Essays on trends in income distribution and redistribution in affluent countries and China

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6 Determinants of income inequality among the elderly in 8 countries▪

ABSTRACT

A major concern in an ageing society is the well-being of elderly people, which to a large extent depends on the income distribution of the elderly, including its mean and dispersion or inequality. While the issue of inequality in general has become a popular subject of research and public interest, only a few studies have focused on the determinants of income inequality among the elderly in a comparative setting over time. To fill in this gap, this chapter examines determinants of the income distribution among the elderly in 8 OECD countries, namely Australia, Canada, Denmark, Germany, Israel, Norway, the United Kingdom and the United States, based on micro data from LIS from around 1995 to around 2005. For this purpose, various counterfactuals were constructed and simulated. The results show that income inequality among the elderly has increased and is mainly associated with changes in the distribution of earnings, followed by changes in the distribution of private pensions. Public pensions have become more inequality-reducing over time in most of the countries that were studied. Finally, the demographic structure of the elderly played a negligible role in driving income distribution among the elderly.

Key words: income inequality, elderly, inequality decomposition

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6.1 INTRODUCTION

The bulk of income distribution studies focus on the total or working-age population,[1] with only scant attention being paid to income inequality among the elderly.[2] This is regrettable as the latter has been reported to be high and rising. For example, according to the OECD Income Distribution database (2014), in 1995 in the United States the Gini ratio was 0.360 for pensioners aged 65 and above compared with a Gini of 0.351 for the working-age population. In Australia, the Gini for the elderly was 0.260 in 1995 but increased to 0.303 in 2004, converging fast to the Gini for the working-age population (0.305).

The significance of studying inequality among the elderly is threefold. First, as a subpopulation group, their inequality affects the overall distribution. In other words, if everything else would remain constant, changing income gaps among the elderly would lead to changes in a society's total inequality. Second, even if inequality among the elderly does not change it becomes more important when the population share of the elderly grows, as is happening in many countries. In that case, discovering the determinants of inequality among the elderly becomes increasingly crucial for containing the overall inequality. Finally, the elderly generally earn less than the working-age population. Also, pensions have become less generous in many industrialized countries according to Scruggs' pension generosity index (Scruggs, Jahn and Kuitto, 2014). For any population subgroup with a low average income, high or rising inequality will imply absolute poverty for some of its members. Elderly poverty, like all other poverty, is not acceptable and one solution to this poverty problem is to change the income distribution, even in the absence of more resources to support the elderly. This naturally requires identification of the determinants of income inequality among the elderly.

The role of pensions in affecting income inequality among the elderly has been examined by Kohl (1992), Pestieau (1992) and Behrendt (2000). However, little information has been provided on its magnitude across countries. Obviously, the main source of income for the working-age population is direct earnings from the labour market. The well-being of the elderly relies primarily on public and/or private pensions, though. Thus, the distribution of pensions is expected to be a dominant factor in determining income inequality among the elderly. Goudswaard and Caminada (2010) found that private social security arrangements generally entail less income redistribution than public social transfers. This is due to the fact that public pensions are mostly based on income-related funding and flat-rate benefits whereas private pensions are based on a link between contributions paid and benefits received. However,

1 For example, OECD, 2008; Brandolini and Smeeding, 2009; McCall and Percheski, 2010; Atkinson and Morelli, 2011; OECD, 2011a; Wang et al, 2012; and Thewissen et al, 2013.

2 For example, Coder et al, 1989; Crystal and Shea, 1990; Moore and Pacey, 2001; Engelhardt and Gruber, 2004; Smeeding et al, 2008.

Van Vliet et al (2012a) found that more expenditures on private pensions are not associated with higher levels of income inequality among the elderly over time and across countries.

In addition to pensions, labour market factors and demographics may also affect the income distribution among the elderly. For example, welfare state reforms such as the elimination of mandatory retirement ages enable the elderly to earn more from work and increase their income share from earnings. People working beyond the official retirement age are usually richer than those living on pensions only. With respect to the demographic structure of the elderly, Disney and Whitehouse (2002) showed that in general income tends to be lower at higher ages.

In this context, it is relevant to ask what the trend of income inequality among the elderly is; what role public and private pension have played over time; and how changes in the distribution of earnings, household working status and household composition influence the income inequality among the elderly. Motivated by these questions, the aim of this paper is to uncover the influence of public and private pensions. This publication contributes to the literature in three respects. First, it will quantify the influence of public versus private pensions, labour market and demographic factors on income inequality among the elderly over time across countries, holding other factors constant. As such this paper offers a cross-country overview and detailed information regarding income inequality among the elderly. These factors include changes in the composition of pensions (public versus private), the household working status and household composition. Second, the profile of income inequality among the elderly is constructed for a number of countries, offering a comparative perspective on income inequality among the elderly. Third, we apply a new decomposition approach developed by Chen and Corak (2008) and Fortin et al (2010). With this method, several counterfactual income distributions are simulated to identify various determinants of income inequality among the elderly. The major data source for this paper is the Luxembourg Income Study (LIS), which allows estimation of not only gross and disposable income, but also of income components such as public and private pensions, earnings, social transfers and property income. Moreover, it provides information on households' and individuals' labour market situation and the demographic status of the elderly.

This paper is structured as follows. The next section presents trends in income inequality among the elderly across 8 countries over time (1995-2005). Section 6.3 discusses possible inequality determinants and their impact, which are divided into three broad sets: income composition (mainly public and private pensions), labour market and demographic factors. The research methodology is outlined in section 6.4. Empirical results can be found in section 6.5, along with a sensitivity analysis. Section 6.6 presents the conclusions.

6.2 INCOME INEQUALITY AMONG THE ELDERLY

The analyses are based on micro data from LIS, which provide comprehensive detailed information with respect to income components, labour market status and demographic information. All the variables have been "harmonised" by LIS to make the information comparable among countries. This study pays attention to eight OECD countries (namely Australia, Canada, Denmark, Germany, Israel, Norway, the United Kingdom and the United States) based on data availability. For these countries LIS has information on both private and public pensions from around 1995 (wave IV in LIS) to 2005 (wave VI in LIS).[3] All variables have been "harmonised" by LIS, so they are comparable across countries.

The elderly are defined as individuals aged 65 and above, including the household head, spouse and other relatives living in the household. Assuming resource pooling within families, the square root of the number of family members is applied as the equivalence scale as in LIS. The Gini coefficient is used as a global measure for income inequality. To reduce the influence of outliers, the analysis follows the top and bottom coding procedure of LIS, i.e. observations larger than 10 times the median of the non-equivalised income are set to equal to 10 times this median income and observations smaller than 1 percent of the equivalised mean income are set to equal to 1 percent of the equivalised mean income. As a sensitivity check, other global income inequality indicators are also used, namely the Atkinson's Index (α=0.5), Theil Index (GE (1)), Mean Log Deviation (GE (0)) and the ratio of the income at the 90th percentile to the income at the 10th percentile (P90/P10).

Table 6.1 illustrates the income inequality among elderly people in the countries under study and how it has changed from the mid-1990s to the mid-2000s. The main pattern is that income inequality among the elderly increased during this period, which is in line with the trends observed in the OECD income inequality database. On average across our 8 countries, the Gini coefficient increased from 0.280 to 0.291, i.e. by 0.011 points. The largest rise occurred in Australia while a lesser increase can be seen in the United States and Canada. On the contrary, as an outlier, Israel experienced inequality decline. Around 1995 and 2005, high Gini estimates for the elderly were observed in Israel and the United States (more than 0.350). Meanwhile, Denmark and Norway had Gini coefficients lower than 0.250. These findings are robust to the inequality indicators used, except for the P90/P10 indicator, which decreased in Norway and the United Kingdom. However, this indicator only focuses on two deciles (tails of the distribution) rather than capturing the whole income distribution, which is not Lorenz-consistent (using all data

3 Australia (1995, 2003); Canada (1994, 2004); Denmark (1995, 2004); Germany (1994, 2004); Israel (1997, 2005); Norway (1995, 2004); the United Kingdom (1995, 2004) and the United States (1994, 2004).

points). Thus, P90/P10 may show a different pattern compared to other global indicators.[4]

4 In Norway, the ratio of the equivalised income at the 90th percentile to the 50th percentile (P90/P50) decreased (from 1.69 to 1.62) while the ratio of the equivalised income at the 10th percentile to the 50th percentile (P10/P50) increased (from 0.64 to 0.65) from 1995 to 2004. In the United Kingdom, both P90/P50 and P10/P50 decreased with the former declining faster (from 2.11 to 1.96) than the latter (from 0.64 to 0.60).

Table 6.1 Disposable income inequality among the elderly, 1995-2005

	Around 1995						Around 2005						Change 95-05				
Country	Year	Gini	A(0.5)	GE(1)	GE(0)	P90P10	Year	Gini	A(0.5)	GE(1)	GE(0)	P90P10	Gini	A(0.5)	GE(1)	GE(0)	P90P10
Australia	1995	0.260	0.057	0.121	0.119	2.833	2003	0.295	0.077	0.172	0.159	3.138	0.035	0.020	0.052	0.040	0.305
Canada	1994	0.256	0.054	0.118	0.105	2.901	2004	0.269	0.059	0.128	0.118	3.116	0.013	0.005	0.010	0.013	0.215
Denmark	1995	0.207	0.039	0.089	0.073	2.290	2004	0.216	0.044	0.102	0.081	2.317	0.009	0.005	0.013	0.009	0.027
Germany	1994	0.258	0.055	0.113	0.114	3.151	2004	0.268	0.060	0.131	0.119	3.162	0.010	0.005	0.018	0.005	0.011
Israel	1997	0.377	0.115	0.252	0.237	5.566	2005	0.367	0.106	0.223	0.224	5.538	-0.010	-0.009	-0.029	-0.013	-0.028
Norway	1995	0.232	0.048	0.108	0.093	2.663	2004	0.242	0.057	0.137	0.103	2.503	0.010	0.009	0.029	0.010	-0.160
UK	1995	0.292	0.070	0.156	0.137	3.281	2004	0.293	0.073	0.164	0.144	3.265	0.001	0.003	0.008	0.007	-0.016
US	1994	0.360	0.106	0.224	0.232	5.138	2004	0.377	0.117	0.254	0.256	5.475	0.018	0.011	0.030	0.024	0.337
mean-8		0.280	0.068	0.148	0.139	3.478		0.291	0.074	0.164	0.150	3.564	0.011	0.006	0.016	0.012	0.086

Note: Bootstrap standard errors of the Gini coefficients vary across countries and survey years, and generally the 95% interval is plus 1 percentage point, except for Israel in 1997 (standard error is 0.011).
Source: Own calculations using micro data from LIS.

6.3 THE DETERMINANTS OF INCOME INEQUALITY AMONG THE ELDERLY

Following OECD (2008: 282-292), there are three broad sets of factors affecting the income distribution: the composition or components of income, demographics and labour market factors.

6.3.1 Income components

The gross income of the elderly consists of public pensions, private pensions, earnings, other public transfers, private transfers and cash property income. On average, pensions and earnings account for more than 70% and 10% of gross income, respectively (Table 6.2). Thus, this paper will focus on changes in the distribution of pensions, and on earnings. In general, public pensions are supposed to generate more redistribution of income compared to private pension schemes. Public pensions are usually pay-as-you-go systems, with flat-rate benefits, based on income-related contributions while private pensions are usually funded systems where the contributions paid are related to benefits based on previous earnings. Therefore, as a rule, public pensions are assumed to generate more redistribution than private pensions. Pensions are expected to play an important role in determining income inequality among elderly people across countries (see Van Vliet et al, 2012a). Moreover, maturation of voluntary private pension schemes may have increased the share of private pensions. In the last decades, the rise of female labour force participation has automatically increased the coverage of private pensions.

The transition from public to private pensions, if any, can be measured by changes in the amount of public and private benefits received by elderly people. Since elderly people usually do not have much income from work, public pensions are their main source of income. As a result, income support from the social programmes plays an important role in reducing income inequality among elderly people. As private pension plans are based on a link between contributions paid and benefits received, they do not contain elements of income redistribution (Van Vliet et al, 2012a). Private pensions are generally less redistributive than public social security (Goudswaard and Caminada, 2010).

Following the definition of LIS, public pensions consist of universal old-age pensions, employment-related old-age pensions, old-age pensions for public sector employees, early retirement benefits, and survivors pensions,[5] while private pensions include mandatory occupational pensions, voluntary occupational pensions, mandatory individual retirement pensions, occupational

5 As part of the state old-age and survivors benefits, survivors pensions are not directly targeted, but also benefit the elderly.

pensions for public sector employees and other pensions.[6] Besides pensions, other income sources such as earnings, other public transfers, private transfers and property income also influence the income distribution among elderly people.

Table 6.2 shows the income components of the gross income of the elderly from 1995 to 2005 across 8 countries. On average, most gross income of the elderly comes from public pensions (56.6% around 1995 and 55.7% around 2005), followed by private pensions (14.3% around 1995 and 16.4% around 2005), earnings (11.7%), other public transfers (8.7%) and property income (8.2%), while private transfers only make up less than 1% of the gross income. The largest share of public pensions exists in Germany (above 77%), both around 1995 and 2005, whereas the lowest share is found in Israel and Australia (below 50%). As for private pensions, the highest share is found in Israel and the United Kingdom (over 20%), whilst the lowest share is found in Germany (less than 5%).

Throughout the entire period under study, the share of private pensions in the gross income increased by 2.09% points on average whilst the share of public pensions declined by 0.86% points, showing a small shift from public to private pensions. However, there is variation across countries. The shift is quite obvious in Canada, Denmark and the United Kingdom with an increase in private pensions and a decrease in public pensions. In Australia, Germany, Israel and Norway, the increase in private pensions has been faster than the rise of public pensions. However, in the United States, the share of private pensions dropped while the share of public pensions rose. In terms of the magnitude of change, both the largest increase in private pensions and the largest decline in public pensions are observed in Canada; other income components of pensioners in Canada were rather stable over time.

Moreover, the share of earnings increased by 0.15% points on average, with the largest rise taking place in the United States, but a moderate drop was seen in Australia, Germany, Israel, Norway and the United Kingdom. The levels of other public transfers and private transfers were rather stable over time while the share of property income decreased by 1.37% points from around 1995 to around 2005 (see Table 6.2).

6 According to the information provided by LIS, public pensions include state old-age and survivors benefits. Private pensions consist of private occupational pensions, mandatory individual retirement pensions, private occupational and other pensions, and public sector occupational pensions. It should be noted that the categories of public and private pensions are troublesome. They cannot be fully distinguished from each other due to the data availability.

Table 6.2 Income components (shares) of equivalised gross income among elderly people, 1995-2005

	Around 1995							Around 2005							Change 95-05					
Country	Year	Public pensions	Private pensions	Earnings	Other public transfers	Private transfers	Cash property income	Year	Public pensions	Private pensions	Earnings	Other public transfers	Private transfers	Cash property income	Public pensions	Private pensions	Earnings	Other public transfers	Private transfers	Cash property income
Australia	1995	46.7%	10.7%	13.1%	16.7%	0.3%	12.5%	2003	48.7%	13.3%	12.4%	13.4%	0.4%	11.8%	2.02%	2.63%	-0.66%	-3.26%	0.04%	-0.77%
Canada	1994	55.5%	16.0%	11.9%	5.9%	1.5%	9.2%	2004	49.3%	24.3%	13.1%	4.7%	1.5%	7.2%	-6.26%	8.33%	1.23%	-1.21%	-0.03%	-2.06%
Denmark	1995	63.4%	12.9%	7.0%	10.1%	0.6%	6.0%	2004	62.5%	16.1%	8.2%	8.4%	0.5%	4.3%	-0.86%	3.23%	1.23%	-1.73%	-0.10%	-1.77%
Germany	1994	77.3%	3.9%	8.5%	4.2%	0.4%	5.7%	2004	77.7%	4.5%	7.3%	4.3%	0.2%	6.1%	0.39%	0.52%	-1.23%	0.17%	-0.21%	0.36%
Israel	1997	42.2%	22.6%	18.6%	10.1%	1.1%	5.4%	2005	43.1%	24.9%	17.8%	8.1%	1.1%	5.0%	0.94%	2.27%	-0.83%	-2.09%	0.09%	-0.38%
Norway	1995	63.1%	13.4%	10.6%	6.3%	0.1%	6.4%	2004	63.3%	14.9%	8.7%	7.6%	0.3%	5.3%	0.16%	1.49%	-1.95%	1.22%	0.14%	-1.06%
UK	1995	50.2%	20.4%	7.9%	11.7%	0.3%	9.6%	2004	46.0%	22.3%	7.6%	16.4%	0.4%	7.2%	-4.14%	1.89%	-0.25%	4.74%	0.08%	-2.32%
US	1994	54.2%	14.4%	15.7%	4.4%	0.3%	11.1%	2004	55.0%	10.7%	19.3%	6.3%	0.4%	8.2%	0.86%	-3.63%	3.64%	1.91%	0.17%	-2.94%
Mean		56.6%	14.3%	11.7%	8.7%	0.6%	8.2%		55.7%	16.4%	11.8%	8.6%	0.6%	6.9%	-0.86%	2.09%	0.15%	-0.03%	0.02%	-1.37%

Note: Other public transfers include occupational injury and disease benefits, disability benefits, child/family benefits, unemployment compensation benefits, maternity and other family leave benefits, other social insurance benefits, social assistance cash benefits and near-cash benefits. Private transfers include alimony/child support, regular private transfers and other cash income. Cash property income includes interest and dividends, rental income, private savings plans, royalties and cash property income.
Source: Own calculations using micro data from LIS.

6.3.2 Labour market factors

Another broad set of factors affecting the income distribution of the elderly is related to the labour market (OECD, 2008: 289). From the mid-1990s to the mid-2000s, welfare state reforms led to significant changes in the labour market status of the elderly. In the United States, for instance, the post-2000 increase in labour force participation of the elderly is related to the elimination of mandatory retirement ages, a decrease in the pension replacement rate, a move from defined-benefit to defined-contribution pensions, and a decline in the coverage of post-retirement health insurance for workers in the private sector (Munnell and Sass 2009: 35-60). The distribution of earnings among the elderly also changed. Take Denmark in the period 1997-2007, for example, where the biggest change in earnings occurred among the 60-64 year olds and to a lesser extent among the 70-74 year olds (Larsen and Pedersen, 2012). Hungerford et al (2001) pointed out that earnings may become a more important source of retirement income in the future because of changes in the retirement earnings test for social security beneficiaries.

In this paper, labour market factors are represented by two variables: a dummy variable indicating whether the household head and spouse are both employed, either the household head or the spouse is employed or neither of them is employed,[7] and the annual earnings they obtain. Haider and Loughran (2001) found that employment of the elderly in the United States correlates positively with health, education and wealth. Therefore, if rich elderly people have more earnings and a higher chance to work, income dispersion among the elderly would be larger. The reverse would be true if healthier elderly people in lower income groups have a higher chance to earn more. Larsen and Pedersen (2012) showed that in Denmark employment rates for elderly people aged 60-64 increased in the period from around 1995 to around 2005 while they were rather stable for the group of people aged 65 and above.

Labour market factors also reflect broader forces such as the business cycle, economic integration, technological changes and globalization. Many of these factors are independent of government transfers, but there could certainly be important interactions between the structure of social policy and labour supply, particularly among low income groups in the working-age population and to a much lesser extent among elderly people.

7 The current labour force status distinguishes between the employed, the unemployed, and those not in the labour force. People are considered employed during the reference period if they carried out any type of employment duties – even if it was just one occasional hour of paid work or irregular unpaid family work.

6.3.3 Demographics of the elderly

Finally, changes in demographic structures of the elderly may affect their income inequality. Three variables can be used in the empirical analysis: the proportion of households with a household head above 75 years old, whether the elderly people are living alone or not, and whether the household head attended university or higher education. The latter factor is measured by using a binary variable implying whether the household head's education level is tertiary or above.[8]

The ageing effect is captured by the first variable. In general, at a specific moment the income of elderly people tends to decline with age for several reasons (Disney and Whitehouse 2002). First, the pensions of the elderly are determined by their past earnings, which tend to be higher for younger cohorts with a higher real lifetime income than older cohorts. Second, many old-aged pensioners are women, who live longer than men and could be poorer than older men. Third, because of the immaturity of contribution-based pension-schemes, earlier contributors may not have accumulated sufficient entitlements for a 'full' pension. Fourth, partial non-indexation of pension benefits income may hamper older cohorts more than younger pensioners over the years. Fifth, a small number of younger elderly who are still working are relatively more well off than their elder counterparts. Sixth, as the lifecycle hypothesis implies, older pensioners will have a lower income from savings than younger pensioners if they have spent down their assets. However, older cohorts could also be richer because old-aged survivors typically have higher financial, housing and pension wealth than those who die young.

A single household living arrangement affects elderly income distribution in two ways. On the one hand, a single pensioner tends to have a higher equivalised income than married couples where one partner has an incomplete contribution history. This is the case for most continental European systems in particular, where the amount of social security is fully based on contribution and earnings (OECD, 2001; Whitehouse, 2002a, 2002b), This differs from the flat-rate benefit systems implemented in Denmark and the United Kingdom. On the other hand, assuming that household resources are shared among family members, income inequality would be lower when less elderly people are living alone. For example, suppose an elderly man with both a public and private pension is living with an elderly woman having only a public pension. In that case their income is shared within their family, in other words their income is redistributed within the family. This leads to a lower income inequality in society than if both of them would live separately. Therefore, a lower share of single households may result in lower income inequality.

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8 For example, tertiary education level or higher in the United States combines those with associate degrees, bachelor's degrees and advanced degrees (master's, professional school, or doctorate).

The third variable, education, is positively associated with earnings (Blundell et al, 2005). Thus, better educated households usually have a higher income after retirement. Furthermore, a higher education enhances the probability of remaining at work and the chances of becoming self-employed (Robinson and Sexton, 1994). Obviously, when the higher education level is located more in the upper part of the income distribution, income inequality becomes larger (over time).

6.4 ANALYTICAL FRAMEWORK

The aim of this analysis is to examine the relative influences of public versus private pensions, demographic and labour market factors on the overall changes in income inequality among elderly people in 8 countries. In order to gauge its net impact on income distribution, we need to estimate what the income inequality among elderly people would have been conditional on the other factors in the earlier period. The starting point is to develop a counterfactual income distribution based on all impacts being constant around 1995, except for one specific factor. This counterfactual income distribution allows us to derive the income inequality indicator among elderly people around 2005 if all factors except for the one under study had remained the same. The impact of changes in single households on income inequality among the elderly that we would like to examine, is the difference between the counterfactual income inequality indicator and the actual income inequality indicator. In order to develop the counterfactual income distribution, this study follows the approach offered by DiNardo et al (1996), Fortin et al (2010), and Chen and Corak (2005; 2008), which consists of two methods: reweighting and rank-preserving exchange.

This approach belongs to a family of budget incidence analyses in line with the work of Musgrave, Case and Leonard (1974); see also Wang, Caminada and Goudswaard (2012). It assumes that individuals behave the same in the presence or absence of a particular factor. (Frick et al, 2000; Palme, 1996). In reality, people's behaviour usually changes when a variable disappears or emerges, e.g. public or private pension income is present or absent. Government policies also change over time and it is almost impossible to incorporate policy impacts into any analytical framework. Therefore, the results and research findings of this paper are indicative only and must be interpreted with caution.

As introduced by DiNardo et al (1996), the reweighting procedure replaces the marginal distribution of a factor (or factors) in period 0 with its counterpart in period 1 using a reweighting factor:

$$\phi(X) = \frac{dF_{X1}(X)}{dF_{X0}(X)} \tag{1}$$

where $dF_{x0}(X)$ is the marginal distribution in period 0, $dF_{x1}(X)$ is the marginal distribution in period 1, and $\phi(X)$ is the reweighting factor, the ratio of two multivariate marginal distribution functions (of the covariates X). This allows us to simulate a counterfactual income distribution using a probit model to estimate the counterfactual weight and decompose the impact of changes in multiple factors on the income distribution. This approach can be applied both to averages and global indicators of income inequality (Gini coefficients) and is used by, among others, Chen and Corak (2005; 2008), Chiquiar and Hanson (2005) and Daly and Valletta (2006).

The reweighting method can be used to isolate the impact of a binary variable or categorical variables (with more than 2 categories) as well as continuous variables. Let us consider the binary variable S that defines whether an elderly individual lives alone or not ($S = 1$ indicates a single elderly household and $S = 0$ indicates other living arrangements). The density of year-1995-equivalised incomes $f_{95}(y)$ can be expressed as the weighted sum of the densities of elderly people living in a single household and elderly people living in other household types:

$$f_{95}(y) = \Pr_{95}(S=1) f_{95}(y \mid S=1) + \Pr_{95}(S=0) f_{95}(y \mid S=0) \tag{2}$$

Suppose that the share of elderly people living in a single household has increased from 10% in 1995 to 20% in 2005. To examine the influence of this change over time, each observation can be reweighted according to the percentage change in the share of each group. Therefore, every single-household elderly individual in 1995 should be up-weighted by 2 (that is 0.20/0.10) and every elderly person in another type of household should be down-weighted by 0.889 (that is 0.80/0.90). After reweighting, the counterfactual density function is:

$$f^{*}{}_{95}(y) = \phi(S=1)\Pr_{95}(S=1) f_{95}(y \mid S=1) + \phi(S=0)\Pr_{95}(S=0) f_{95}(y \mid S=0) \tag{3}$$

where the reweighting factor is

$$\phi(S) = \frac{dF_{95}(S)}{dF_{05}(S)} = S \cdot \frac{\Pr_{05}(S=1)}{\Pr_{95}(S=1)} + (1-S) \cdot \frac{\Pr_{05}(S=0)}{\Pr_{95}(S=0)} \tag{4}$$

For non-binary variables, the reweighting procedure can be implemented by pooling data from the two years under study and using a probit model to obtain the reweighing factor.

Then, the counterfactual income distribution can be simulated with the adjusted weights equal to the reweighting factor multiplied by the original weight. The impact of changes in single elderly households can be computed by comparing the Gini estimate based on the counterfactual with the actual Gini coefficient in 1995.

Chen and Corak (2008) note that the reweighting method assumes that the distribution of the characteristics does not affect the distribution of the outcome variable. For example, the influences of all of the demographic factors and some of the labour market factors are assumed constant. This is a rather bold assumption and unrealistic for the purpose of isolating the impacts of earnings or pensions on income inequality among elderly people. This is because the equivalised income of elderly people derives mostly from pension and labour income and the welfare system and labour market have undergone significant changes over time. Consequently, the rank-preserving exchange method will be used when assessing the impacts of earnings and pension variables.

The rank-preserving exchange approach maps the variable that needs to be fixed in a certain rank of the income distribution in one period to the same rank of the income distribution in the other period. It can be applied to simulate the impact of changes in earnings, private and public pensions on income distribution among the elderly, conditional on other factors. In the case of public pensions, for example, this approach involves subtracting each elderly person's equivalised public pensions from his or her total equivalent disposable income in 1995 and adding back the amounts in 2005 from the same income rank. That is:

$$I^{*}_{95} = I_{95} - Pubpen_{95} + Pubpen_{05} \quad (5)$$

where I^{*}_{95} is the counterfactual equivalised income of the elderly people in 1995, I_{95} is the actual equivalised income of the elderly people in 1995, and and $Pubpen_{95}$ and $Pubpen_{05}$ are the equivalised public pensions of the elderly people in 1995 and 2005, respectively. In the empirical application, all elderly people are first ranked from lowest to highest by equivalised income and divided into equally sized groups, considering household sampling weights.[9] Now, the median incomes within each percentile in 1995 can be computed. Then, for the same percentile rank, the equivalised public pensions are subtracted in 1995 and replaced with the variable in 2005. The resulting counterfactual income distribution is the distribution holding all factors at the same level as in 1995, with the exception of public pensions. The difference between income inequality based on the distributions of I^{*}_{95} and I_{95} is the contribution of changes in the public pension's distribution to the changes in income inequality from 1995 to 2005.

To recap, the reweighting method will be applied to analyze the impacts of all demographic factors (share of households with the household head above 75 years old, education level of the household, and single household) and some of the labour market factors (household working status). For other factors such

9 The number of groups is determined by the sample size. The larger the number of groups, the less the bias of the global income inequality indicator that arises from the grouping.

as annual earnings, public and private pensions, the rank-preserving exchange approach is used.

It should be noted that the applied decomposition method may produce a residual term due to two reasons. First, other factors that were not taken into account could play a role. Second, residuals arise due to overlap when variables measuring partial decomposition effects reflect the same effects. It is common to find such residuals with this decomposition approach (see Chen and Corak, 2005; 2008, OECD, 2011a, chapter 5).

6.5 SIMULATION RESULTS

Table 6.3 shows the impact on income inequality among the elderly of the composition of pension income, labour market factors and demographic factors from 1995 to 2005 in 8 countries. On average, income inequality as indicated by Gini increased by 0.011, mainly contributed by labour market factors (+0.020), especially the distribution of earnings, and to a lesser extent by the changes in the distribution of private pensions (+0.003). However, this increase was offset by the effect of the public pension system (-0.012). Furthermore, demographic factors play a negligible role. This is because cohorts entering old-aged groups look like individuals that were originally part of the elderly group.

However, there is large variation across countries. Conditional on other labour market and demographic factors, in all countries except the United States (private and public) pensions had a partially equalizing effect on income inequality among the elderly. In Australia, Israel, Norway, the United Kingdom and the United States, private pensions contributed to the rise in income inequality. Interestingly, public pensions became more redistributive in 2005 compared to 1995 in all countries except Canada.

Labour market factors led to a higher income inequality in all studied countries except Israel. The household working status had an inequality-increasing effect in Australia, Denmark and Germany. Changes in the distribution of earnings also led to higher inequality in all countries except Israel.

As for demographic factors, the change in the share of people above 75 years old is associated with higher income inequality in Israel and Norway, but lower inequality in Australia and Germany. Elderly people living in single family households do not cause increased inequality except in Denmark, Germany and Israel. University attendance of the household head in elderly households does not influence the income distribution among the elderly.

As tabulated in the last row of Table 6.3, the residual (i.e. unexplained or overlapping effects) is rather small, on average around 0.001 or 9% of the total change in inequality. The residual captures the impacts of omitted variables and the possible overlapping of one or more variables. For example, the effect of changes in the decision to work on income inequality may be different in

the presence or absence of changes in pensions. Fortunately, the residual is relatively small. Over 90% of inequality changes are accounted for by our analyses.

The model's explanatory power differs across countries. It is pretty good for some countries, namely Australia, Denmark, Germany, Israel and the United States. Over 70% of inequality changes were taken into account for these countries. However, it is less robust for the United Kingdom. Its rather large residual suggests that important factors may have been neglected. However, it should be noted that the UK is a special case: the change in the Gini over time was very small (+0.001), so partial decomposition effects can be troublesome.

To explore the sensitivity of the results to global inequality measures, the above exercise was repeated using other inequality indicators: Mean Log Deviation, Theil Index and Atkinson's Index (α=0.5). See the annex 6A for details. In general, the results do not seem to be sensitive to the indicator that is used. For all indicators, public and private pensions were found to be more inequality-reducing over time and labour market factors more inequality-increasing. Demographic factors played a negligible role. However, in some cases the results are sensitive to the inequality measure used. For example, Mean Log Deviation and Atkinson's Index (a=0.5) are more sensitive to lower income groups. Therefore, in the United States the effect of public pensions became stronger over time, i.e. more inequality-reducing when MLD was used then when the Gini was used.

Table 6.3 Decomposition of changes in income inequality among the elderly, 1995-2005 (Gini coefficient)

	Australia (1995, 2003)	Canada (1994, 2004)	Denmark (1995, 2004)	Germany (1994, 2004)	Israel (1997, 2005)	Norway (1995, 2004)	United Kingdom (1995, 2004)	United States (1994, 2004)	Average
1. Income inequality among the elderly									
Around 1995	0.260	0.256	0.207	0.258	0.377	0.232	0.292	0.360	0.280
Around 2005	0.295	0.269	0.216	0.268	0.367	0.242	0.293	0.377	0.291
Change	0.035	0.013	0.009	0.010	-0.010	0.010	0.001	0.018	0.011
2. Contribution to changes in income inequality among the elderly									
2a. Private/Public mix of pensions	-0.006	-0.001	-0.008	-0.015	-0.015	-0.003	-0.028	0.001	-0.009
Private pensions	0.011	-0.003	-0.006	-0.003	0.002	0.011	0.001	0.006	0.003
Public pensions	-0.018	0.002	-0.002	-0.013	-0.018	-0.015	-0.029	-0.005	-0.012
2b. Labour market factors	0.046	0.011	0.017	0.024	-0.001	0.018	0.023	0.021	0.020
Household working status	0.005	0.000	0.002	0.002	0.000	0.000	0.000	0.000	0.001
Annual earnings	0.041	0.011	0.015	0.022	-0.001	0.018	0.023	0.021	0.019
2c. Demographic factors	-0.001	0.000	0.001	0.000	0.004	0.000	0.000	-0.003	0.000
Share of people above 75 years old	-0.001	-0.001	0.000	-0.001	0.001	0.003	0.000	0.000	0.000
Single household	-0.001	0.000	0.001	0.001	0.003	-0.003	0.000	-0.002	0.000
University attendance of household head	0.000	0.000	0.000	0.000	-	0.000	-	0.000	0.000
Residual	-0.004	0.003	-0.001	0.002	0.003	-0.004	0.006	-0.001	0.001

Note: Information on education is not available for Israel and the United Kingdom.
Source: Derived by the author using micro data from LIS

6.6 DISCUSSION

Income inequality in OECD countries has increased in the last decades. To a large extent this is due to changes in income composition, labour market and demographic factors. Literature examining the links between the trend of rising income inequality and its driving forces mainly focus on income inequality among the total or prime-age population. This study concentrates on the well-being of the elderly, providing information on the extent to which these factors contribute to the changes in income inequality among the elderly in 8 OECD countries from around 1995 to around 2005.

During this period, the overall income inequality among elderly people in these countries increased slightly, with Australia showing the highest increase and the United States and Canada showing a less prominent increase, while income inequality in Israel declined. By simulating counterfactual income distributions of the elderly, this study found that on average the majority of the increase can be attributed to labour market factors, especially the distribution of earnings, and to a lesser extent to changes in the composition of public versus private pensions. The empirical analysis indicates that (on average across countries) higher inequality caused by private pensions was compensated for by changes in the distribution of public pensions. In line with an earlier study (Van Vliet et al, 2012a), the shift from public to private pensions does not (yet) seem to create higher levels of income inequality among the elderly. Furthermore, demographic factors play a negligible role in changes in income inequality among the elderly during the period and countries under study.

The changes in income inequality among the elderly are attributable to several factors. Private pensions contribute to higher income inequality among the elderly in 2005 compared to 1995, except in Canada, Denmark and Germany. Public pensions have become more redistributive over time, except in Canada. With respect to demographic factors, the share of people above 75 years old is associated with less income inequality in Israel and Norway but has a slightly negative impact in Australia and Germany. The share of elderly people living in a single family household does not drive the outcomes except for those in Germany and Israel. With regard to labour market factors, changes in the distribution of earnings lead to a larger income inequality in all countries under study except Israel. In addition, there is a positive effect of the household working status on income inequality among the elderly in Australia, Denmark and Germany.

These results lead to the policy suggestion that tackling poverty and income inequality among the elderly should focus on their earnings' distribution. In addition, the changes in the mix of public versus private pensions do not seem to result in higher income inequality among the elderly. However, these findings should be interpreted with caution since our decomposition approach only considers the partial equilibrium or static state rather than global equili-

brium or the dynamic situation. Future work should shed more light on the income inequality among the elderly, and improve the decomposition method to reduce the influence of alternative explanations (= minimize residuals).

Annex 6A

Sensitivity analysis for decomposition using different global income inequality indicators

Table 6A.1 Decomposition of changes in income inequality among the elderly, 1995-2005 (Mean Log Deviation, Theil Index and Atkinson's index (a=0.5))

	Australia (1995, 2003)			Canada (1994, 2004)			Denmark (1995, 2004)			Germany (1994, 2004)			Average		
	MLD	GE(1)	A(0.5)	MLD	GE(1)	A(0.5)	MLD	GE(1)	A(0.5)	MLD	GE(1)	A(0.5)	MLD	GE(1)	A(0.5)
1. Income inequality among the elderly															
Around 1995	0.119	0.121	0.057	0.105	0.118	0.054	0.073	0.089	0.039	0.114	0.113	0.055	0.139	0.148	0.068
Around 2005	0.159	0.172	0.077	0.118	0.128	0.059	0.081	0.102	0.044	0.119	0.131	0.060	0.150	0.164	0.074
Change	0.040	0.052	0.020	0.013	0.010	0.005	0.009	0.013	0.005	0.005	0.018	0.005	0.012	0.016	0.006
2. Contribution to changes in income inequality among the elderly															
2a. Private/Public mix of pensions	0.004	0.005	0.001	0.000	-0.004	-0.001	-0.009	-0.023	-0.007	-0.022	-0.016	-0.009	-0.009	-0.003	-0.003
Private pensions	0.011	0.017	0.006	-0.003	-0.006	-0.002	-0.007	-0.013	-0.004	-0.004	-0.004	-0.002	0.003	0.006	0.002
Public pensions	-0.008	-0.012	-0.005	0.004	0.003	0.001	-0.002	-0.010	-0.003	-0.017	-0.013	-0.007	-0.011	-0.009	-0.005
2b. Labour market factors	0.045	0.077	0.027	0.010	0.012	0.005	0.015	0.031	0.010	0.025	0.031	0.013	0.018	0.031	0.011
Household working status	0.004	0.004	0.002	0.000	0.000	0.000	0.001	0.002	0.001	0.002	0.001	0.001	0.001	0.001	0.000
Annual earnings	0.042	0.073	0.025	0.010	0.012	0.005	0.013	0.029	0.009	0.023	0.030	0.012	0.017	0.030	0.011
2c. Demographic factors	0.001	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.001	0.000
Share of people above 75 years old	0.001	0.000	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	-0.002	-0.001	-0.001	0.000	0.001	0.000
Single household	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.002	0.001	0.001	0.000	0.001	0.000
University attendance of household head	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Residual	-0.010	-0.031	-0.008	0.003	0.001	0.001	0.003	0.004	0.002	0.003	0.002	0.001	0.002	-0.013	-0.002

Note: MLD = Mean Log Deviation; GE(1) = Theil Index; A(0.5) = Atkinson's index (a=0.5). Information on education is not available for Israel and the United Kingdom.
Source: Own calculation using micro data from LIS

Table 6A.1 Decomposition of changes in income inequality among the elderly, 1995-2005 (Mean Log Deviation, Theil Index and Atkinson's index (a=0.5)), continued

	Israel (1997, 2005)			Norway (1995, 2004)			United Kingdom (1995, 2004)			United States (1994, 2004)			Average		
	MLD	GE(1)	A(0.5)	MLD	GE(1)	A(0.5)	MLD	GE(1)	A(0.5)	MLD	GE(1)	A(0.5)	MLD	GE(1)	A(0.5)
1. Income inequality among the elderly															
Around 1995	0.237	0.252	0.115	0.093	0.108	0.048	0.137	0.156	0.070	0.232	0.224	0.106	0.139	0.148	0.068
Around 2005	0.224	0.223	0.106	0.103	0.137	0.057	0.144	0.164	0.073	0.256	0.254	0.117	0.150	0.164	0.074
Change	-0.013	-0.029	-0.009	0.010	0.029	0.009	0.007	0.008	0.003	0.024	0.030	0.011	0.012	0.016	0.006
2. Contribution to changes in income inequality among the elderly															
2a. Private/Public mix of pensions	-0.011	-0.002	-0.004	0.002	0.039	0.009	-0.023	-0.026	-0.012	-0.011	0.003	-0.001	-0.009	-0.003	-0.003
Private pensions	0.009	0.006	0.003	0.012	0.040	0.011	0.001	0.003	0.001	0.003	0.009	0.003	0.003	0.006	0.002
Public pensions	-0.019	-0.007	-0.007	-0.010	0.000	-0.002	-0.024	-0.029	-0.012	-0.014	-0.007	-0.004	-0.011	-0.009	-0.005
2b. Labour market factors	0.005	-0.001	0.000	0.008	0.010	0.005	0.025	0.040	0.014	0.010	0.045	0.013	0.018	0.031	0.011
Household working status	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.000
Annual earnings	0.005	-0.001	0.000	0.008	0.010	0.005	0.025	0.040	0.014	0.010	0.045	0.013	0.017	0.030	0.011
2c. Demographic factors	0.004	0.008	0.003	0.004	0.004	0.001	0.000	0.000	0.000	-0.003	-0.004	-0.001	0.001	0.001	0.000
Share of people above 75 years old	0.001	0.002	0.001	0.005	0.006	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000
Single household	0.003	0.005	0.002	-0.001	-0.001	-0.001	0.000	0.000	0.000	-0.003	-0.003	-0.001	0.000	0.001	0.000
University attendance of household head	-	-	-	0.000	0.000	0.000	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000
Residual	-0.011	-0.034	-0.008	-0.004	-0.025	-0.007	0.005	-0.005	0.000	0.029	-0.014	0.001	0.002	-0.013	-0.002

Note: Information of education is not available in Israel and the United Kingdom.
Source: Derivation by the author using micro data from LIS