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An Empirical Analysis Using New and  
Revised OECD Data

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# **Public/private pension mix, income inequality, and poverty among the elderly in Europe: an empirical analysis using new and revised OECD data**

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## **Abstract**

Prior studies have suggested that higher public pensions are associated with lower income inequality among the elderly, whereas the reverse is true for private pensions. Van Vliet *et al.* (2012) empirically test whether relative shifts from public to private pension schemes entail higher levels of income inequality among the elderly using panel data from the OECD SOCX and the EU-SILC databases. Contrasting earlier empirical studies using either cross-sectional or time-series data, they do not find evidence that shifts from public to private pension provision are associated with higher levels of income inequality or poverty among elderly. The aim of the current paper is to extend the analysis of Van Vliet *et al.* by 1) adding additional countries, 2) adding additionally available years, and 3) using revised OECD SOCX data. In contrast to Van Vliet *et al.*, we find that a greater relative importance of private pensions is associated with higher levels of income inequality and poverty among elderly. A central explanation of the difference in conclusions stems from revision of OECD SOCX data.

**Key words:** income inequality, poverty, public/private-mix, elderly, welfare state, pensions

## 1. Introduction

Several studies have analysed the adequacy of (future) pensions income approach (e.g. Scholz *et al.*, 2006; Haveman *et al.*, 2007; Crawford & O’Dea, 2012; Knoef *et al.*, 2016). Although a replacement rate of 70 per cent of final gross earnings is often used as a rule of thumb for an adequate pensions (Haveman *et al.*, 2007), Chybalski and Marcinkiewicz (2016) argue that the replacement rate is an imperfect indicator to measure the adequacy of pensions in cross-country analyses. A disadvantage of the replacement rate as a sufficient indicator of pension adequacy is that it only focuses on the aspect of consumption smoothing. Instead, Chybalski and Marcinkiewicz (2016) propose using an indicator that relates income to the at-risk-of-poverty rate (PL 60) and income inequality (S80/S20) among the elderly. This indicator should do more right to the dimension of protecting retirees from poverty than replacement rates.

Van Vliet, Been, Caminada, and Goudswaard (2012) hypothesize that the pension reforms that governments have adopted over the recent years in order to relieve pressure on public finances, entailing a relative shift from public to private pension schemes, has led to higher levels of income inequality (S80/S20) and (at-risk-of) poverty (PL 60) among the elderly. However, the authors do not find evidence that shifts from public to private pension provision are associated with higher levels of income inequality or poverty among elderly people. The authors’ conclusions are based on an empirical analysis of the distributional effects of shifts from public to private pension provision in 15 European countries for the period 1995–2007 using data from the *OECD Social Expenditure (SOCX)* database (2010) and the *EU-SILC* database (2011). Despite the fact that Van Vliet *et al.* are the first to analyse this issue with panel data and that the conclusions appear to be robust for a wide range of econometric specifications, the results contradict both theoretical expectations and prior empirical analyses using time-series (e.g. Milligan, 2008) or cross-sectional data (e.g. Welling, 2004).

The aim of the present paper is twofold. First, it extends the empirical analysis of Van Vliet *et al.* (2012) with newly released data. We argue that an update of Van Vliet *et al.* is relevant because of additionally available years and because of substantial revisions in the OECD SOCX data. Our second contribution is therefore to show the dependence of conclusions on the revisions in the OECD SOCX data. This might be of interest to more scholars using OECD SOCX data.

To analyse the association between shifts from public to private pension provision and the levels of income inequality and poverty among elderly people, we extend the analysis of Van Vliet *et al.* mainly in three ways:

1. We add Spain and Switzerland to the 15 European countries.
2. We add additionally available data years:
  - The comparison of pension spending across countries and over time now covers the years 1995-2011.
  - The comparison of income inequality and (at-risk-of) poverty among the elderly across countries and over time now covers the years 1995-2011.
  - The regression analysis now covers the years 1995-2011.
3. We use substantially revised data series of the OECD Social Expenditure database.

Following Van Vliet *et al.*, we first analyse to what extent reforms have resulted in a trend towards relatively more private pension provision across European countries. To that end, we used the most recent release of the OECD Social Expenditure database (2015). There have been shifts from public to private in the pension systems of many countries in the period 1995–2011, but there is substantial variation across countries. Country-specific shifts – in the extended period - are larger than reported in Van Vliet *et al.* Subsequently, we compare income inequality and poverty among the elderly across countries and over time using the latest release of the EU-SILC database (2015). This database allows us to compare the level and trends in income inequality and poverty across countries for the period 1995-2011. Finally, to examine the extent to which shifts in the public/private pension mix have influenced income inequality levels and poverty rates among the elderly we combine the data of OECD Social Expenditure and EU-SILC to perform a pooled time series cross-section regression analyses for 17 European countries covering 1995-2011.

The main result of Van Vliet *et al.* is that a relatively higher private share of pension provision in a country is not associated with higher levels of income inequality or poverty among the elderly in that country. In contrast to Van Vliet *et al.*, the main result of our analysis is that a relatively higher private share of pension provision in a country is associated with higher levels of income inequality and poverty among the elderly in that country. Also, we find that higher spending on public pension schemes is associated with lower levels of both income inequality and poverty among the elderly. These conclusions are in line with the theoretical expectations and prior empirical analyses using time-series and cross-sectional

data. We conclude that the different conclusions can partially be explained by the revised OECD SOCX data.

The article is structured as follows. An overview of the literature is presented in Section 2. Section 3 discusses the data and methodology used. Section 4 presents descriptive statistics and the results of the regression analyses. The differences between the present analysis and Van Vliet *et al.* are examined in section 5. A discussion of the results follows in section 6 and section 7 concludes.

## 2. Literature

*A priori* it is expected that the privatisation of pension plans, which 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 (Barr & Diamond, 2009; OECD, 2009; Orenstein, 2011), has led to higher levels of income inequality among the elderly. Some public pension plans are based on income-related funding and flat rate benefits, or benefits that are based on years of work, but not on past earnings. These schemes relatively strongly benefit lower income groups. Other countries have earnings-related public pension schemes.<sup>1</sup> But these schemes may also show relatively equal outcomes, because of tax-financed non-contributory elements and a compressed benefit structure enforced by benefit ceilings. Therefore, public pensions are expected to generate a more equal income distribution and less poverty among the elderly.

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 between individuals. However, private pension plans may contain elements of redistribution. The OECD considers pensions provided by private bodies as social if they are compulsory or if they involve interpersonal redistribution (see section 3.1). Private earnings-related pension schemes, for example, may not be actuarially fair. Thresholds or ceilings generally distribute resources within generations in DB schemes, while risk-sharing redistributes across generations. Supplementary pension schemes in which contributions are tax exempt can stimulate the provision of private pension schemes (Yoo & de Serres, 2004). However, such tax advantages may primarily favour the wealthy as private pension plans are positively related to the income level in most countries (Goudswaard & Caminada, 2010). In addition, there has been a shift in several countries from DB plans to DC plans (OECD, 2015). Most DC plans are actuarially fair and do not involve interpersonal redistribution.<sup>2</sup>

Hence, it seems plausible that private pension schemes will generate less income redistribution from rich to poor than public programmes such that relative shifts from public to private pensions lead to higher income inequality among the elderly.

Empirically, Smeeding & Williamson (2001) concluded that high levels of public social spending are associated with low levels of income inequality and poverty. This can be explained by the finding that private social security arrangements generally entail less income redistribution than public social security (Pestieau, 1992; Pedersen, 1999; Behrendt, 2000; Goudswaard & Caminada, 2010). Explicitly focusing on public pensions as a component of social spending, a number of cross-sectional macro-level studies indicate that income inequality among older people is lower as larger shares of the income of the elderly consist of public pension benefits (Brown & Prus, 2004; Fukawa, 2006; Weller, 2004). Using a time-series analysis, Schirle (2009) finds that a larger private share in the pension provision is associated with an increasing income inequality among elderly people in Canada. Combining information on public and private pensions, Oshio & Shimizutani (2005) and Milligan (2008) conclude that a larger public share in the pension provision is related to less poverty among elderly people. Hughes & Steward (2004) find that increases in the private share are associated with an increase in the poverty rate among the elderly.

A similar conclusion is drawn by Ginn & Arber (1999) using micro-level data regarding relative contributions of private pensions to total retirement income in the UK. Neugschwender (2014) also finds evidence for more income inequality and poverty among younger retired cohorts due to higher dependency on personal pension plans using microdata from six European countries. This is consistent with the finding that public pension benefits are one of the main components of redistribution (Wang *et al.*, 2012; Hwang, 2016).

### **3. Data, measures and method**

#### ***3.1 Public and private pension expenditure***

To examine changes in the public/private-mix of pension provision, we use data from the most recent OECD Social Expenditure Database (2015). This database contains social expenditure data (measured by the benefits) on both public and private pension schemes. In this database, programmes are classified as social when two conditions are simultaneously satisfied (Adema, 2010; Adema & Ladaïque, 2009). First, they have to be intended to serve a social purpose, such as old-age. 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. 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. The distinction between public and private social security is based on the institution that controls the financial flows, namely public agencies or private bodies. For an extensive discussion on the classification of public and private pensions, we refer to Pedersen (2004) and De Deken (2013). Private pensions can be mandatory or voluntary. An example of the former are supplementary schemes negotiated by social partners in collective labour contracts (second pension pillar). Voluntary individual retirement plans are also considered as ‘social’, and are thus included in the data base, if the contributions are tax advantaged. Private pensions which are based on individual risk-profiles and are bought at market prices, without tax advantages, are not classified as ‘social’ and are not included in the data base. In practice, however, it is difficult to make a clear distinction between voluntary private pensions that are considered as ‘social’ and those who are not. Contributions have been paid over a very long time and the nature of the contributions and the tax treatment may have changed over time. Data do not always allow for an unambiguous classification. The OECD decides on a case-by-case basis whether or not private pension plans contain social elements and are included in the SOCX database (Adema and Ladaique, 2009, p.15). Hence, the definition of private pension plans might slightly differ between countries as well as within countries over time as our analysis in Section 5 suggests.<sup>3</sup>

Our study analyses public and private social pension expenditure, both expressed as percentage of GDP.<sup>4</sup> 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. Furthermore, the indicator includes expenditures on incomes of people who retired at the statutory retirement age and of early retirees.<sup>5</sup> Expenditures on survivor pensions are not included in the indicators.

In a cross-national analysis at the macro-level, expenditure indicators have some limitations. 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. To control for the ageing of populations, we include a control variable measuring the percentage of the population aged 65 and above. For this measure, we used

data from Eurostat (2015). 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 standardised 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 (2015).<sup>6</sup> 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 equivalized disposable income of the top 20 per cent incomes of elderly by the total equivalized disposable income of the bottom 20 per cent 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, we would also like to use the *Gini-coefficient* or the *Atkinson index* as 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, which makes it difficult to use these measures in the regression analysis.

Poverty among the elderly is measured by the percentage of people aged 65 and over who live below the poverty line of 60 per cent of median equivalised (disposable) income of the total population. This poverty line of 60 per cent is also officially used as poverty measure by the European Union. A higher value of this indicator implies a higher rate of at-risk-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. This paper explicitly focus on the elderly only instead of total population (although we apply a poverty threshold of 60 per cent of equivalised disposable income of the total population). Restricting the analysis to the elderly avoids some of the problems inherent to comparisons of incomes between people who are at different stages in their lives. Moreover, we employ only two simple measures of income inequality and poverty, while a variety of strategies exist for the operationalisation of income inequality and poverty. Using a variety of income inequality and poverty measures would not contribute that much to our



empirical strategy, although different measures may lead to other outcomes depending on the specific characteristics of the income distributions across countries. Of course, several European countries will be more (less) successful in reducing at-risk-of-poverty at 40 or 50 per cent thresholds rather than reducing the risk of poverty at the EU-agreed upon level (60 percent threshold). However, applying a bunch of income inequality and poverty measures goes beyond the scope of this paper.

### 3.3 Method

To analyse the association between the public/private pension-mix and income inequality and poverty among the elderly, we follow Van Vliet *et al.* (2012) and run a pooled time series cross-section regression analysis which takes the form:

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

In Equation 1,  $Q$  represents the dependent variables of income inequality (S80/S20) or (at-risk-of) poverty (PL 60) among the elderly.  $X$  represents pension variables, namely 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).  $Z$  captures two control variables, being ageing and GDP per capita (constant (2000) prices ppp)). For the latter variable, we use data from the OECD (2015). As the variation in income inequality and poverty among the elderly may be associated with unobserved country- and year-specific effects, country ( $i$ ) and year ( $t$ ) dummies are modelled by  $\mu$  and  $\lambda$ , respectively. Kittel & Winner (2005) argue that using country- and time-dummies are inappropriate in macro-level analysis when there is little within-country variation in the independent variables. Our independent variables show sufficient within-country variation to explain the dependent variable conditioning on country- and year-specific effects (see Table 1 in Section 3.1). The error-term  $\varepsilon$  is allowed to follow an AR(1)-process to correct for possible autocorrelation. In addition, we used panel-corrected standard errors to correct for panel-heteroskedasticity and simultaneous spatial correlation (Beck & Katz, 1995) to obtain conservative standard errors.

The regression analysis covers 17 European countries – Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom – for the years 1995 up till

2011. The panel data set is unbalanced. Data are particularly missing for Scandinavian countries with respect to income inequality and (at-risk-of) poverty.

## **4. Empirical analysis**

### ***4.1 Descriptive statistics: public/private pension-mix***

Table 1 illustrates the level and developments in pension expenditures for the included countries from 1995 up till 2011. Countries with particularly high public pension expenditures in 1995 are Austria, France, Greece, Italy, and Scandinavian countries. Most of these countries still have relatively high public pension expenditures in 2011. Austria, Finland, Greece, Italy, and Portugal have shown substantial increases in public pension expenditure from 1995 to 2011.

Private pension expenditures are substantially lower than public pension expenditures in all countries in 1995. Countries with relatively high private pension expenditures in 1995 are Denmark, the Netherlands, Sweden, Switzerland, and the UK. These are also the countries with fairly substantial increases in private pension spending from 1995 to 2011.

Since total pension expenditures have increased, due to the aging of the populations, we are especially interested in the differences in the share of private pension expenditures between countries and over time as this would suggest a relative shift from public- to private pensions. Interestingly, only 9 out of 17 countries show an increasing trend in the relative share of private pensions with Denmark, the Netherlands, Sweden, and Switzerland showing the most substantial increases since 1995. Nevertheless, the mean increase in the relative share of private pensions is much more substantial than in Van Vliet *et al.* (0.6 compared to 1.6). As a consequence, the estimated effects of this shift might be much more pronounced in a regression analysis possibly leading to different results.

Table 1. Pension expenditures in European countries, 1995–2011.

	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	2011	Δ95-11	1995	2011	Δ95-11	1995	2011	Δ95-11	1995	2011	Δ95-11
Austria	10.0	12.0	2.0	0.4	0.7	0.3	10.4	12.7	2.3	3.8	5.5	1.7
Belgium	7.0	8.3	1.3	1.3	1.1	-0.2	8.3	9.4	1.1	15.7	11.7	-4.0
Denmark	8.4	8.4	0.0	1.8	4.7	2.9	10.2	13.1	2.9	17.6	35.9	18.3
Finland	8.5	10.6	2.1	0.3	0.2	-0.1	8.8	10.8	2.0	3.4	1.9	-1.5
France	10.6	12.5	1.9	0.1	0.2	0.1	10.7	12.7	2.0	0.9	1.6	0.7
Germany	7.8	8.6	0.8	0.6	0.8	0.2	8.4	9.4	1.0	7.1	8.5	1.4
Greece	9.2	12.3	3.1	0.4	0.3	-0.1	9.6	12.6	3.0	4.2	2.4	-1.8
Ireland	3.6	4.7	1.1	1.0	0.8	-0.2	4.6	5.5	0.9	21.7	14.5	-7.2
Italy	10.8	13.4	2.6	1.5	1.4	-0.1	12.3	14.8	2.5	12.2	9.5	-2.7
Luxembourg	8.2	5.9	-2.3	0.5 <sup>a</sup>	0.4	-0.1	5.4 <sup>a</sup>	6.3	0.9	9.3 <sup>a</sup>	6.3	-3.0
Netherlands	5.5	6.2	0.7	2.6	4.3	1.7	8.1	10.5	2.4	32.1	41.0	8.9
Norway	7.1	7.1	0.0	0.6	0.7	0.1	7.7	7.8	0.1	7.8	9.0	1.2
Portugal	6.0	11.3	5.3	0.2	0.3	0.1	6.2	11.6	5.4	3.2	2.6	-0.6
Spain	8.3	8.9	0.6	0.0	0.0	0.0	8.3	8.9	0.6	0.0	0.0	0.0
Sweden	9.8	9.4	-0.4	1.9	2.6	0.7	11.7	12.0	0.3	16.2	21.7	5.5
Switzerland	6.4	6.5	0.1	2.7	4.3	1.6	9.1	10.8	1.7	29.7	39.8	10.1
United Kingdom	5.4	6.1	0.7	4.6	5.2	0.6	10.0	11.3	1.3	46.0	46.0	0.0
Mean	7.8	9.0	1.2	1.2	1.6	0.4	8.8	10.6	1.8	13.6	15.2	1.6

Note: a) 2001

Source: OECD Social Expenditure Database (OECD, 2015) and own calculation

#### ***4.2 Descriptive statistics: income inequality and poverty among the elderly***

Table 2 shows the level of income inequality and poverty among the elderly across countries and over time in the period 1995–2011. We present three columns: 1995, 2011, and the change.

In the 1990s, relatively low levels of old-age income inequality were found in the Scandinavian countries. Of the Scandinavian countries, only Denmark and Norway have been able to further reduce the income inequality among elderly. Finland and Sweden have shown some increases in income inequality over time. Belgium, Germany, Greece, Portugal and the UK started out with relatively high income inequality in 1995 but have all reduced the inequality substantially over time. The average of the 17 European countries indicates a reduction in old-age income inequality. Compared to Van Vliet *et al.*, the reduction is about twice as small (-1.1 compared to -0.5).

Luxembourg and the Netherlands showed relatively low old-age (at-risk-of) poverty in 1995. Both countries have reduced poverty among the elderly even further ever since. Except for Finland, Spain, Sweden and Switzerland, all countries have reduced poverty substantially with Greece and Portugal decreasing poverty about 11 and 18 percentage point respectively. On average, old-age poverty has decreased substantially in the European countries over almost two decades. This decrease is substantially larger than the decrease in old-age poverty rates reported by Van Vliet *et al.* (-2.9 compared to -4.3).

In a number of countries, such as Denmark, Finland, the Netherlands and Norway, relatively low levels of income inequality are combined with relatively low poverty rates. In contrast, in Belgium a low level of income inequality is combined with a high poverty rate. With regard to the developments over time, in the Netherlands both income inequality and poverty in old-age are decreased over the past two decades, whereas in Austria, Ireland and Spain decreasing poverty rates are not accompanied by decreasing income inequality levels. In Switzerland, there are relatively high levels of income inequality and poverty among the elderly and these levels have been rather stable over time.

Table 2. Income inequality and poverty among elderly people, 1995–2011.

	Income inequality among the elderly (S80/S20)			At-risk-of poverty among the elderly (PL 60)		
	1995	2011	$\Delta$ 95-11	1995	2011	$\Delta$ 95-11
Austria	4.0	4.1	0.1	20.0	16.2	-3.8
Belgium	4.9	3.0	-1.9	25.0	20.2	-4.8
Denmark	3.5 <sup>b</sup>	3.2	-0.3	20.9 <sup>b</sup>	16.0	-4.9
Finland	2.6 <sup>a</sup>	3.0	0.4	12 <sup>a</sup>	18.9	6.9
France	4.8	4.5	-0.3	19.0	9.7	-9.3
Germany	4.9	3.9	-1.0	15.0	14.2	-0.8
Greece	7.6	4.5	-3.1	35.0	23.6	-11.4
Ireland	3.9	4.1	0.2	19.0	11.0	-8.0
Italy	4.6	4.2	-0.4	18.0	17.0	-1.0
Luxembourg	4.1	3.3	-0.8	12.0	4.7	-7.3
Netherlands	4.2	3.3	-0.9	8.0	6.5	-1.5
Norway	3.0 <sup>a</sup>	2.8	-0.2	20.6 <sup>b</sup>	11.1	-9.5
Portugal	6.6	5.0	-1.6	38.0	20.0	-18.0
Spain	4.3	4.7	0.4	16.0	19.8	3.8
Sweden	2.9 <sup>c</sup>	3.3	0.4	14.0 <sup>c</sup>	18.2	4.2
Switzerland	4.8 <sup>d</sup>	4.9	0.1	26.1 <sup>d</sup>	28.1	2.0
United Kingdom	4.9	4.6	-0.3	32.0	21.8	-10.2
Mean	4.4	3.9	-0.5	20.6	16.3	-4.3

Note: a) 1996; b) 2003; c) 2004; d) 2007

Source: Eurostat SILC-database (Eurostat, 2015) and own calculations.

### 4.3 Regression results

Specification 1 shows that public pension expenditure as percentage of GDP is negatively related to income inequality among the elderly, whereas we do not find a significant correlation with private pension expenditure as percentage of GDP. In contrast, Van Vliet *et al.* find a negative association of private pension expenditures and a non-significant association of public pension expenditures. Similar to Van Vliet *et al.* we find a significant negative association of total pension expenditures (specification 2). We do not find a positive association between the private pension share and income inequality among the elderly (specifications 3, and 4). The results by Van Vliet *et al.*, however, suggest a negative and significant correlation. Regression specification 5, conditioning on both total pension expenditures and GDP per capita, shows a positive and significant correlation between the private share and income inequality among the elderly. The results in regression 1-5 suggest that public pensions are associated with lower levels of income inequality while a shift towards more private pension schemes is associated with increasing levels of income inequality among the elderly.

Regarding (at-risk-of) poverty among the elderly, we find that public pension expenditure (specification 6) as well as total pension expenditure (specification 7) are associated with lower levels of poverty. This is in line with the result of Van Vliet *et al.* However, our estimates show that a higher private share is positively associated with poverty among the elderly regardless of the control variables taken into account (specifications 8-10). This contrasts the results of Van Vliet *et al.* who did not find any significant correlations between the private share and poverty among the elderly.

The results in regression 6-10 suggest that public pensions are associated with lower levels of poverty while a shift towards more private pension schemes is associated with increasing levels of poverty among the elderly.

These main conclusions are robust to excluding Southern European countries<sup>7</sup>, excluding Scandinavian countries<sup>8</sup> or excluding the Netherlands<sup>9</sup>. Furthermore, we rule out possible non-linear effects of the private share and the population share.<sup>10</sup>

For comparison, baseline regression specifications 1 and 2 in Van Vliet *et al.* (Table 3 in that paper) are the most direct measures of the correlation between the relative importance of shifts in the public/private pension mix and income inequality (poverty) among older people. Specification 1(7) uses the percentage of GDP spent on public and private pensions separately. Specification 2(8) uses the percentage of total pensions spent on private pensions. Hence, specification 1(7) uses two coefficients to pick up changes in the public/private

pension mix whereas specification 2(8) uses one coefficient. Both specifications suggest that more private pensions in the public/private pension mix is correlated with less income inequality among the elderly and uncorrelated with poverty among the elderly. For completeness, Van Vliet *et al.* also showed a specification in which they only use total pension spending (specification 4(10)). The other specifications shown in Table 3 in Van Vliet *et al.* contain slight alterations to these main specifications.

The estimation results of specification 1(6), 2(7), and 4(9) presented in Table 3 are directly comparable to these main specifications in Van Vliet *et al.* Specification 3(8) and 5(10) are additionally proposed to estimate the correlation between the private share and the outcome variable conditional on total pension expenditures (specification 3(8)) as well as GDP per capita (specification 5(10)). This, however, does not have large implications for the main conclusions contrasting Van Vliet *et al.* compared to a specification in which the private share is not modeled conditional on total pension expenditures and GDP per capita (specification 2(7)).

Table 3 Panel Corrected Standard Error Regressions with AR(1) disturbances for pension expenditures and income inequality (s80/s20) and (at-risk-of) poverty (PL 60) among the elderly (65+)

	Income inequality (s80/s20) among the elderly (65+)					At-risk-of poverty (PL 60) among the elderly (65+)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Public pension expenditures (% GDP)	-0.16**					-3.14***				
	(0.08)					(0.43)				
Private pension expenditures (% GDP)	0.01					0.07				
	(0.09)					(0.58)				
Private share (% total pension expenditures)			0.02	0.01	0.02*			0.61***	0.27*	0.58***
			(0.01)	(0.01)	(0.01)			(0.13)	(0.14)	(0.13)
Total pension expenditures (% GDP)		-0.12*	-0.15*		-0.15**		-2.11***	-3.18***		-2.90***
		(0.07)	(0.08)		(0.07)		(0.41)	(0.40)		(0.48)
Population share 65+	-0.07	-0.07	-0.08	-0.11	-0.09	1.33***	1.19**	1.08***	0.38	1.35***
	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.51)	(0.54)	(0.37)	(0.53)	(0.32)
GDP per capita (/1000)					-0.02					0.43
					(0.03)					(0.26)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR(1) disturbances	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations (N x T)	215	215	215	215	215	234	234	234	234	234
Adj. R-squared	0.97	0.98	0.97	0.97	0.98	0.94	0.93	0.95	0.92	0.95
Rho	0.52	0.50	0.52	0.52	0.49	0.58	0.65	0.56	0.67	0.56

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. Rho indicates the degree of autocorrelation. 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, Spain, Sweden, Switzerland, and the United Kingdom. Years included: 1995-2011. Data sources: EU-SILC (Eurostat, 2015); OECD Social Expenditure Database (2015).



Table 4 Estimation results 1995-2007 excluding Spain and Switzerland.

	Income inequality (s80/s20) among the elderly (65+)					At-risk-of poverty (PL 60) among the elderly (65+)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Public pension expenditures (% GDP)	-0.14 (0.12)					-2.76*** (0.83)				
Private pension expenditures (% GDP)	-0.09 (0.09)					-0.26 (0.41)				
Private share (% total pension expenditures)			0.01 (0.01)	0.00 (0.01)	0.01 (0.01)			0.40*** (0.12)	0.09 (0.07)	0.37*** (0.13)
Total pension expenditures (% GDP)		-0.13 (0.09)	-0.15 (0.11)		-0.15 (0.11)		-1.72*** (0.56)	-2.72*** (0.75)		-1.86** (0.95)
Population share 65+	-0.04 (0.10)	-0.04 (0.10)	-0.04 (0.10)	-0.08 (0.11)	-0.04 (0.10)	0.56 (0.69)	0.25 (0.71)	0.55 (0.66)	-0.26 (0.69)	2.00 (0.66)
GDP per capita (/1000)					0.00 (0.00)					1.07** (0.49)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR(1) disturbances	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations (N x T)	135	135	135	135	135	152	152	152	152	152
Adj. R-squared	0.98	0.98	0.98	0.98	0.98	0.95	0.94	0.95	0.94	0.95
Rho	0.47	0.47	0.47	0.45	0.45	0.58	0.61	0.58	0.59	0.55

Note: PL 60 of Finland 1995 and Sweden 2003 missing in updated EU-SILC compared to Van Vliet *et al.* 2011

## 5. Explaining differences with Van Vliet, Been, Caminada, and Goudswaard (2012)

The estimation results in section 3.3 are in line with our expectations based on both theoretical and empirical literature on pension reform and income inequality, but in contrast with the results presented in Van Vliet *et al.* To understand these differences, we perform an additional regression analysis in which we restrict our sample to the same countries and time-period as used in Van Vliet *et al.* The results can be observed in Table 4.

Using the country- and time-constraint we find highly robust results for old-age poverty, but we no longer see significant associations between pension expenditures and income inequality. Neither do we observe associations as presented in Van Vliet *et al.* By only excluding Spain and Switzerland, but including the years 2008-2011 we find no correlation between the private share and income inequality and a positive correlation between the private share and poverty. By only excluding the years 2008-2011, but including Spain and Switzerland we find positive correlations for the private share and income inequality as well as poverty.

However, the additional years of data and countries do not explain the full difference between the findings reported in this paper and by Van Vliet *et al.* Table 5 indicates that the differences are not likely to be a consequence of major updates in the series of the *dependent* variables.

Table 5 Correlation coefficients between old and revised series of the EU-SILC Database

	s80/s20		PL 60	
	(65+)		(65+)	
	Coeff.	P-val	Coeff.	P-val
Austria	1.000	0.000	0.999	0.000
Belgium	1.000	0.000	1.000	0.000
Denmark	1.000	0.000	1.000	0.000
Finland	1.000	0.000	1.000	0.000
France	1.000	0.000	1.000	0.000
Germany	1.000	0.000	1.000	0.000
Greece	1.000	0.000	1.000	0.000
Ireland	1.000	0.000	1.000	0.000
Italy	0.995	0.000	1.000	0.000
Luxembourg	1.000	0.000	1.000	0.000
Netherlands	1.000	0.000	1.000	0.000
Norway	0.974	0.005	0.883	0.047
Portugal	1.000	0.000	1.000	0.000
Sweden	1.000	0.000	1.000	0.000
UK	0.988	0.000	0.993	0.000

Based on OECD (2014), we argue that the discrepancy mainly is a consequence of updating the data series of the OECD Social Expenditure database. By comparing the data series used in Vliet *et al.* to the latest available data series of the OECD Social Expenditure database used in the current paper, we underwrite our suspicion. Table 6 shows the correlation coefficient of the new and the old data series per country for both *public* and *private* spending. The table indicates that the old series is fairly similar to the new series of *public* pension expenditures although most countries do not show a correlation coefficient equal to one. The comparability of Ireland performs much worse as the correlation coefficient is statistically not significantly different from zero.<sup>xi</sup> The series of *private* pension expenditures performs much worse than the *public* pension expenditures in terms of comparability. Only 5 out of 15 countries show a correlation coefficient that is bigger than 0.9. Belgium and Ireland even show a correlation coefficient that is statistically not significantly different from zero.<sup>xii</sup> The degree of correlation between the old and revised data series is likely to explain the different conclusions.

This is confirmed by regression analyses using the new series of *independent* variables (OECD SOCX) and the old series of *dependent* variables (EU-SILC). These estimation results show an absent correlation between the private share and income inequality (this was a

negative correlation in Van Vliet *et al.*) and a positive correlation between the private share and poverty (this was negative in Van Vliet *et al.*) (not reported here).

Table 6 Correlation coefficients between old and revised series of the OECD Social Expenditure Database

	Public pension expenditures		Private pension expenditures		Private share	
	Coeff.	P-val	Coeff.	P-val	Coeff.	P-val
Austria	0.995	0.000	0.830	0.000	0.768	0.002
Belgium	0.937	0.000	-0.350	0.241	-0.458	0.116
Denmark	0.996	0.000	0.522	0.067	0.655	0.015
Finland	0.998	0.000	0.912	0.000	0.897	0.000
France	0.978	0.000	0.530	0.062	0.512	0.074
Germany	0.997	0.000	0.866	0.000	0.522	0.067
Greece	0.999	0.000	0.831	0.000	0.691	0.009
Ireland	0.240	0.430	0.204	0.505	0.350	0.241
Italy	0.879	0.000	0.694	0.008	0.791	0.001
Luxembourg	1.000	0.000	0.917	0.004	0.915	0.004
Netherlands	0.942	0.000	0.977	0.000	0.990	0.000
Norway	0.996	0.000	0.786	0.001	0.492	0.088
Portugal	1.000	0.000	0.827	0.000	0.791	0.001
Sweden	0.995	0.000	0.947	0.000	0.960	0.000
UK	0.962	0.000	0.990	0.000	0.988	0.000

## 6. Discussion

Although our main finding that shifts towards relatively more private pensions are related to higher levels of income inequality among older people is in line with theoretical expectations and prior empirical evidence, it should be noted that several aspects of the pension system are not captured by our analysis. First of all, shifts in the public/private pension mix do not differentiate between shifts because of 1) increases in private pensions while keeping the expenditures on public pensions constant or 2) cuts in the expenditures on public pensions. Secondly, it does not differentiate between true policy reforms and shifts in the public/private mix due to changes in more participation in private pension schemes. Thirdly, it does not take into account differences in the timing of shifts in the public/private pension mix between countries.

Besides the public/private mix, also the institutional design of the mix is relevant. Particularly, the basic pensions are important with respect to inequality and poverty (Ebbinghaus & Neugschwender, 2011; Marx, Nolan, and Olivera, 2014). The analysis does not indicate institutional differences in public pensions, such as the degree to which public pensions function as a safety net. OECD (2009) distinguished three main institutional differences between public pension schemes: 1) resource-tested 2) basic scheme and 3) minimum pension. Resource-tested and minimum public pensions are usually means-tested and reduce benefits once the target level of income is reached. Whereas minimum pension only takes into account pension income, resource-tested public pension take into account all income sources. Basic schemes pay a flat-rate benefit conditional on the number of years in residency (e.g. the Netherlands) or on years of contribution (e.g. Ireland, UK).

Barr & Diamond (2009), OECD (2009) and Orenstein (2011) argue that the changing public-private mix usually entails a change from the defined benefit (DB) to the defined contribution (DC) system. A drawback of the current study is that we are not able to distinguish DB and DC plans in private pensions for the whole period of our analysis. Distinguishing DB from DC schemes might be relevant in the analysis of income inequality among the elderly as DC schemes are actuarially fair as a rule, whereas DB plans may contain elements of redistribution that are negotiated in collective labour contracts. Since there has been a shift from DB to DC plans in several countries (OECD, 2015) a part of our results may be explained by this shift that is unobserved in our data. Neither does the analysis take into account the extent to which coverage in private pension plans is mandatory or voluntary. Additionally, it should also be noted that an essential function of pensions is to redistribute income intertemporally over the life cycle. However, the focus on annual macro data in this

article implies that such an analysis of redistribution over the life cycle is not possible as the macro analysis is unable to take into account individual benefits received and premiums paid. As current individual pension benefits are determined by long-term effects, statutory changes in entitlements are hardly able to be captured in a macro-level analysis because of the restricted time-dimension. Moreover, the use of macro-level data also implies that the analysis is unable to take into account individual-level determinants of income, such as personal characteristics, wages, and macroeconomic conditions. Hence, we cannot exclude a possible effect of different socio-demographic composition on our estimated relationships which might be relevant as younger cohorts might have accumulated more pension benefits due to increased female labour force participation. On a macroeconomic level, this also implies that the effect of the public/private pension mix on old-age inequality may depend to some extent on the level of income inequality among the working-age population.

## 7. Conclusion

As private social security arrangements generally entail less income redistribution than public social security (Goudswaard & Caminada, 2010), it is expected that shifts from public to private pension provision lead to higher levels of income inequality and poverty among elderly people (Arza, 2008). Empirically this has been confirmed by studies using cross-sectional (e.g. Milligan, 2008) and time-series data (e.g. Weller, 2004). Using panel data from a combination of the OECD Social Expenditures and the EU-SILC databases, Van Vliet *et al.* (2012) do not find evidence that shifts from public to private pension provision are associated with higher levels of income inequality or poverty among elderly. Despite having analysed many econometric specifications, their conclusions contradict both theory and prior empirical studies.

The current paper extends the analysis of Van Vliet, Been, Caminada and Goudswaard (2012) by 1) adding additional countries (17 European countries including Spain and Switzerland) 2) adding additionally available years (adding 2008-2011 to 1995-2007) and 3) using revised data series of the OECD Social Expenditures database (see OECD, 2014). In line with the *a priori* expectations, we find that higher public pension expenditures are associated with lower levels of income inequality and poverty in old-age whereas a greater relative importance of private pensions is associated with higher levels of income inequality and poverty among elderly. These results contradict the results presented in Van Vliet *et al.*

Additional analyses taught us that the different conclusions are largely due to the revised data series of the OECD Social Expenditure (SOCX) database. Much of the revision of the OECD SOCX data entailed changes in the expenditures on private pensions (as a percentage of GDP). Part of these changes is due to the use of different (read: improved) definitions of private pensions. The other part of these changes can be explained by revisions (read: improvements) in the measurement of GDP. Conclusions drawn from the OECD SOCX data depend on the version (pre- or post-revision) of the data, as shown in this paper. This observation might be of interest to a wide range of studies using pre-revision OECD SOCX data.

The OECD SOCX database has a number of shortcomings, such as extensively reported by De Deken & Kittel (2007), but in the most recent version of the OECD SOCX database (2015) a number of these shortcomings have been improved. Hence, we believe this data to remain a valuable source for performing cross-country analysis regarding social policy if one bears in mind the shortcomings of the data. The most prominent shortcoming, we believe, is the many details of social policy that are lost in the process of making the spending data comparable across countries (Van Vliet, 2010).

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<sup>1</sup> See OECD Pensions at a Glance (various years) for a description of pension systems in OECD and G20 countries.

<sup>2</sup> Exceptions are the DC plans in Denmark and Sweden, which offer collective risk sharing.

<sup>3</sup> For a critical discussion of the (2005 version of the) OECD SOCX database and the classification of pension expenditures see De Deken and Kittel (2007). Some of the limitations of this classification have been improved in the revised version of the dataset. These revisions are discussed below (section 5).

<sup>4</sup> Van Vliet *et al.* (2012) show that conclusions based on spending measures expressed as percentage of GDP are robust to spending measures expressed as millions of US dollars (constant [2000] prices, ppp) per pensioner.

<sup>5</sup> Expenditures on public pensions also include spending on some other services for the elderly. See: Vandenbroucke & Vleminckx (2011).

<sup>6</sup> A well-known limitation of these Eurostat data is a break in the time series. Until 2001, data were provided by the ECHP. Since 2005 EU countries provide data from the new EU-SILC. During the transitional period poverty indicators were provided by national sources which were harmonised 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. However, to examine developments in poverty and inequality for a relatively large group of EU countries, these are the best data at hand and they are regularly used in pooled time series regression analyses (Dafermos & Papatheodorou, 2013; Van Vliet & Wang, 2015).

<sup>7</sup> Greece, Italy, Portugal, Spain. Except that the private share is no longer significant in the s80/s20 equation.

<sup>8</sup> Denmark, Finland, Norway, Sweden. Except that the private share is no longer significant in the s80/s20 equation.

<sup>9</sup> The Netherlands may be a specific case because of their low initial level of poverty.

<sup>10</sup> A quadratic effect is not significantly different from zero. Estimation results are robust nonetheless.

<sup>xi</sup> Correspondence with the OECD teaches us that this can be explained by revisions in both public pensions and (mostly between 1990 and 1998) and revisions in GDP (mostly from 1996) from SOCX 2010 to SOCX 2014.

<sup>xiii</sup> Correspondence with the OECD teaches us that the differences for Belgium can be explained by revisions in the definition of private pensions. The revision led to the inclusion of all civil servant pensions and the exclusion of individual life insurance payments. The differences for Ireland can largely be explained by the aforementioned revisions in GDP.