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A Sensitivity Analysis**

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## ABSTRACT

### **Estimation of Joint Income-Wealth Poverty: A Sensitivity Analysis\***

Most poverty studies build on measures that take account of recurring incomes from sources such as labour or social transfers. However, other financial resources such as savings and assets also affect living standards, often in very significant ways. Previous studies that have sought to incorporate assets into poverty measures suggest that (1) poverty estimates including wealth are considerably lower than income-based measures; (2) poverty rates of the elderly are more affected than those of the nonelderly and (3) poverty rates are especially affected by the household's main residence. This paper assesses the sensitivity of these conclusions to various plausible alternative assumptions, such as the poverty line calculation, the types of assets included in the wealth concept and choices with respect to the equivalence scale. Moreover, we check whether the impact of alternative assumptions is consistent across age and institutional settings. To that effect we compare Belgium and Germany, two countries with similar living standards and income poverty rates, but very different levels and distributions of wealth. Using data from the HFCS we show that accounting for wealth affects the incidence and age structure of poverty in a very substantial way. Country comparisons are also affected in very substantial ways.

JEL Classification: I32

Keywords: income, wealth, poverty measurement, sensitivity analysis

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# 1 Introduction

Researchers and policy makers in the rich world mostly worry about income poverty. However, the wider financial resources on which people can draw are also important in assessing financial precariousness. Households that can smooth out consumption by relying on savings and assets, loans or the financial help of others are clearly better off than households who do not have these opportunities. Yet, apart from the direct income flows they may generate, traditional poverty measures often disregard the role of such assets (Azpitarte, 2011; Brandolini et al., 2010). In contrast, financial liabilities may make households more economically vulnerable than their incomes suggest. Moreover, evidence also shows that wealth and income have an independent impact on subjective well-being (Headey & Wooden, 2004) and on satisfaction of life (D'Ambrosio et al., 2009). Recent high-level reports also argue in favour of a joint income-wealth perspective on living standards (Stiglitz et al., 2009; OECD, 2013b).

If one agrees on the fact that wealth should be included in poverty measurement, the question arises: how should we do it? In the literature there are two approaches. A first approach integrates the two financial resources into one single dimension by converting wealth into yearly annuities (Brandolini et al., 2010; Short & Ruggles, 2005; Van den Bosch, 1998; Weisbrod & Hansen, 1968), while a second approach applies a two-dimensional framework by developing separate poverty lines for income and wealth (Kim & Kim, 2013; Azpitarte, 2012; Headey, 2008; Haveman & Wolff, 2004). The general findings of these approaches are (1) that poverty estimates including wealth are much lower than the traditional income-based measures; (2) that poverty rates of the elderly are much more affected than those of the non-elderly and (3) that the decline in poverty rates is much higher when the value of the household's main residence is included than when only non-housing wealth is taken into account (Azpitarte, 2012; Brandolini et al., 2010; Headey, 2008; Caner & Wolff, 2004; Van den Bosch, 1998). However, we may want to be careful about generalizing these findings of a limited number of studies. Indeed, "we need to better understand the properties of these alternative indicators and assess their sensitivity to different assumptions" (Brandolini et al., 2010, p.281).

The purpose of this paper is exactly this. We investigate several issues related to the measurement of joint income-wealth poverty. We discuss in detail the two approaches adopted in the literature and empirically review the robustness of poverty outcomes to various measurement assumptions, such as the use of different poverty lines, wealth concepts, equivalence scales, etc. Moreover, we also highlight the sensitivity of the results from the angle of age. This after all is the socio-demographic characteristic which is thought to be the most sensitive to the way we include wealth information. We use income and wealth data from the Eurosystem Household Finance and Consumption Survey (HFCS) for Belgium and Germany. These countries are known for having very similar living standards and income poverty rates, but appear to have very different levels and distributions of wealth, and which are differently correlated with income. We show that the two most important conclusions drawn in the literature largely depend on specific measurement choices. First, studies generally find that poverty estimates including wealth are much lower than the traditional income-based measures. We show that this strongly depends on the way one calculates the poverty line. Poverty rates may increase as well as decrease after wealth is accounted for, substantially altering cross-country rankings. Second, as one

would expect, the inclusion of wealth has a great effect on the observed poverty incidence among young versus older households, yet any conclusion on the ratio between elderly and non-elderly poverty is again highly sensitive to the assumptions that are made.

The paper proceeds as follows. The second part discusses the literature on joint income-wealth poverty and its relationship to the traditional poverty literature. More specifically, we highlight several reasons why it is important to include wealth in the measurement of poverty and how in practice this is implemented by the two approaches. The data are briefly described in the third part and the fourth part presents the baseline results for Belgium and Germany. In the following part we address the choices that researchers need to make in the operationalisation of the joint income-wealth poverty index and we perform sensitivity analyses for several of these measurement issues. In particular, we consider the robustness of our outcomes to variations in the following aspects: the poverty line, wealth concept, equivalence scale and the interest rate. The last part concludes.

## **2 Measuring poverty**

### **2.1 Why include wealth in poverty measurement?**

“Although poverty reduction is a universal goal among both nations and international organizations, there is no commonly accepted way of identifying who is poor.” (Haveman & Wolff, 2004, p.146). However, the concept of poverty usually refers to a situation of economic hardship, when the financial resources over which people have command are insufficient to guarantee a minimally acceptable standard of living. A definition of poverty requires an identification of ‘financial resources’ and a method to determine the minimally acceptable living standard. In a developed context, the first is typically expressed in terms of yearly or monthly disposable income, while the latter is more contested. In the EU the most important poverty indicator is the At-Risk-of-Poverty (AROP) measure, which sets the poverty threshold at 60 per cent of national median equivalised disposable household income. This income concept covers income from labour, pensions and social transfers as well as financial income such as interests, dividends, etc.

Hence, apart from the direct income flow they generate, the role of assets is absent (Azpitarte, 2011; Brandolini et al., 2010). Since there are also assets that generate little or no income flow this approach is not satisfying. Moreover, evidence shows that estimates of capital income and self-employment income (which often also includes some type of capital income) are typically underestimated in household surveys (Mattonetti, 2013; Davies et al., 2011; Wagner & Grabka, 1999 as cited by Milanovic, 2006). The most evident example of an asset that is currently not represented in poverty measures is housing. A solution to this problem has been suggested by adding to income the concept of ‘imputed rent’, which is the estimated value of housing services provided by owner-occupied dwellings less the value of costs incurred to maintain the property (Canberra Group, 2011). However, this addition is not sufficient because savings and assets contribute to living standards above and beyond the direct income flows they generate. They assure economic and financial security because they can be used to face unexpected financial setbacks. Moreover, assets provide their owners with a form of economic power by enabling them to make purchases to move up or maintain class status (Cowell & Van Kerm, 2015; Nam et al., 2008). In other words, assets contribute to living standards not

only by generating income flows but also because they can be converted directly into cash or can be used as collateral (Azpitarte, 2012). In contrast, the presence of large financial liabilities might also be incorporated in poverty measurement because it may make households much more vulnerable than their mere incomes suggest. Furthermore, because income is by nature rather volatile, evidence shows a large turnover in income poverty (Azpitarte, 2012), while assets and liabilities are much more stable. For these and other reasons several authors have argued in favour of including information on wealth in poverty measurement because it better reflects *all* the financial resources available to households (e.g. Azpitarte, 2012; Brandolini et al., 2010; OECD, 2013; Stiglitz et al., 2009).

Many authors would take these critiques as arguments for using consumption information. Indeed, as it reflects the difference between income and the change in net worth it might be sufficient to look at this single dimension instead of trying to integrate two resources. The large drawback of this approach, however, is that it only looks at *actual consumption* patterns. Particularly in the case of wealth, households may want to decide not to use all available resources for consumption. Imagine two households with the same low income and median wealth; it is not because the first household decides to use their wealth to support consumption and the second household does not that the latter is necessarily worse off. In the words of Sen (1985, 1997), we should look at all available resources to be able to identify the capability set of households. Combining information on income and wealth allows to determine all *consumption possibilities* (Stiglitz et al., 2009, p.115).

## 2.2 How include wealth in poverty measurement?

In a developed context there exist two main approaches to take account of the contribution of assets to households' living standards. The first one summarizes the wealth and income dimensions into a unidimensional poverty index. Since wealth is a stock and income a flow the annuity method proposed by Weisbrod & Hansen (1968) is often used in order to make assets "commensurable" (p.1315). The method is adopted by among others Brandolini et al. (2010), Short & Ruggles (2005), Zagorsky (2005) and Van den Bosch (1998). The second approach follows a two-dimensional approach by developing separate poverty lines for income and wealth. The most notable contributions in this stream are Azpitarte (2012; 2011), Headey (2008) and Haveman & Wolff (2004). We discuss both approaches below in more detail, with a graphical illustration provided in Figure 1.

First, the unidimensional approach defines poverty by the sum of income and wealth. In general it is considered too extreme to expect households to use all their wealth to keep living standards at an adequate level. Therefore, the method of Weisbrod & Hansen (1968) to annuitize wealth is used. Wealth is converted into a flow of resources, so as to end up with an augmented income concept (Azpitarte, 2011; Brandolini et al., 2010). "Income and wealth are perfectly fungible, and one unit of wealth can be straightforwardly substituted for one unit of income" (Brandolini et al., 2010, p.269). This seems intuitive because most assets are the result of an accumulation of income and can be converted back into income (Kim & Kim, 2013).<sup>1</sup> The annuitization is specified using the following formula:

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<sup>1</sup> It should be clear that not all asset types can be easily sold or bought on the market. In the case of non-liquid assets like real estate it is certain that an immediate sale would mean incurring substantial costs.

$$AY_t = Y_t + \left[ \frac{\rho}{1 - (1 + \rho)^{-n}} \right] NW_{t-1} \quad (1)$$

$$n = T \text{ for unmarried,}$$

$$T_1 + (T - T_1)b \text{ for married}$$

(Brandolini et al., 2010, p.270)

Where  $AY_t$  refers to annuitized income,  $Y_t$  equals income received in year  $t$ ,  $NW_{t-1}$  is net worth held at the beginning of the period and  $\rho$  and  $n$  are the interest rate and length of the annuity respectively. The latter is expressed in terms of life expectancies, where  $T_1$  refers to time to death of the person who dies first,  $T$  time to death of the survivor and  $b$  is the reduction in the equivalence scale coefficient which results from the death of the first person (for a detailed derivation of this formula see Brandolini et al., 2010, pp.269-271 & 273)<sup>2</sup>. Income ( $Y_t$ ) should be interpreted as net of the yield from net worth because this yield would be lost if net worth is depleted (Weisbrod & Hansen, 1968, p.1317). In other words,  $Y_t$  only covers income received from labour, pensions and social transfers and not financial income. A nuance that should be added to this, however, is that annuities exist as distinct financial products. As this flow originates from assets that are no longer in possession of the household it should also be added to the income variable.

The main critique on this first approach is that it aggregates all available information so that it does not allow studying differences in income and wealth positions (Azpitarte, 2012). Second, it is argued that the single income-net worth approach obliges researchers to impose several assumptions, mainly regarding the values of the length and interest rate of the annuity. “We might be reluctant to impose so much structure on the measurement, especially when we take into account the profound implications that such a measure has for the age structure of poverty.” (Brandolini et al., 2010, p.271). Finally, Weisbrod & Hansen (1968) stress that they developed an approach that is operationally feasible, but may not reflect how households handle their assets in practice. Indeed, they do not imply “[...] either that people generally *do* purchase annuities with any or all of their net worth, that they necessarily *should* do so, or that they *can* do so” (pp.1316-1317).

The second approach specifies poverty thresholds for each dimension separately. In this regard income poverty retains its traditional interpretation, while asset poverty<sup>3</sup> is seen as the situation where asset holdings are insufficient to maintain the household at a minimally acceptable living standard when income from labour or social transfers is not available (Brandolini et al., 2010; Haveman & Wolff, 2004). In other words, wealth adds a sort of sustainability aspect to the definition of poverty (Törmälehto et al., 2013). Haveman & Wolff (2004, p.149) and Caner & Wolff (2004, p.496) use the following operational definition: “a household or a person is considered to be asset poor if their access to wealth-type resources is insufficient to enable them to meet their basic needs for some limited period of time”.

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<sup>2</sup> The specification of  $n$  in function of expected lifetimes of both partners is proposed by Rendall & Speare (1993). Although Brandolini et al. (2010) discuss this broader specification, they do not implement it. As most authors they use the longest of the two expected lifetimes. We prefer to use the Rendall & Speare specification because it represents the improved economic situation of the surviving household as the same level of wealth is then available to fulfill the needs of fewer household members. Ideally, one should take into account the wealth loss due to inheritance taxes.

<sup>3</sup> Authors tend to refer to wealth poverty when implementing the unidimensional approach, while the term asset poverty is mostly used for the two-dimensional approach. As both approaches use net worth in their calculations, this reflects only a difference in terminology.

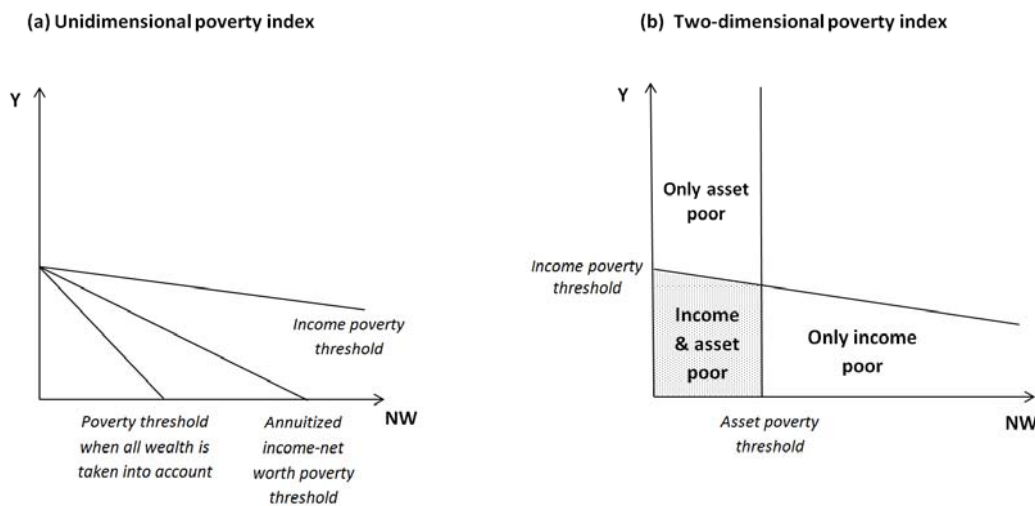
More specifically, they set the asset poverty threshold as a fraction ( $\zeta$ ) of the official income poverty line ( $Z_t$ ), which can be formalised as follows:

$$\begin{aligned} \text{Asset poverty: } & NW_{t-1} < \zeta Z_t \\ \text{Income poverty: } & Y_t < Z - r_t NW_{t-1} \end{aligned} \quad (2)$$

(Brandolini et al., 2010, p.271)

This approach enables one to identify three types of poverty groups, and hence provides an answer to the first critique. First, there are households which are poor in both dimensions. Second, there is a group of households that fall under the income poverty line, but can rely on substantial amounts of assets. Finally, households may have an income above the income poverty threshold, but are asset poor because they own little or no assets to fall back on (Azpitarte, 2012). Headey (2008) also applies this approach to the measurement of poverty in Australia but takes into account a third dimension, namely consumption. The reason is mainly that it reflects borrowing opportunities. However, for reasons explained in section 2.1 and because borrowing opportunities are correlated with income and wealth (e.g. Azpitarte, 2012; Sullivan, 2008) (i.e. they tend to be unavailable to those with both low income and low wealth), it is sufficient to jointly look at income and wealth poverty.

**Figure 1: Illustration of poverty lines**



Source: Brandolini et al. (2010, p. 270 & 272)

### 3 Data & methods

We use data from the first wave of the Eurosystem Household Finance and Consumption Survey (HFCS) version 1.1. The HFCS is a rich dataset covering detailed wealth, gross income and consumption information of more than 62,000 households in 15 Euro area member states (Eurosystem Household Finance and Consumption Network (HFCN), 2013a & 2013b). In Belgium 2,327 households were surveyed in 2010, while the German HFCS covers information on 3,565 households and surveys took place in 2010 and 2011. For both countries incomes refer to 2009, while the value of assets and liabilities refers to the time of the interview. Noteworthy features of the HFCS are oversampling of the wealthy<sup>4</sup>, multiply imputed data and replicate weights.

<sup>4</sup> In Belgium this oversampling was based on the NUTS 1 region and the average income by neighbourhood of residence.



### 3.1 Belgium and Germany as case studies

This paper builds on Belgium and Germany as case studies. These neighbouring countries belong to the most advanced economies in Europe and their social security systems are both largely founded on Bismarckian principles. Both countries rely on pay-as-you go pension systems. What makes the two countries particularly interesting is that while median living standards and overall poverty rates are nearly identical, their levels and distributions of private household wealth differ completely.

As can be seen in Table 1, median equivalised incomes are almost the same and the traditional at-risk-of-poverty rate is at a similar level in both countries. However, Table 1 also shows that median wealth accumulations are much higher in Belgium than in Germany. This difference is mainly the consequence of a significant discrepancy in the home-ownership rate. About 70 per cent of Belgian households own their house, but although many countries have similar home-ownership rates today, Belgium has been a ‘nation of homeowners’ for a long time already (De Decker, 2011). This is the consequence of a century of an “asset-based approach to welfare” (De Decker & Dewilde, 2010) in which homeownership was highly encouraged through various policy mechanisms. In contrast, Germany has at 44 per cent the lowest home-ownership rate in the Euro Area, which “[...] can be explained by historical (WW2), taxation and institutional reasons” (HFCN, 2013b, p.29). Moreover, the correlation between the income and wealth distributions is weaker in Belgium than in Germany (Arrondel et al., 2014; Skopek et al., 2012). In particular, Belgium has a relatively large share of households with low incomes but substantial wealth holdings, which are mainly represented among the elderly population (Arrondel et al., 2014; Van den Bosch, 1998). As a result of the combination of higher wealth levels and a weaker correlation with income, we expect that the inclusion of wealth in poverty measurement will have a larger impact in Belgium than in Germany.

**Table 1: Comparison of social indicators Belgium and Germany**

	Belgium	Germany
Median equivalised disposable income (*)	€19,313	€18,586
At-risk-of-poverty rate (*)	14.6%	15.5%
Median net wealth	€206,000	€51,000
Home-ownership rate	69.6%	44.2%

Note: (\*) We use data from 2009, in line with the HFCS income reference period.

Source: Eurostat, HFCN (2013a)

### 3.2 Methods

With regard to wealth we use the HFCS ‘net worth’ concept (see first column of Table 3 for an overview of its components), which does not include asset types such as human and social capital or the valuation of pension and social security wealth. The HFCS covers only gross incomes, which are not suitable for poverty analysis. However, for several countries these have been converted into disposable incomes<sup>5</sup> using the tax-benefit microsimulation model EUROMOD (see Kuypers et al., 2015)<sup>6</sup>. For the traditional income poverty we use the EU At-risk-of-poverty line (AROP), which is defined as 60 per cent of national median equivalised disposable income. The income variable that is

<sup>5</sup> Property taxes could not be taken into account because the HFCS does not include cadastral values.

<sup>6</sup> A Eurostat study (2013) proposes another method to jointly assess poverty in disposable income and net wealth. By statistically matching the EU-SILC and HFCS data they largely find the same results.

implemented in the two-dimensional approach refers to disposable income, while the income variable in the unidimensional approach covers only income from employment, self-employment, public and private pensions and social and private transfers. As annuity products are uncommon in Europe, these types of assets are not surveyed in the HFCS.

Formulas (1) and (2) require income in year  $t$  and net worth at the beginning of that year. Since the HFCS combines information on income during the last twelve months/calendar year and net worth at time of survey, there could be some resources that are represented in both income and net worth. This type of 'double counting' exists with regard to income that is received during year  $t$  which is not consumed but instead saved or invested<sup>7</sup>. The problem is that it is not clear which part of wealth at the end of the year originated from income received throughout the year. We propose to exclude from wealth an amount equal to the income from financial investments, such as dividends, interests and rental income from property. This appears to be a good proxy because evidence shows that people are more likely to save from irregular income sources such as financial income than from regular wages and salaries (Shefrin & Thaler, 1992; Thaler, 1990 as cited by Beverly et al., 2008). Indeed, since financial income is rather insecure it is often not accounted for in household budgeting, which makes it easier to set aside. Moreover, it will be easier to save or invest financial income because it already originates from the financial sphere and the costs of reinvestment are smaller.

In order to calculate the annuity in the unidimensional approach we use life expectancies by age and gender which are provided by the Directorate-General Statistics, Department Economics of the Belgian Federal Government (2014) and the Statistisches Bundesamt (2012). Since age is top coded at 85 years in the HFCS we restrict our analysis to households where both partners are maximum 84 years old.<sup>8</sup>

## 4 Baseline results

We start our empirical discussion by looking at poverty headcounts for Belgium and Germany when implementing the standard assumptions of the literature, our so-called 'baseline indicators'. The unidimensional approach to joint income-wealth poverty is in most studies operationalised by setting the interest rate ( $\rho$ ) equal to 2 per cent and the poverty line is set equal to the official income poverty line (e.g. Brandolini et al., 2010; Van den Bosch, 1998; Weisbrod & Hansen, 1968). The parameters of the two-dimensional approach are in existing studies determined as follows: the income poverty line retains its traditional interpretation and the asset poverty line is set at  $\frac{1}{4}$  of the income poverty line (e.g. Azpitarte, 2012; Haveman & Wolff, 2004). Based on these choices the general findings of the literature are first that the estimates are much lower than for the traditional income-based measures. This is not surprising as they tend to keep the traditional poverty line constant while including considerably more financial resources to the measure that is evaluated against this poverty line. Second, as a consequence of the life-cycle model of wealth accumulation poverty rates of the elderly are much more affected than those of the non-elderly. Finally, since housing wealth represents the

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<sup>7</sup> Also saved income from the ongoing year can be represented in the net worth measure. As we have no information on current incomes we cannot correct for this.

<sup>8</sup> We cannot assign life expectancies if we do not have information on the exact age. As a consequence for both countries about 80 sample households were not included in the analysis.

largest share of a household's asset portfolio the decline in poverty rates is much higher when the value of the household's main residence is included than when non-housing wealth is only taken into account (e.g. Azpitarte, 2012; Brandolini et al., 2010; Caner & Wolff, 2004).

The results of the baseline indicators for our two countries are shown in Table 2. In line with previous studies we find lower poverty rates when wealth is incorporated in the measurement of poverty compared to the traditional income poverty headcount, but the impact differs largely between countries. The unidimensional approach suggests a decrease of the number of poor households with 5.7 percentage points for Belgium and with 2.2 percentage points for Germany. Outcomes for the two-dimensional approach indicate that about 6.2 per cent of Belgian households are both income and asset poor, while almost 11 per cent have an income below the poverty threshold but own substantial amounts of wealth, which is about two-thirds of all income-poor households. Interestingly, 5.6 per cent of households are not considered poor according to the traditional income poverty line, but they have little or no assets to fall back on, which makes them very vulnerable to an income loss. Among German households the three groups represent about the same share. Less than half of all income poor households are found to have sufficient wealth holdings. These outcomes confirm our expectations; because wealth levels are lower in Germany and more correlated with income, the inclusion of wealth information has a much weaker impact in Germany than in Belgium.

Table 2 also provides results separately for the elderly and non-elderly<sup>9</sup>. It is clear that the inclusion of wealth has a much larger impact on the number of poor elderly than non-elderly, which also corresponds to evidence from other studies. Again, the effect is larger among the Belgian elderly than among the German elderly.

**Table 2: Baseline poverty rates**

Poverty measure	All		Elderly (65-84)		Non-elderly (-64)	
	Belgium	Germany	Belgium	Germany	Belgium	Germany
<b>Income poverty<sup>10</sup></b>	17.1	18.5	14.2	16.6	18.1	19.2
<b>Unidimensional</b>	11.4	16.3	3.5	11.9	14.1	18.0
<b>Two-dimensional</b>						
Income & asset poor	6.2	9.7	1.4	5.7	7.9	11.3
Only income poor	10.9	8.7	12.8	10.9	10.2	7.9
Only asset poor	5.6	11.1	4.2	6.0	6.1	13.0

Note: unidimensional poverty is calculated using unadapted poverty line (i.e. traditional income poverty line) (see part 5.1)

Source: own calculations based on HFCS

<sup>9</sup> Elderly is defined as at least one of the adults being 65 years or older, the legal retirement age in Belgium and Germany.

<sup>10</sup> The results based on the HFCS are slightly higher than the official income poverty rates reported by Eurostat (See Table 1). This is the consequence of the combination of a slightly higher median income in the HFCS than in other surveys and lower disposable incomes at the bottom of the distribution (Kuypers et al., 2015). Moreover, in contrast to the general evidence on income poverty (OECD, 2008; Eurostat), the traditional income poverty measure based on the HFCS suggest a smaller incidence among elderly than among non-elderly.

## 5 Sensitivity analysis

The next step is to assess the robustness of these results to various measurement issues. In the first section we consider how to determine the poverty line when taking a joint income-wealth perspective on poverty. Several other issues related to the measurement of joint income-wealth poverty are discussed in the second section, such as the wealth concept that is adopted, the impact of equivalence scales and differing interest rates. The last section focusses on the age structure of poverty.

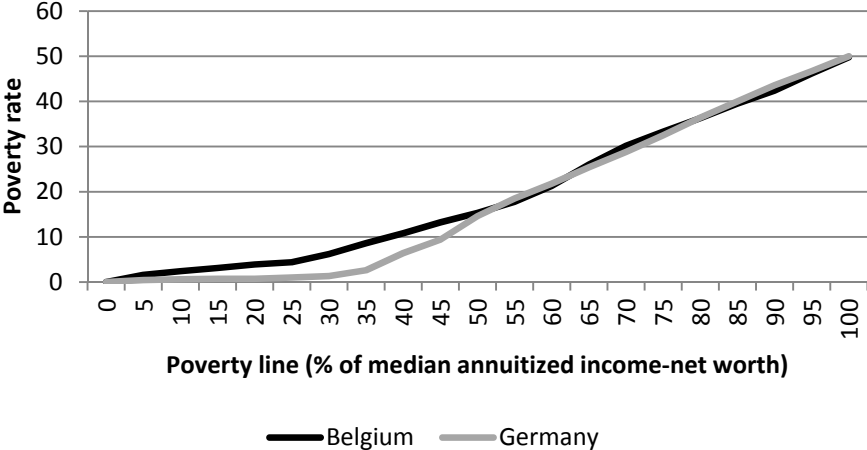
### 5.1 Poverty line

The most important choice when operationalising any poverty measure is where to draw the poverty line. In case of the unidimensional approach it reflects whether or not to adapt the single poverty line to the inclusion of wealth information. Prior studies often only change the sources which are taken into account to assess living standards and evaluates it against the classic income poverty line (this is also what we have done in the baseline indicator in Table 2). This is compatible with the view that the current income poverty line reflects the true resources needed by households to sustain an acceptable living standard. As shown above, this choice results in lower poverty estimates which are believed to be closer to the true level of poverty (see e.g. Brandolini et al., 2010; Van den Bosch, 1998; Weisbrod & Hansen, 1968).

A competing view argues that the income poverty line was initially set to represent a ‘standard’ level of resources, whereby different poverty lines are determined for example for homeowners and tenants. If wealth is accounted for as a financial resource, then the poverty line should be adjusted upwards in order to reflect the fact that it implies a higher level of consumption possibilities (Lerman & Mikesell, 1988, p.360). The poverty line would then be set as a percentage of ‘median equivalised income + annuitized net worth’. As Brandolini et al. (2010, p.275) argue this is “more consistent with a fully relative approach”. Figure 2 shows the poverty rate for different percentages of median equivalised income-net worth. In contrast to the baseline results in Table 1, the poverty headcount is considerable lower in Germany than in Belgium up until a poverty line at 45 per cent of median annuitized income-net worth, while poverty lines at higher percentages result in very similar poverty rates in the two countries. For instance, if we would set it at 60 per cent such as in the AROP then the share of poor households would be equal to 21.3% in Belgium and 21.8% in Germany.

Hence, the conclusion of the literature that poverty rates decline when wealth is taken into account largely depends on the assumption that the poverty line is not adapted to the broader resources concept. The poverty headcount can both increase as decrease and this may have a substantial impact on cross-country rankings. The remainder of the sensitivity analyses will all use the 60% of median equivalised income-net worth (hence, the baseline indicator is the one from Table 1 but with an adapted poverty line).

**Figure 2: Effect of a relative poverty line on poverty rates**

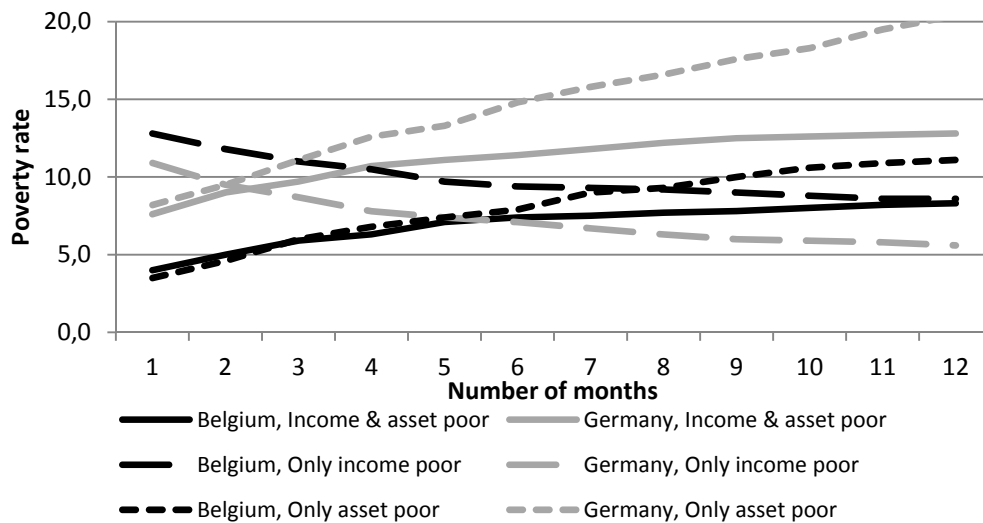


Source: own calculations based on HFCS

In the two-dimensional approach to income-wealth poverty a similar issue arises. In this approach the asset poverty line is typically defined in function of the income poverty threshold. It would also be possible to define the asset threshold in function of another approximation of a minimally acceptable living standard, for example the household budget standard. Moreover, one could just as well think of some absolute asset poverty threshold, such as the asset poverty line of \$200 000 implemented by Headey (2008). Sherraden (1991) argues that in terms of political reality an absolute perspective on asset poverty is more valid than a relative one. Finally, Bucks (2011) uses a subjective measure of ‘assets/savings adequacy’ by evaluating the assets available to households to their desired level of precautionary savings, i.e. the amount of savings households themselves consider to be sufficient to cover unanticipated expenses.

When deciding to set the asset poverty line as a fraction of the income poverty threshold, a second choice involves at which fraction it should be set. In other words, what is the time period households are supposed to sustain themselves at the official poverty line without income from work or other sources. In existing studies the asset poverty threshold is generally set at one-fourth, which means that households need to have sufficient wealth to keep them at the income poverty line for at least three months. The rationale provided for this is that unemployment is regarded as the most important cause of economic hardship, for which the expected duration in the United States, prior to the financial crisis, was between two and four months (McKernan et al., 2012, Haveman & Wolff, 2004; Caner & Wolff, 2004). However, expected unemployment duration is typically longer in Europe than in the US (OECD, 2014, p.96) and also longer as a consequence of the crisis. Therefore, we assess the sensitivity of the poverty rate for periods between 1 month and a year, which is shown in Figure 3.

**Figure 3: Effect of number of months of asset poverty line on poverty rates**



Source: own calculations based on HFCS

As expected, the longer households are supposed to sustain themselves at the official income poverty line the larger the share of the categories of income & asset poor and only asset poor and the lower the share of those who are only income poor. For example, if households need to be able to sustain themselves at the income poverty threshold for six instead of three months solely drawing on their wealth the number of income & asset poor increases by about 1.5 percentage points in both countries, which reflects a shift from the group who is only income poor. At the same time the share of households which are only asset poor increases with around 2 and 3.5 percentage points in Belgium and Germany respectively. This means that a non-negligible share of households have enough wealth accumulations to sustain themselves for three months at the income poverty line, but not for six months. Furthermore, the cross point where the share of only asset poor households becomes higher than the share of the only income poor is already at an asset poverty line of 2 months in the case of Germany, while it is found only at 8 months for Belgium. In other words, of those households with an income above the traditional poverty line, Germans have significantly lower wealth accumulations than Belgians.

## 5.2 Other measurement issues

Another methodological issue that applies to both approaches refers to which wealth concept, or ‘wealth-type resources’ in the definition of Haveman & Wolff (2004), is studied. More specifically, whether to include real estate, and in particular the main residence, in the calculation of poverty is often debated. On the one hand it does not seem reasonable to expect households to sell their homes to overcome periods of low income and in practice they also rarely tend to do so. “Even if a family sells their home, most would need to use the proceeds to lease or buy a replacement home” (Aratani & Chau, 2010, p.5). On the other hand homeowners are clearly better off than tenants. “Owner-occupied housing [...] provides services to the owner and frees up resources that would otherwise be spent on rent” (Caner & Wolff, 2004, p.493).

Furthermore, the unidimensional approach assumes that “income and wealth are perfectly fungible, and that one unit of wealth can be straightforwardly substituted for one unit of income” (Brandolini,

et al., 2010, p.269). However, this is only the case for liquid assets. For non-liquid assets it is very likely that a certain cost is associated with its conversion to cash income. Therefore, most authors calculate poverty figures for several wealth concepts. We use three different wealth concepts: net worth, non-housing wealth and liquid assets.<sup>11</sup> The HFCS asset components that are covered by these concepts are shown in Table 3. Net worth refers to the difference between total assets and total liabilities, non-housing wealth disregards any wealth or debt related to the main residence, while the liquid assets concept only takes into account assets that can be easily bought or sold without incurring substantial costs.

**Table 3: Asset components covered by the three wealth concepts**

Net worth	Non-housing wealth	Liquid assets
+ Household main residence	+ Other real estate property	+ Deposits
+ Other real estate property	+ Vehicles (cars & other)	+ Mutual funds
+ Vehicles (cars & other)	+ Valuables	+ Bonds
+ Valuables	+ Self-employment business wealth	+ Publicly traded shares
+ Self-employment business wealth	+ Deposits	+ Non-self-employment business wealth
+ Deposits	+ Mutual funds	+ Managed accounts
+ Mutual funds	+ Bonds	
+ Bonds	+ Publicly traded shares	
+ Publicly traded shares	+ Non-self-employment business wealth	
+ Non-self-employment business wealth	+ Managed accounts	
+ Managed accounts	+ Money owed to the household	
+ Money owed to the household	+ Private pensions/whole life insurance	
+ Private pensions/whole life insurance	+ Other financial assets	
+ Other financial assets		
- Household main residence mortgage	- Other property mortgage	
- Other property mortgage	- Credit line/ bank overdraft debt	
- Credit line/ bank overdraft debt	- Credit card debt	
- Credit card debt	- Non-mortgage loans	
- Non-mortgage loans		

Table 4 shows the poverty headcount for these different types of wealth concepts. For the unidimensional approach, where the poverty line is each time set at 60 per cent of the respective wealth concept, the poverty headcount decreases in the case of non-housing wealth by 2.1 and 1.2 percentage points for Belgium and Germany respectively and by 2.9 percentage points for both countries in case only liquid assets are included. In case of the two-dimensional approach the poverty line is as in the baseline indicator each time set at 3 months of the traditional income poverty line. Results show that for Belgium the share of both income and asset poor increases with 1.3 percentage point when non-housing wealth is used and with about 4 percentage points if only liquid assets are taken into account, while the share of only income poor households decreases at the same rate. The largest impact is found with regard to the share of those who are only asset poor; it increases from 5.6 per cent in case of net worth to 10.4 per cent in case of non-housing wealth and even to more than 22 per cent for the liquid assets concept. These trends are also found for Germany, although the effects are slightly weaker. As a consequence of a lower home-ownership rate, the difference between the different wealth concepts is less expressed than in Belgium.

<sup>11</sup> It is also possible to use broader wealth concepts. For example, augmented wealth will add to disposable wealth some valuation of pension rights and human capital or a comparable measure of future earnings possibilities (Wolff, 1990). However, since this kind of information is not covered in the HFCS data, we do not implement such a wider wealth concept.

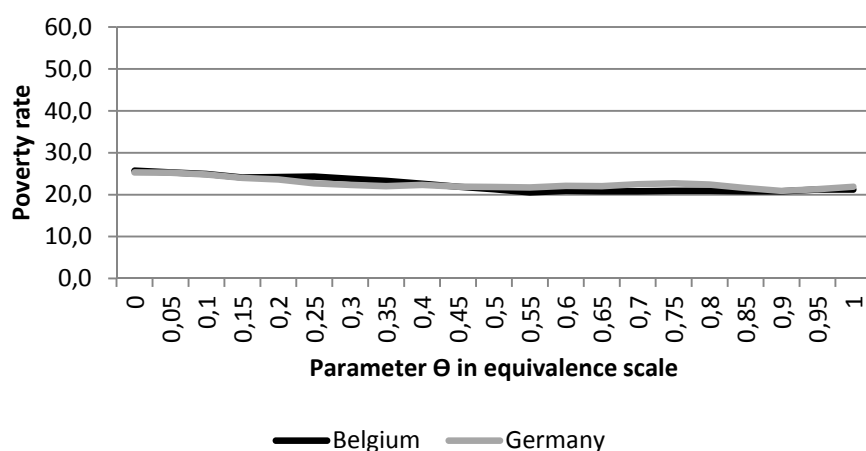
**Table 4: Effect of different wealth concepts on poverty rates**

Poverty measure	Net worth		Non-housing wealth		Liquid assets	
	Belgium	Germany	Belgium	Germany	Belgium	Germany
<b>Unidimensional</b>	21.3	21.8	19.2	20.6	18.4	18.9
<b>Two-dimensional</b>						
Income & asset poor	6.2	9.7	7.5	10.2	10.3	12.4
Only income poor	10.9	8.7	9.6	8.3	6.8	6.1
Only asset poor	5.6	11.1	10.4	13.5	22.2	24.2

Note: unidimensional poverty is calculated using adapted poverty line (i.e. fully relative poverty line) (see part 5.1). However, the results are similar if the unadapted poverty line would be used.

Source: own calculations based on HFCS

A second measurement consideration that applies to both poverty approaches is whether or not to apply equivalence scales. Studies analysing income poverty typically use an equivalised income concept to control for different needs, relating for instance to household size and composition in order to capture the impact of economies of scale, although there remains considerable discussion on this issue (e.g. Buhmann et al., 1988; Coulter et al., 1992; de Vos & Zaidi, 1997). There is no general agreement on whether equivalence scales should be applied to wealth holdings and if so whether those used for income are appropriate for wealth (OECD, 2013a, p.169). In studies of financial vulnerability wealth is considered to be an economic resource supporting current consumption and therefore contributing to the standard of living. In this case it seems appropriate to equalize both household income and wealth (OECD, 2013b, pp. 141-142 & 178; Jäntti et al., 2013). Equivalence scales for wealth are also used by Azpitarte (2012, 2011) and Brandolini et al. (2010). In our baseline indicators the square root equivalence scale for both income and wealth was implemented. In Figure 4 we show poverty outcomes for different equivalence scales. We use the functional form  $e = 1/h^\theta$  where  $h$  refers to household size and  $\theta \in [0,1]$ <sup>12</sup>. We each time apply the same equivalence scale to wealth and income. We only show the results for the unidimensional approach, but the same trend applies to the two-dimensional approach. The overall poverty headcount appears to be largely robust to the parameter  $\theta$ . Poverty slightly diminishes between 0 and 0.55, after which it remains more or less stable. As we will show below these small differences are largely driven by effects among the elderly population.

**Figure 4: Effect of equivalence scale on poverty rates**

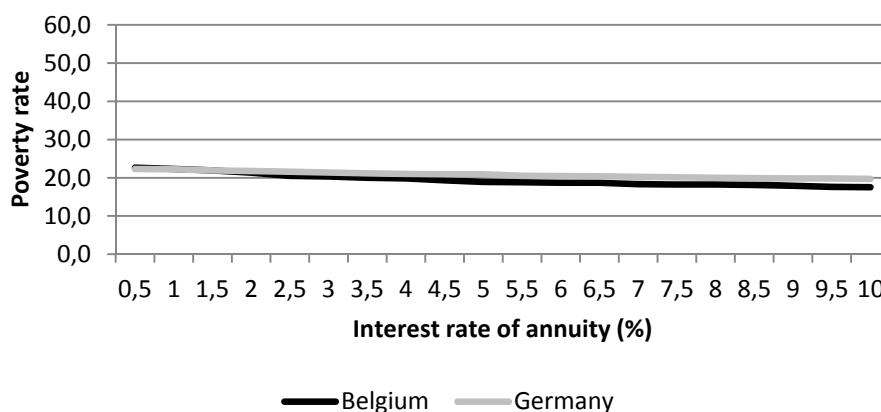
<sup>12</sup>  $\theta$  equal to 0.5 refers to the square root equivalence scale, which is used in the baseline indicators.



Source: own calculations based on HFCS

In case of the unidimensional approach a further consideration reflects the interest rate of the annuity ( $\rho$ ). Radner (1990) argues that the interest rate is essentially an arbitrary choice and that in the literature various interest rates, both real and nominal, have been used. As mentioned before, existing studies mostly implement a 2 per cent interest rate (e.g. Brandolini et al., 2010; Van den Bosch, 1998). Van den Bosch (1998) is one of the few who provides an argumentation for this figure. His choice is based on Vuchelen (1991) who shows that the real average return on wealth of Belgian households between 1961 and 1988 was equal to 2.34 per cent. However, these estimations are based on a proxy indicator of wealth rather than on direct information. Moreover, interest rates tend to fluctuate relatively strongly over time, certainly across business cycles and also across longer economic phases (e.g. Piketty, 2014). Because of the profound impact of the chosen interest rate on the weight that is granted to wealth (Radner, 1990), we study the impact of a different interest rate on our poverty outcomes. The results in Figure 5 show a slightly decreasing share of poor households with increasing interest rates of the annuity. Particularly the difference between a 1 or 10 per cent interest rate is significant, while higher interest rates appear to have only a minor effect. Note also that most elderly households already have sufficient wealth holdings to be above the poverty line even without applying an interest rate (see also part 5). Furthermore, evidence shows that rates of return on wealth differ strongly by initial wealth level (through economies of scale and threshold effects), educational level (i.e. financial literacy), etc. (e.g. Piketty, 2014; Jappelli & Padula, 2013).

**Figure 5: Effect of interest rate annuity on poverty rates**



Source: own calculations based on HFCS

The length of the annuity ( $n$ ) is typically expressed in terms of life expectancies “such that the economic welfare of a unit is equal to its current income plus the lifetime annuity value of its current net worth” (Azpitarte, 2011, p.90). This is consistent with the fact that household saving is mainly motivated by consumption smoothing over the lifetime and precautionary saving (Weisbrod & Hansen, 1968, p.1317-1318). A first problem with these expected remaining lifetimes is that they are only available by age and gender and consequently ignore the fact that wealth and life expectancy are correlated. Wealthier persons tend to live longer than poorer ones so that they need to spread out their wealth over a longer period (Radner, 1990, footnote 2 p.4). This in turn implies that the level of

annuitized wealth that is included in poverty calculations is smaller, which results in more households being classified as poor (Brandolini et al., 2010, p.271)<sup>13</sup>.

Furthermore, by basing the annuitization on life expectancies one assumes that no wealth remains at death and consequently does not take into account the possibility of bequests. However, besides the consumption smoothing and precautionary saving motives, people are also found to be motivated by leaving something for their survivors (Szydluk, 2011; Kopczuk & Lupton, 2007)<sup>14</sup>. Moreover, elderly people might implicitly also trade bequests for care (or future assurance for care) from children or other persons (Cremer & Pestieau, 2006; Bernheim et al., 1985, as cited by Rendall & Speare, 1993, footnote 2 p.3). Own calculations on the HFCS reveal that in the Eurozone around 36 per cent of households have received a 'substantial gift or inheritance' and 13.5 per cent expect to receive one in the future. Moreover, 6 per cent of respondents indicated that one of the purposes they are saving for are bequests. If bequests would be made through inter vivos gifts, a smaller amount of wealth is available for annuitization. Of course, one could wonder whether people ought to save for estate purposes and if so how much (Weisbrod & Hansen, 1968). Substantial intergenerational transfers may be socially undesirable because they maintain, and possibly increase, the level of wealth inequality from generation on generation. Indeed, Piketty (2014) shows that the increasing importance of inherited wealth is one of the main driving factors of rising inequalities over the last decades. However, alternatives to these aspects cannot be expressed in terms of formulas (1) or (2) and hence require a fully different perspective on joint income-wealth poverty, such that it is beyond the scope of this paper.

### 5.3 Age structure of poverty

The results of the previous sections will likely not only affect the *number* of poor households, but also the *types* of households that are regarded as poor. In this respect age appears to be the most important aspect because traditional income poverty rates and wealth accumulations significantly differ over the lifetime. As mentioned before, Belgian elderly are often found to combine a low income with moderate to high wealth holdings.

In a more detailed analysis we have also performed the robustness analysis of the previous part separately for elderly and non-elderly households. Although we have shown in part 4 that the initial effect of taking wealth into account in poverty measurement has a larger impact on poverty rates among the elderly than among the non-elderly, the overall effect of different measurement assumptions appears to be relatively similar for the two groups. However, when using the narrower wealth concepts discussed above the difference in poverty rates of the elderly and non-elderly diminishes somewhat. This is because the net value of the household main residence constitutes the largest share in total wealth, and elderly households have typically paid off their mortgage, while younger households often have substantial mortgages. Another notable exception is the effect of equivalence scales. In Figure 6 we show the same analysis as in Figure 5, but for elderly and non-elderly

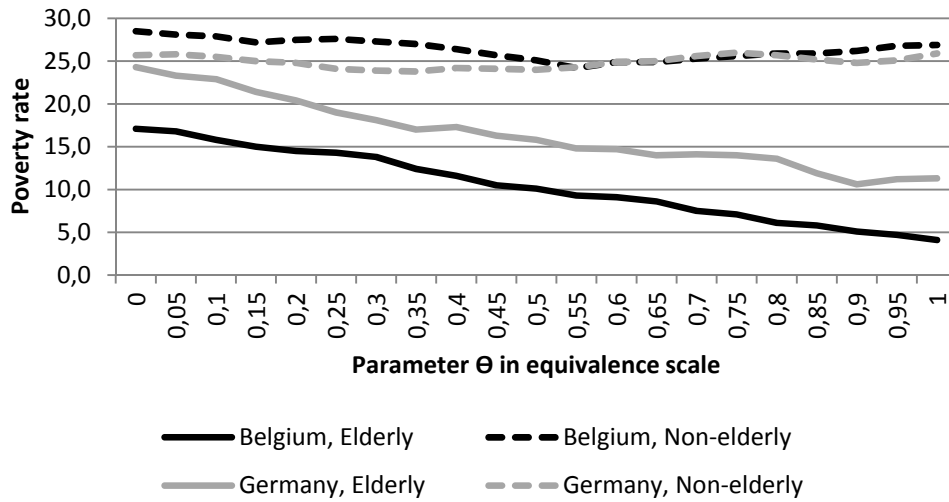
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<sup>13</sup> If wealth is annuitized over an infinite period it would be equal to the traditional income poverty indicator.

<sup>14</sup> Weisbrod & Hansen (1968, footnote p.1318) argue: "the fact that intergenerational transfers are so frequently made via the estate route rather than by transfers before death may be less an indication of people's desires to pass on their wealth than it is a reflection of their inability to anticipate the time of their death." Indeed, if people were to know exactly when they would die, they would transfer their wealth before death so as to avoid inheritance taxes.

households separately. It is clear that poverty rates of the elderly are strongly affected by different equivalence scales, while they are relatively constant among the non-elderly<sup>15</sup>.

**Figure 6: Effect of equivalence scale on poverty rates, elderly vs non-elderly**



Source: own calculations based on HFCS

For Belgium the impact of different wealth concepts also appears to be significantly different for the elderly and the non-elderly. Indeed, when the narrower wealth concepts of non-housing wealth and liquid assets are used poverty increases for the elderly, while it decreases for the non-elderly such that the difference between the elderly and non-elderly diminishes somewhat. In other words, in Belgium the ratio between elderly and non-elderly in poverty depends on whether or not all wealth is taken into account. Since the net value of the household main residence constitutes the largest share in total wealth, this difference is mainly the consequence of the elderly and non-elderly being in different stages of life cycle accumulation. Elderly households have typically paid off their mortgage, while younger households are often substantially indebted. This means that the difference between the net worth concept on the hand and non-housing and liquid assets concepts on the other hand is much larger for pensioners. Because home-ownership is less common this trend is much less visible for Germany.

The most important aspect with regard to the age dimension, however, is that both approaches to joint income-wealth poverty fail to take account of the life cycle effects of wealth accumulation. Younger households typically have lower net worth and longer life expectancies, which translates into much lower annual annuities, which in turn implies higher poverty rates (Brandolini et al., 2010; Weisbrod & Hansen, 1968). However, these households usually have important saving potential and can expand their net worth above and beyond a mere interest rate, for example by investing in a house or business. Also the two-dimensional approach only takes into account the level of current net worth. Ideally, one should be able to distinguish between structural asset poverty and age-related asset poverty. Moreover, the age effect is likely to be an issue in comparisons across countries and across time. If joint income-wealth poverty is larger in one country than in another this can be the effect of either a different age structure in these countries, differences in wealth accumulations or a

<sup>15</sup> This is not only true for the joint income-wealth poverty measures; equivalence scales also have the largest impact on the elderly in terms of traditional income poverty (e.g. de Vos & Zaidi, 1997).

combination of the two. Likewise, if joint income-wealth poverty of a certain country changes over time it is not clear whether it is the consequence of changes in its age structure or in the wealth accumulations of its households (see Cowell & Van Kerm, 2015; Almås & Mogstad, 2012; Atkinson, 1971 for a discussion of this issue in relation to wealth inequality).

## 6 Conclusion

A convincing case can be made that the measurement of poverty, and more broadly living standards, should be based on a joint income-wealth perspective. Conventional poverty measures mostly assess actual household incomes against some threshold. But the wider financial resources on which people can draw are also important in assessing financial precariousness. Households that can smooth out consumption by relying on savings and assets, loans or the financial help of others are clearly better off than households who do not have these opportunities. Previous studies have implemented two different approaches, one which integrates the two financial resources into a single dimension by converting wealth into yearly annuities and one which applies a two-dimensional framework by developing separate poverty lines for income and wealth. The findings so far are rather similar and indicate that (1) poverty estimates including wealth are much lower than the traditional income-based measures; (2) poverty rates of the elderly are much more affected than those of the non-elderly and (3) the decline in poverty rates is much higher when the value of the household's main residence is included than when only non-housing wealth is taken into account.

However, the analysis here shows that such findings can be quite sensitive to the way one accounts for wealth in measuring poverty. Most strikingly, the conclusion that poverty rates decline when wealth is taken into account hinges on whether the poverty line is adapted to the broader resources concept or not. When the poverty line is defined in fully relative terms, poverty rates could increase as well as decrease and can substantially alter cross-country rankings. Furthermore we show that any conclusion on the ratio between elderly and non-elderly poverty is highly sensitive to plausible measurement choices.

This paper compared Belgium and Germany, countries with similar living standards and income poverty rates, but very different levels and distributions of wealth. We find that the inclusion of wealth information has a much weaker impact in Germany than in Belgium, which is in line with expectations as wealth levels are lower in Germany and more correlated with income. In terms of the sensitivity analysis we find that in the baseline indicator poverty rates are higher for Germany than for Belgium, while it is the other way around when using a fully relative poverty line up until 45 per cent of median annuitized income-net worth and very similar poverty rates for higher percentages. Poverty ranking between the two countries appears to be less sensitive to the other measurement aspects discussed in this paper.

These results may impact on the way we think about social policy and how we evaluate the impact of policy. For example, it is clear that joint income-wealth based poverty measures can impact quite significantly on the relative extent of poverty among young people as compared to older people. For future research purposes it will therefore be interesting to analyse how a joint income-wealth poverty measure could be operationalised in practice such that it can guide future development of the

European social agenda. Moreover, in view to the growing importance of bequests shown by Piketty (2014) and others, it might also prove interesting to study the intergenerational transmission of joint income-wealth poverty. Unfortunately, data do not yet allow for this kind of analysis.

Important to note is that we were not able to submit all relevant aspects to an empirical sensitivity analysis. First, sensitivity was checked for a single interest rate, while in practice evidence shows that interest rates differ strongly by initial wealth level (through economies of scale and threshold effects), educational level (i.e. financial literacy), etc. Second, we did not assess the robustness of the specification of the length of the annuity in terms of differential life expectancies. Also, we not yet accounted for the fact that wealth and life expectancy are correlated. Bequest desires are still to be included too. Finally, ideally one would want to take into account the savings potential of (younger) households as well as social security wealth.

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