefficients; panel-corrected standard errors in parentheses; Prais-Winsten transformation.
* Significant at the .10 level; ** at the .05 level; *** at the .01 level.

Table A3. Panel data regressions of pension expenditures and social outcomes among the elderly (65+) ***including GDP per capita***

	Income inequality (s80/s20) among the elderly (65+)			Poverty (PL 60) among the elderly (65+)		
	(1)	(2)	(3)	(4)	(5)	(6)
Public pension expenditures (% GDP)	-0.22* (0.12)			-0.94 (1.01)		
Private pension expenditures (% GDP)	-0.58*** (0.18)			-0.50 (0.97)		
Private share (% total pension expenditures)		-4.39*** (1.51)			7.98 (14.05)	
Total pension expenditures (% GDP)			-0.28** (0.14)			-0.78 (0.87)
GDP per capita (/1000)	-0.10*** (0.03)	-0.08** (0.03)	-0.08*** (0.03)	0.71** (0.36)	0.81*** (0.29)	0.70** (0.36)
Population aged 65 and over (% total)	-0.33*** (0.12)	-0.32** (0.13)	-0.27** (0.12)	0.13 (0.65)	0.11 (0.64)	0.04 (0.67)
Constant	14.03*** (2.95)	11.05*** (2.35)	13.32*** (3.06)	9.03 (16.89)	-3.42 (9.30)	8.98 (16.52)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
AR(1) disturbances	Yes	Yes	Yes	Yes	Yes	Yes
Observations	135	135	135	154	154	154
Adj. R-squared	0.85	0.84	0.85	0.79	0.79	0.79
Rho	0.36	0.34	0.46	0.64	0.65	0.65

OLS regressions; unstandardized coefficients; panel-corrected standard errors in parentheses; Prais-Winsten transformation.
* Significant at the .10 level; ** at the .05 level; *** at the .01 level.

Table A4. Panel data regressions of pension expenditures and social outcomes among the elderly (65+) ***with linearly inter- and extrapolated dependent and independent variables***

	Income inequality (s80/s20) among the elderly (65+)			Poverty (PL 60) among the elderly (65+)		
	(1)	(2)	(3)	(4)	(5)	(6)
Public pension expenditures (% GDP)	0.08 (0.07)			-0.06 (0.48)		
Private pension expenditures (% GDP)	-0.34*** (0.12)			-0.03 (0.77)		
Private share (% total pension expenditures)		-5.31*** (1.64)			1.42 (12.04)	
Total pension expenditures (% GDP)			0.07 (0.09)			0.03 (0.55)
Population aged 65 and over (% total)	-0.00 (0.10)	0.03 (0.10)	0.03 (0.09)	1.64*** (0.55)	1.58*** (0.48)	1.57*** (0.51)
Constant	3.77*** (1.46)	4.14*** (1.52)	3.16* (1.83)	-3.69 (6.74)	-3.53 (7.54)	-3.69 (7.64)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
AR(1) disturbances	Yes	Yes	Yes	Yes	Yes	Yes
Observations	195	195	195	195	195	195
Adj. R-squared	0.75	0.76	0.75	0.72	0.71	0.71
Rho	0.55	0.58	0.61	0.70	0.74	0.73

OLS regressions; unstandardized coefficients; panel-corrected standard errors in parentheses; Prais-Winsten transformation.
* Significant at the .10 level; ** at the .05 level; *** at the .01 level.

Table A5. Panel data regressions of pension expenditures and social outcomes among the elderly (65+) ***with linearly inter- and extrapolated independent variables***

	Income inequality (s80/s20) among the elderly (65+)			Poverty (PL 60) among the elderly (65+)		
	(1)	(2)	(3)	(4)	(5)	(6)
Public pension expenditures (% GDP)	0.18 (0.10			-0.02 (0.58)		
Private pension expenditures (% GDP)	-0.25** (0.13			0.03 (0.72)		
Private share (% total pension expenditures)		-5.20*** (1.57)			-1.70 (9.47)	
Total pension expenditures (% GDP)			0.07 (0.09)			0.00 (0.52)
Population aged 65 and over (% total)	-0.01 (0.12)	0.04 (0.12)	0.05 (.11)	1.68*** (0.44)	1.67*** (0.36)	1.66*** (0.43)
Constant	2.76 (2.06)	3.97** (.76)	2.90 (2.03)	-4.75 (5.85)	-4.82 (5.61)	-4.66 (5.90)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
AR(1) disturbances	Yes	Yes	Yes	Yes	Yes	Yes
Observations	189	189	189	189	189	189
Adj. R-squared	0.76	0.76	0.75	0.72	0.71	0.71
Rho	0.60	0.60	0.61	0.71	0.72	0.71

OLS regressions; unstandardized coefficients; panel-corrected standard errors in parentheses; Prais-Winsten transformation.
* Significant at the .10 level; ** at the .05 level; *** at the .01 level.

Table A6. Panel data regressions of pension expenditures and social outcomes among the elderly (65+) ***with linearly interpolated independent variables***

	Income inequality (s80/s20) among the elderly (65+)			Poverty (PL 60) among the elderly (65+)		
	(1)	(2)	(3)	(4)	(5)	(6)
Public pension expenditures (% GDP)	-0.09 (0.11)			-1.38 (0.64)		
Private pension expenditures (% GDP)	-0.35*** (0.13)			-1.05 (0.79)		
Private share (% total pension expenditures)		-2.90** (1.44)			-1.33 (10.64)	
Total pension expenditures (% GDP)			-0.16 (0.11)			-1.22** (0.57)
Population aged 65 and over (% total)	-0.21** (0.10)	-0.21* (0.11)	-0.18* (0.10)	-0.45 (0.57)	-0.63 (0.54)	-0.50 (0.56)
Constant	8.43*** (1.91)	7.47*** (1.63)	8.50*** (1.94)	40.28*** (.55)	28.40*** (8.35)	39.54*** 8.64
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
AR(1) disturbances	Yes	Yes	Yes	Yes	Yes	Yes
Observations	164	164	164	169	169	169
Adj. R-squared	0.83	0.83	0.83	0.75	0.73	0.74
Rho	0.43	0.45	0.49	0.62	0.66	0.64

OLS regressions; unstandardized coefficients; panel-corrected standard errors in parentheses; Prais-Winsten transformation.
* Significant at the .10 level; ** at the .05 level; *** at the .01 level.

Table A7. Panel data regressions of pension expenditures and social outcomes among the elderly (65+) ***with cubically interpolated independent variables***

	Income inequality (s80/s20) among the elderly (65+)			Poverty (PL 60) among the elderly (65+)		
	(1)	(2)	(3)	(4)	(5)	(6)
Public pension expenditures (% GDP)	-0.09 (0.11)			-1.39** (0.64)		
Private pension expenditures (% GDP)	-0.33** (0.14)			-1.02 (0.78)		
Private share (% total pension expenditures)		-2.73* (1.47)			1.58 (10.51)	
Total pension expenditures (% GDP)			-0.15 (0.11)			-1.23** (0.56)
Population aged 65 and over (% total)	-0.20** (0.10)	-0.21* (0.11)	-0.18* (0.10)	-0.45 (0.52)	-0.64 (0.50)	-0.51 (0.52)
Constant	8.37*** (1.97)	7.43*** (1.67)	8.46*** (2.00)	40.41*** (8.02)	28.58*** (7.70)	39.73*** (8.09)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
AR(1) disturbances	Yes	Yes	Yes	Yes	Yes	Yes
Observations	164	164	164	168	168	168
Adj. R-squared	0.83	0.82	0.82	0.75	0.74	0.75
Rho	0.48	0.48	0.53	0.62	0.65	0.63

OLS regressions; unstandardized coefficients; panel-corrected standard errors in parentheses; Prais-Winsten transformation.
* Significant at the .10 level; ** at the .05 level; *** at the .01 level.

Table A8. Panel data regressions of pension expenditures and social outcomes among the elderly (65+) ***with cubically spline interpolated independent variables***

	Income inequality (s80/s20) among the elderly (65+)			Poverty (PL 60) among the elderly (65+)		
	(1)	(2)	(3)	(4)	(5)	(6)
Public pension expenditures (% GDP)	-0.09 (0.11)			-1.40* (0.73)		
Private pension expenditures (% GDP)	-0.32** (0.14)			-1.02 (0.85)		
Private share (% total pension expenditures)		-2.67* (1.48)			2.83 (12.21)	
Total pension expenditures (% GDP)			-0.15 (0.11)			-1.26* (0.65)
Population aged 65 and over (% total)	-0.21* (0.11)	-0.21* (0.11)	-0.18* (0.11)	-0.47 (0.66)	-0.69 (0.64)	-0.55 (0.63)
Constant	8.39*** (2.00)	7.47*** (1.71)	8.51*** (2.07)	40.95*** (9.80)	29.09*** (9.80)	40.45*** (9.88)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
AR(1) disturbances	Yes	Yes	Yes	Yes	Yes	Yes
Observations	160	160	160	162	162	162
Adj. R-squared	0.83	0.83	0.83	0.77	0.76	0.77
Rho	0.49	0.49	0.54	0.64	0.67	0.65

OLS regressions; unstandardized coefficients; panel-corrected standard errors in parentheses; Prais-Winsten transformation.
* Significant at the .10 level; ** at the .05 level; *** at the .01 level.

Table A9. Panel data regressions of pension expenditures and social outcomes among the elderly (65+) ***excluding Scandinavian countries***

	Income inequality (s80/s20) among the elderly (65+)			Poverty (PL 60) among the elderly (65+)		
	(1)	(2)	(3)	(4)	(5)	(6)
Public pension expenditures (% GDP)	0.00 (0.11)			-1.58* (0.84)		
Private pension expenditures (% GDP)	-0.31** (0.16)			-0.90 (0.81)		
Private share (% total pension expenditures)		-2.77* (1.56)			7.10 (12.12)	
Total pension expenditures (% GDP)			-0.06 (0.11)			-1.30* (0.69)
Population aged 65 and over (% total)	-0.24** (0.11)	-0.22** (0.11)	-0.21* (0.11)	-0.94 (0.75)	-1.18 (0.73)	-1.06 (0.74)
Constant	7.96*** (1.81)	7.70*** (1.67)	8.00** (1.85)	49.86*** (11.40)	36.79*** (10.92)	49.06*** (11.46)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
AR(1) disturbances	Yes	Yes	Yes	Yes	Yes	Yes
Observations	112	112	112	123	123	123
Adj. R-squared	0.85	0.86	0.86	0.79	0.78	0.79
Rho	0.45	0.48	0.54	0.61	0.65	0.63

OLS regressions; unstandardized coefficients; panel-corrected standard errors in parentheses; Prais-Winsten transformation.
* Significant at the .10 level; ** at the .05 level; *** at the .01 level.

Table A10. Panel data regressions of pension expenditures and ***different poverty lines (PL 50, PL 70)*** among the elderly (65+)

	Poverty (PL 50) among the elderly (65+)			*Poverty (PL 70)* among the elderly (65+)		
	(1)	(2)	(3)	(4)	(5)	(6)
Public pension expenditures (% GDP)	-1.98***			-1.77**		
	(0.59)			(0.86)		
Private pension expenditures (% GDP)	-1.88**			-1.40		
	(0.92)			(1.19)		
Private share (% total pension expenditures)		-6.62			-5.35	
		(11.39)			(12.93)	
Total pension expenditures (% GDP)			-1.91***			-1.66**
			(0.53)			
Population aged 65 and over (% total)	-0.87*	-1.16**	-0.90*	0.18	-0.11	-0.12
	(0.51)	(0.47)	(0.49)	(0.53)	(0.51)	(0.49)
Constant	43.26***	26.92***	42.99***	44.08***	30.05***	43.90***
	(6.22)	(7.16)	(6.38)	(8.88)	(7.93)	(9.03)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
AR(1) disturbances	Yes	Yes	Yes	Yes	Yes	Yes
Observations	128	128	128	128	128	128
Adj. R-squared	0.79	0.78	0.79	0.88	0.88	0.88
Rho	0.42	0.38	0.43	0.60	0.59	0.60

OLS regressions; unstandardized coefficients; panel-corrected standard errors in parentheses; Prais-Winsten transformation.
* Significant at the .10 level; ** at the .05 level; *** at the .01 level.

Table A11. Panel data regressions of pension expenditures and income inequality among the elderly (65+) ***using income distribution variables of OECD (2010) instead of Eurostat (2011)***

	Gini before taxes and transfers (1)	Gini after taxes and transfers (2)	Standard coefficient of variation (3)	Mean log deviation (4)	Gini before taxes and transfers (5)	Gini after taxes and transfers (6)	Standard coefficient of variation (7)	Mean log deviation (8)
Private share (% total pension expenditures)	-0.09 (0.20)	-0.07*** (0.02)	-0.03 (0.04)	-0.13*** (0.04)	-0.10 (0.24)	-0.13*** (0.04)	-0.01*** (0.00)	-0.22*** (0.07)
Constant	0.76*** (0.08)	0.32*** (0.01)	1.83*** (1.40)	0.20*** (0.02)	0.81*** (0.01)	0.31*** (0.00)	1.02*** (0.20)	0.23*** (0.03)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR(1) disturbances	No	No	No	No	No	No	No	No
Year restriction	***No***	***No***	***No***	***No***	***Yes***	***Yes***	***Yes***	***Yes***
Country restriction	***No***	***No***	***No***	***No***	***Yes***	***Yes***	***Yes***	***Yes***
Observations	85	108	96	96	37	45	42	42
Adj. R-squared	0.72	0.95	0.45	0.97	0.88	0.93	0.79	0.89

OLS regressions; unstandardized coefficients; panel-corrected standard errors in parentheses; Prais-Winsten transformation.
* Significant at the .10 level; ** at the .05 level; *** at the .01 level.
The coefficients and standard errors are multiplied by a factor of 100 in the columns (1), (2), (4), (5), (6) and (8).
The full time span covers the years 1985 – 2005. The restricted period covers the years 1995 – 2005 to make the time span comparable to our main analyses based on the data from Eurostat (2011a).
The full country group includes the 15 European countries and Australia, Canada, Czech Republic, Hungary, Iceland, Japan, Korea, Mexico, New Zealand, Poland, Slovak Republic, Switzerland, Turkey and the United States. The countries are restricted to the 15 European countries from the Eurostat (2011a) data set to make the analyses comparable.

Table A12. Panel data regressions of pension expenditures and social outcomes among the elderly (65+) ***using a decomposition of private pension expenditures into mandatory and voluntary expenditures***

	Income inequality (s80/s20) among the elderly (65+)			Poverty (PL 60) among the elderly (65+)		
	(1)	(2)	(3)	(4)	(5)	(6)
Public pension expenditures (% GDP)	-0.43* (0.23)			-1.66 (2.08)		
Mandatory pension expenditures (% GDP)	-0.37 (0.30)			-1.40 (2.50)		
Voluntary pension expenditures (% GDP)	-0.76*** (0.13)			-0.66 (0.84)		
Voluntary share (% total pension expenditures)		-3.31** (1.39)	-7.55* (1.14)		12.61 (11.95)	-1.83 (10.23)
Mandatory share (% total pension expenditures)			1.57 (1.90)			1.71 (17.89)
Population aged 65 and over (% total)	0.17** (0.08)	-0.19* (0.11)	0.18** (0.09)	1.65 (1.13)	-0.84 (0.75)	1.45 (1.13)
Constant	omitted	4.39* (0.11)	1.30 (1.70)	10.02 (29.26)	30.99*** (11.25)	-6.74 (21.34)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
AR(1) disturbances	Yes	Yes	Yes	Yes	Yes	Yes
Observations	49	135	49	60	154	60
Adjusted R-squared	0.67	0.84	0.67	0.82	0.78	0.82
Rho	-0.02	0.41	-0.04	0.44	0.65	0.46

OLS regressions; unstandardized coefficients; panel-corrected standard errors in parentheses; Prais-Winsten transformation.
* Significant at the .10 level; ** at the .05 level; *** at the .01 level.

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