LWS
Working Paper Series

No. 24

Wealth, Top Incomes and Inequality

Frank Cowell, Brian Nolan, Javier Olivera and Philippe Van Kerm

July 2017

Luxembourg Income Study (LIS), asbl

Wealth, Top Incomes and Inequality

Frank Cowell
London School of Economics

Brian Nolan
University of Oxford

Javier Olivera
Luxembourg Institute of Socio-Economic Research

Philippe Van Kerm
University of Luxembourg and Luxembourg Institute of Socio-Economic Research

December 2016

Abstract

Although it is heartening to see wealth inequality being taken seriously, key concepts are often muddled, including the distinction between income and wealth, what is included in "wealth", and facts about wealth distributions. This chapter highlights issues that arise in making ideas and facts about wealth inequality precise, and employs newly-available data to take a fresh look at wealth and wealth inequality in a comparative perspective. The composition of wealth is similar across countries, with housing wealth being the key asset. Wealth is considerably more unequally distributed than income, and it is distinctively so in the United States. Extending definitions to include pension wealth however reduces inequality substantially. Analysis also sheds light on life-cycle patterns and the role of inheritance. Discussion of the joint distributions of income and wealth suggests that interactions between increasing top income shares and the concentration of wealth and income from wealth towards the top is critical.

Keywords: Inequality, Wealth, Income, Households, Inheritance, Top Incomes, Cross national, comparative

1. Introduction

These days, discussion of wealth and inequality is everywhere. It is the stuff of political discussion, journalistic fascination and serious academic research. This was not always so. In the 20th century there was a great deal of academic and policy interest in income distribution and inequality: wealth only occasionally peeked through as a distinct issue.[1] But we are now in an era when a book with the title Capital in the 21st Century can become a best seller and politicians of both left and right find it prudent to make reference to the accumulation and ownership of personal wealth.

Unfortunately, although it is heartening to see wealth inequality being taken seriously in economic discussion, key concepts are often muddled, often by commentators who should know better. Sometimes this muddle appears in the failure to distinguish clearly between income and wealth. It also concerns what is to be included in "wealth", and the muddle often extends to the facts about wealth distribution.

Accordingly, the purpose of this chapter is to provide an overview of the main issues that arise in making important ideas and facts about wealth distribution and wealth inequality precise. It also covers the economics that underlie the generation of wealth distributions and that perpetuate inequality. Here is a brief guide to what we do.

The Basics

We begin with the fundamental concepts of private wealth and the problems of interpreting them empirically (Section 2). This means making clear what is and is not included in wealth statistics gathered at household level. The principal problem involved is that of valuing a wide range of financial and nonfinancial assets; some of these assets – such as public and private pension rights – raise special difficulties. It also requires careful consideration of the ways in which measurement of inequality presents particular difficulties in the case of wealth: this includes the theoretical requirement that inequality measures deal with negative as well as zero values and empirical circumstances such as the presence of negatives and the skewness and fat tails of the wealth distributions resulting in sparse, extreme data. These issues have important implications for modelling wealth inequality and for statistical inference. They also give rise to major issues concerning data quality and the problem of cross-country comparisons are reviewed.

---

[1] Honourable exceptions to this neglect include Atkinson (1974), Atkinson and Harrison (1978), Miller and McNamee (1977), Revell (1967) and Wolff (1955).

Application

These theoretical and empirical issues are more convincingly discussed in the context of a specific application. To do this, we examine in Section 3 what can be learned from data now becoming available from specially-designed harmonised surveys carried out across 15 European countries, initiated and organised by the European Central Bank: the Eurosystem Household Finance and Consumption Survey (HFCS). We use data from this source for five European countries (France, Germany, Italy, Luxembourg, Spain) and data from the Luxembourg Wealth Study for three more non-HFCS countries (Australia, the UK and the USA) to focus on the key issues of wealth distribution to take a fresh look at some of the basic questions about wealth and wealth inequality. We then, in Section 4, examine the size and composition of household net worth in these eight countries and use the techniques discussed in Section 2 of the chapter to compare wealth inequality and income inequality across countries.

The Mechanisms that Drive Inequality

Later in the chapter we set out the elements of the essential economic story of personal wealth and income. Both market and non-market mechanisms in the story of how wealth inequalities and long-run income inequalities develop and persist.

This story divides naturally into two parts, each part having a distinctive account of the mechanisms that determine the dynamics of wealth distributions.

The first of these two parts concerns what happens within a person's lifetime. So in Section 5 we examine the lessons that may be learned from the literature on life-cycle models. The simplest of these intra-generational models attempt to understand and replicate the transmission and concentration of wealth, based on the actions of rational individuals in financial markets. The variation in people's wealth over their life cycle will itself contribute to dispersion of wealth and so it is useful to consider how much this process contributes to wealth inequality and income inequality. However, a substantial part of the assets accumulated through this process, public and private pension rights, present special problems when one considers including them in an aggregation of personal or household assets: these problems – discussed in Section 6 - are not mere technicalities, as they can substantially influence one's estimates of, and interpretations of wealth inequality.

The second part of the story concerns the connections through wealth between the generations: the role of bequests and inheritances. It is clear that this intergenerational component of the wealth-distribution process has the potential to be a major force in the creation of and perpetuation of wealth inequality. But the economic analysis of the intergenerational process presents a number of difficulties. Unlike the intra-generational story where the baseline model is fairly clear and founded on market activity, there is no simple

consensus on the appropriate way to model what is going on, and economists have to accept that here the role of the family is likely to be much more important than the role of the market. These issues are discussed in Section 7.

Top Incomes and Wealth

It is clear that there ought to be some connections between high wealth and high income. But the links are not mechanical and the relationship between these two important economic concepts can be complex. Income inequality and wealth inequality each deserve careful analysis in their own right and it would be foolish to suggest that either of them should be pursued to the exclusion of the other: one needs to keep an analytical eye on both. Section 8 examines the key messages about trends in top incomes and the contrasting patterns across the developed countries revealed by the recent research led by Atkinson, Piketty and Saez based principally on data from the administration of income tax systems. It then draws on the comparative survey data employed in the rest of the chapter to investigate the wealth holdings and sources of income of those at the top of the income distribution in those surveys (which will in all likelihood not adequately capture the top 1%), and the extent to which their wealth and income sources are distinctive.

2. Measuring wealth with survey data

The empirical measurement of wealth is even more challenging than that of income. How best to assign values to assets and liabilities at a certain point of the life-cycle, the choice of unit of analysis and whether differences in household size are taken into account, and deciding which assets to include all represent significant methodological choices. Here we highlight some of the distinctive empirical and statistical issues arising in the measurement of wealth inequality using household survey data; Cowell and Van Kerm (2015) provides a more detailed and technical discussion of problems and potential solutions.

Measuring household wealth

Sources of data

Several sources have historically been used to obtain information on wealth at the 'micro' level (individuals, families or households): wealth tax data, estate tax data, capitalisation methods based on capital income data and, of course, direct surveys. We focus on the latter. The main advantage of household surveys is that they allow coverage of a wide range of assets for representative samples of a population. They are becoming available in a growing number of countries. Collecting survey data on wealth is however notably more complicated than collecting data on income. Issues of sampling and non-sampling error are compounded by the nature of wealth data and its distribution.

Household net worth

The most common concept used to analyse the distribution of household wealth is the current net worth defined as the difference between the monetary value of a household's assets and its total liabilities:

$$w = \sum_{j=1}^{m} p_j A_j - D$$

where A_j is the amount of asset type j owned by the household, p_j is its price or unit value and D is the household's total outstanding debt. Empirically, this definition requires decision about what assets---financial and non-financial---are included, a decision which is typically dictated by data availability and decisions of the survey agency. In general, one will include among non-financial assets the value of the household's main residence and other real estate property, the value of self-employment business and of additional real assets such as cars and jewellery. Financial assets will usually include deposits on current or savings accounts, mutual funds, bonds, shares and other financial assets. Financial assets also often include life insurance and voluntary *private* pension plans. (Inclusion of occupational and public pensions is an issue to which we return below.) On the other side of the household's balance sheet, liabilities typically include home-secured debts, loans and lines of credit as well as informal debt. On the aggregate, the household's main residence represents, by far, the largest share of household assets.

There are two main issues with respect to this definition of net worth. The first is that it misses public pension entitlements (also referred to as social security wealth), which are generally considered to represent an important asset. One motive for wealth accumulation is to finance consumption in old age and it is clear that the incentives for accumulation are lower when people are entitled to generous pensions organised though public transfer mechanisms. Ideally, one would like to be able to capture the 'wealth equivalent' of future pension entitlements in a comprehensive measure of net worth which would reflect better the capacity of people to finance future consumption. While this is generally done with private pension plans, it is a difficult task for public pensions, since this requires knowledge of employment careers and of future state pension parameters. We return to this question in Section 7.

The valuation of assets

The second key issue is the valuation of assets, especially of real assets, that is the choice for p_j in equation (1) above. These valuation choices may have a major impact on measured wealth inequality, including whether the market price is to be used for each asset j, or some type of imputed price – for example, choosing the market price, the imputed rent or the self-reported price for housing may affect the size of wealth and its distribution. Bastagli and Hills

(2013) show the dramatic effect of fluctuating house prices on wealth inequality in the UK, while Wolff (2012) analyses how sharp changes in asset prices affected the distribution of wealth in the USA. In a survey context, respondents' assessments of the current market value of their house may often be reasonably good, but their knowledge of the current market value of financial assets such as stocks and shares may be much more variable and the value of insurance-related long-term savings may be particularly opaque. Under-valuation by respondents of the value of these financial assets is likely to be one contributor to their overall under-representation in household surveys when compared with external aggregate figures (along with non-sampling and representativeness problems to be discussed shortly). There are even greater difficulties in assigning a market value to unincorporated businesses, which will be very important for the minority of households affected but to which they may have great difficulty assigning a value (as reflected in the often high non-response rate to that item in surveys by those who say they do have such a business). Distinctive problems also arise when one aims to incorporate pension wealth – both private and public – into the analysis, as will be discussed below.

The unit of analysis

It is standard practice in analyzing inequality in the distribution of *income* to take the household as the recipient unit but convert total household income into "single-adult equivalent income" and analyse the distribution of that equivalent income across individuals. This is intended to take economies of scale in household spending and the lower needs of children versus adults into account when evaluating the living standard attained with a given income level and household size. By contrast, application of equivalence scales to household *wealth* data is more controversial (Bover 2010, Jäntti et al. 2013, OECD 2013, Sierminska and Smeeding 2005). This reflects the fact that the conceptual and empirical issues arising in the case of wealth are distinctive. For example, if wealth is interpreted as the value of potential *future* consumption (say after retirement), it is not current household composition that should matter, but future composition. Taking a different tack, if one is interested in wealth as an indication of status or power, there is little reason to adjust wealth for household size at all. Furthermore, one might be interested in the wealth held by each individual within the household rather than their holdings in aggregate – particularly from a gender perspective, for example – but the information required to do so satisfactorily may not be available. Practice therefore varies in empirical work and choices can legitimately differ according to the purpose of the analysis. Here, largely for convenience, we take the household as unit of analysis and analyze the wealth (and income) distribution across households rather than individuals, without any account being taken of differences in household size and composition.

Non-sampling error and representativity of wealth surveys

Survey data is subject to both sampling and non-sampling errors, and when sampling from a highly skewed distribution like that of wealth, most samples will underestimate inequality and the length of the upper tail. This can be addressed by over-sampling the upper tail, although

the information required to provide a sampling frame allowing that to be done satisfactorily is not always available. Non-sampling errors take the form of differential unit non-response and misreporting of asset (or debt) amounts. Misreporting commonly takes the form of under-reporting or item non-response – the response rate on wealth items may be particularly high for the wealthy. Re-weighting to improve the representativeness of the sample will be of some help, especially if a high-wealth sampling frame has been used, since respondents from the main and special high-wealth samples can be separately weighted; however, as Davies (2009) points out, a perfect fix for differential response is not available. He also notes that under-reporting and item non-response vary by asset or debt type, appearing to be most severe for financial assets notably stocks and bonds, whereas house values show little bias and mortgage debt is on average only moderately under-reported. Non-sampling errors may be growing more severe because both unit and item response rates are declining in household surveys generally.

International survey data on household wealth

The Eurosystem Household Finance and Consumption survey

The Eurosystem Household Finance and Consumption survey (HFCS) has been initiated and coordinated by the European Central Bank. Two waves of HFCS data have been collected to date. At the time of writing however, data from the first wave only, collected in late 2010 or early 2011 in 15 Eurozone countries, are available.

The HFCS provides comparable data across all Eurosystem countries. The collection is based on an *ex ante* harmonised approach: centrally coordinated definitions of core target variables were adopted, a harmonized questionnaire template was designed, and all countries coordinated sampling design and processing. The survey was designed on the model of the US Survey of Consumer Finances (SCF), which is generally considered to be the 'gold standard' for household surveys on wealth. In particular, various SCF procedures were adopted regarding (multiple) imputation of missing data, over-sampling of wealthy households, the provision of bootstrap replication weights, and the design of the questionnaire. See European Central Bank (2013) and HFCS (2014) for details.

The Luxembourg Wealth Study (LWS)

The Luxembourg Wealth Study (LWS) is a large-scale project of *ex post* harmonisation of household survey data on wealth from thirteen countries. It is a sibling of the well-established Luxembourg Income Study known for providing harmonized data on household *incomes* across 48 countries since the early 1980s. The LWS database focuses on wealth and debt of households and "the goal of LWS is to enhance studies on understanding of households' financial stability through both the analysis of wealth distribution and other related dimensions on economic well-being" (LIS Cross-National Data Center, 2016, p.1). The data files contain

variables constructed from a set of independent surveys collected in different countries. The LWS team has defined a template of variables about household assets, debt and income and data from national surveys are manipulated and recoded to fill the LWS template variables and adhere as closely as possible to the LWS definitions. See Sierminska et al. (2006) for details.

After the release of a first pilot database in 2007, a new version of LWS has been available since 2016. The new release contains more countries and years – including data sets originally collected through the HFCS for a few countries. It is therefore now easy to use consistent definitions of wealth variables for combined analysis of data from the HFCS and from LWS for non-Eurozone countries.

3. Evidence on household wealth in eight countries

We now take advantage of data available in the HFCS and LWS to provide fresh empirical evidence about the size and distribution of household wealth in eight developed countries. We focus our empirics on eight countries covering a range of economic environments as well as institutional and cultural backgrounds: Germany, France, Italy, Luxembourg, Spain (from HFCS) and Australia, the United Kingdom and the United States of America (from LWS). The underlying surveys for the LWS countries are the Wealth and Assets Survey collected in Britain by the Office for National Statistics (2010-12), the Survey of Consumer Finance 2010 by the US Federal Reserve and the Survey of Income and Housing (2009-10) by the Australian Bureau of Statistics.

The size of net wealth

Table 1 displays the level of net worth in the eight countries examined. The first column provides values for average net worth expressed in euros.[2] To help appreciate the size of net worth compared to household income, all subsequent columns express net worth in terms of average annual gross household income. We believe this alternative metric is useful for comparing the importance of net worth in the different countries, and we use it throughout the chapter.

If we except Luxembourg, and Australia to a lesser extent, cross-country differences in average net worth are not very large, from just under 200,000 euros in Germany to 290,000 in Spain and the UK, up to 350,000 in the United States. Cross-country variations are further

---

[2] For non eurozone countries, original values were converted from national currency values at the September average exchange rate of the year of survey, namely 0.72 EUR/AUD, 0.75 EUR/USD and 1.15 EUR/GBP.

muted when average net worth is expressed in years of average household income, from a low 4.5 years in Germany, between 6 and 7 years in France, Australia, the UK and the USA, about 8 years in Italy and Luxembourg and up to 9.3 in Spain.

Average net worth statistics are essential to inform us of the 'size of the cake' but, as is well known, the distribution of net worth tends to be very skewed and concentrated among the richest households, so it is useful to examine differences in median net worth and other quantiles. Cross-country differences appear to be much larger if we consider median net worth. The US now has the lowest value at just under 1 year worth of average annual income, a value close to Germany. This is more than five times less that the median net worth in Luxembourg (4.8), Italy (5) or Spain (5.8). Cross-country differences are of similar orders of magnitude if we look at the other two quartiles (the 25th and 75th percentiles) shown in Table 1, again showing the comparatively low values in the United States. These figures provide a first indication that, although the aggregate levels of net worth are not hugely different in the countries considered here, their distribution across households appear to be remarkably different. As a matter of curiosity at this stage, it is interesting to point out the similarity of values between the United Kingdom and France (and perhaps Australia to a lesser extent) and between Luxembourg and Italy, once net worth is expressed in terms of years of gross household income.

The last column of Table 1 shows the fraction of households having zero or negative net worth (when total asset values are less than liabilities). These shares are relatively low and comparable across countries, with notable exceptions perhaps of Germany (9%) and United States (14%). Although these shares are small, they are sufficiently common to be a practical source of concern for the calculation of net worth inequality measures, as we discuss below.

Table 1. The level of net worth

	Mean		1st quartile	Median	3rd quartile	Share <=0
	(In euros)		(In average annual income)			
Germany	195,170	4.5	0.2	1.2	4.8	0.09
Italy	275,205	8.0	1.0	5.1	9.4	0.03
Luxembourg	710,092	8.5	0.7	4.8	8.8	0.04
Spain	291,352	9.3	2.5	5.8	10.6	0.04
France	233,399	6.3	0.3	3.1	7.6	0.04
Australia	434,952	6.8	1.1	4.2	7.7	0.02
United Kingdom	290,285	6.0	0.8	3.5	7.2	0.03
United States	348,835	6.4	0.1	0.9	3.8	0.14

Notes: Values in euros are converted at the September average exchange rate of the year of survey, namely 0.72 EUR/AUD, 0.75 EUR/USD and 1.15 EUR/GBP. Values expressed in average annual income have been divided by the mean annual gross total household income in the respective country (as reported in the survey).

The composition of household wealth

It has been well documented that the lion's share of total assets are in the form of *real* assets, and in particular in the value of owner-occupied household's main residence (see, e.g., Sierminska et al., 2006, Cowell & Van Kerm, 2015). Figure 1 depicts the composition of net worth in the eight countries examined here. In each panel, the unit length bar at the top represents total household assets. The white segment on this bar shows how much total assets are to be reduced by debts to give net worth. The following four shorter segments show the composition of total assets across four broad asset types: financial assets first (in light grey) and then three real asset types (in dark grey) - the value of household's main owner-occupied residence, the value of self-employment businesses and the value of other real assets (such as other real estate, cars, jewellery, etc.). (The actual values of net worth, debt and each components expressed in years of average household income are shown on the segments.)

Figure 1 shows that, in the aggregate, the level of debts represent a relatively small fraction of total assets, in the range of 5-15 percent. This is in line with estimates provided, e.g., in Davies (2009). The largest incidence of debt relative to the size of total assets is observed in the USA, Australia and the United Kingdom. It is somewhat lower in the Eurozone countries, especially in Italy. On the other side of the balance sheet, the importance of real assets - housing wealth in particular – over financial assets is clear. On average, households own about one year's worth of average income in financial assets in almost all countries. The USA is again an exception with financial holdings of a value up to 3 years' worth of average income. Households' main residence is on average worth between just above two years of income (in Germany or the USA) and above five years of income (in Spain and Italy). Variations in the value of housing relative to income not only informs us of the composition of household asset portfolio, but it is also a direct indication of the cost of acquisition of housing for non-owners. The high value-to-income ratios observed in Spain, Italy or Luxembourg suggest that housing acquisition through inheritance may play a bigger role than elsewhere in this context. We return to the role of inheritance below.

Figure 1. The composition of average net worth: real assets, financial assets and debt

(c) Luxembourg

Net worth: 8.5	Debts: 1.0
Financial assets: 1.1	
Main residence: 4.9	
Other real assets: 3.2	
Self-employment business: 0.	

(d) Spain

Net worth: 9.3	Debts: 1.0
Financial assets: 1.1	
Main residence: 5.6	
Other real assets: 2.8	
Self-employment business: 0.9	

(e) France

Net worth: 6.3	Debts: 0.7
Financial assets: 1.4	
Main residence: 3.3	
Other real assets: 1.7	
Self-employment business: 0.6	

(f) Australia

Net worth: 6.8	Debts: 1.4
Financial assets: 1.4	
Main residence: 4.1	
Other real assets: 2.5	
Self-employment business: 0.	

(g) United Kingdom

Net worth: 6.0	Debts: 1.1
Financial assets: 1.4	
Main residence: 3.8	
Other real assets: 1.4	
Self-employment business: 0.5	

(h) United States

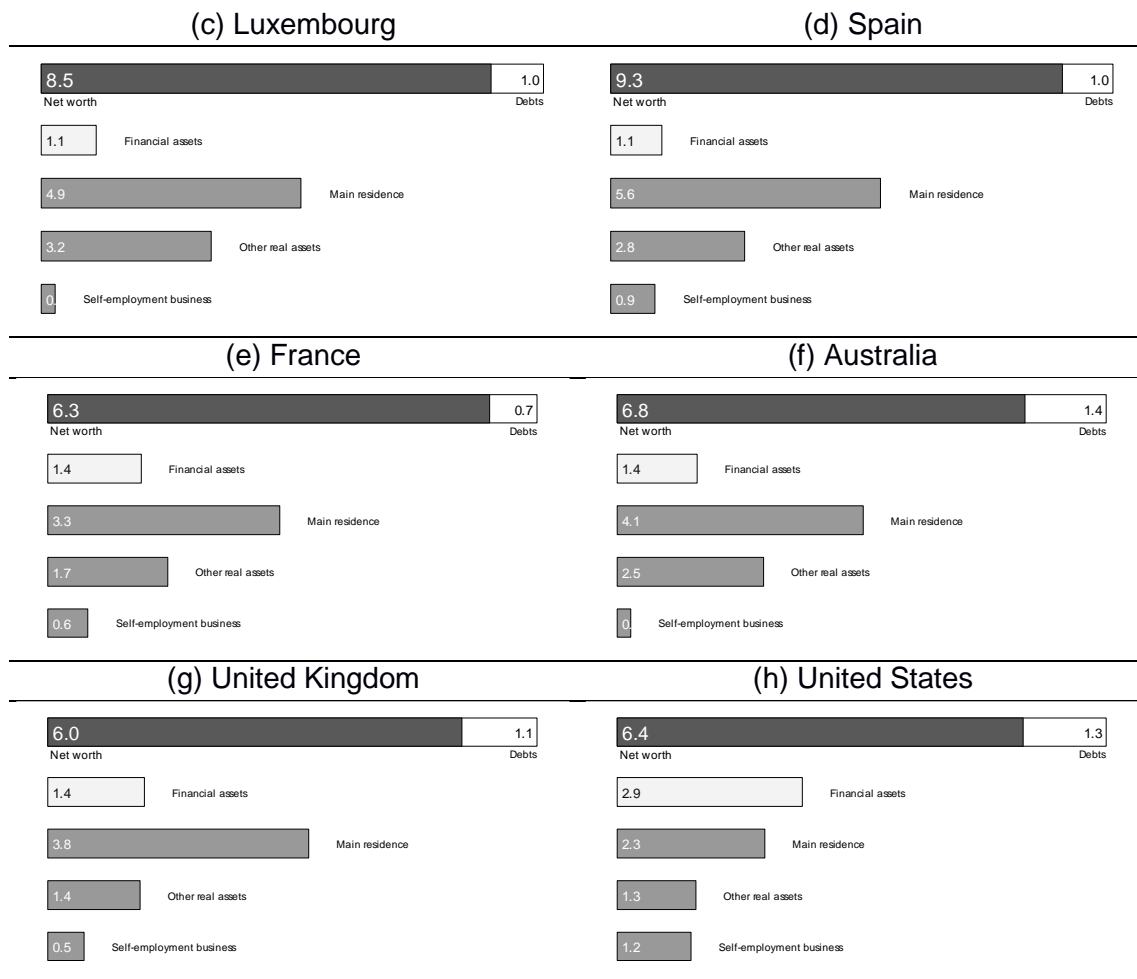|	
Net worth: 6.4	Debts: 1.3
Financial assets: 2.9	
Main residence: 2.3	
Other real assets: 1.3	
Self-employment business: 1.2	

Figure 1 reveals the composition of overall assets in the population. There is obviously a lot of heterogeneity in specific households' portfolio. Specifically there is interest in examining how the composition of net worth for the wealthiest differs from the average just discussed. It is often argued that the wealthy are able to accumulate assets yielding higher returns and thereby consolidate their advantage. Figure 2 shows the asset composition of the wealthiest 5% in our samples. Whether the surveys adequately represent the richest 5% in the population is unlikely, given the difficulties in capturing this segment in surveys as discussed above. Our notion of 'richest 5%' should therefore be interpreted with care, but we believe that comparing the wealthiest in our samples to the rest of the population remains an interesting contrast.

Figure 2 is in all respects designed like Figure 1. One should however first note of course the different levels of net worth: the average net worth of the wealthiest 5% ranges from just above 40 years of annual income in Germany and the United Kingdom, up to 80 years of annual income in the USA!

Unsurprisingly, debts bite a much smaller chunk of total assets than in the overall population, although they remain non-negligible (and higher in absolute value than in the average population). The share of financial assets is not much bigger than in the rest of the population

but there is a reallocation of the composition of real assets towards self-employment business and, more importantly, towards 'other real assets' (which notably includes real estate other than one's own residence). So, overall, while the level of net worth is much higher for the top 5%, its composition does not appear to differ a lot from the rest of the population.

Figure 2. The composition of net worth among the wealthy: real assets, financial assets and debt in the top 5% of the net worth distribution
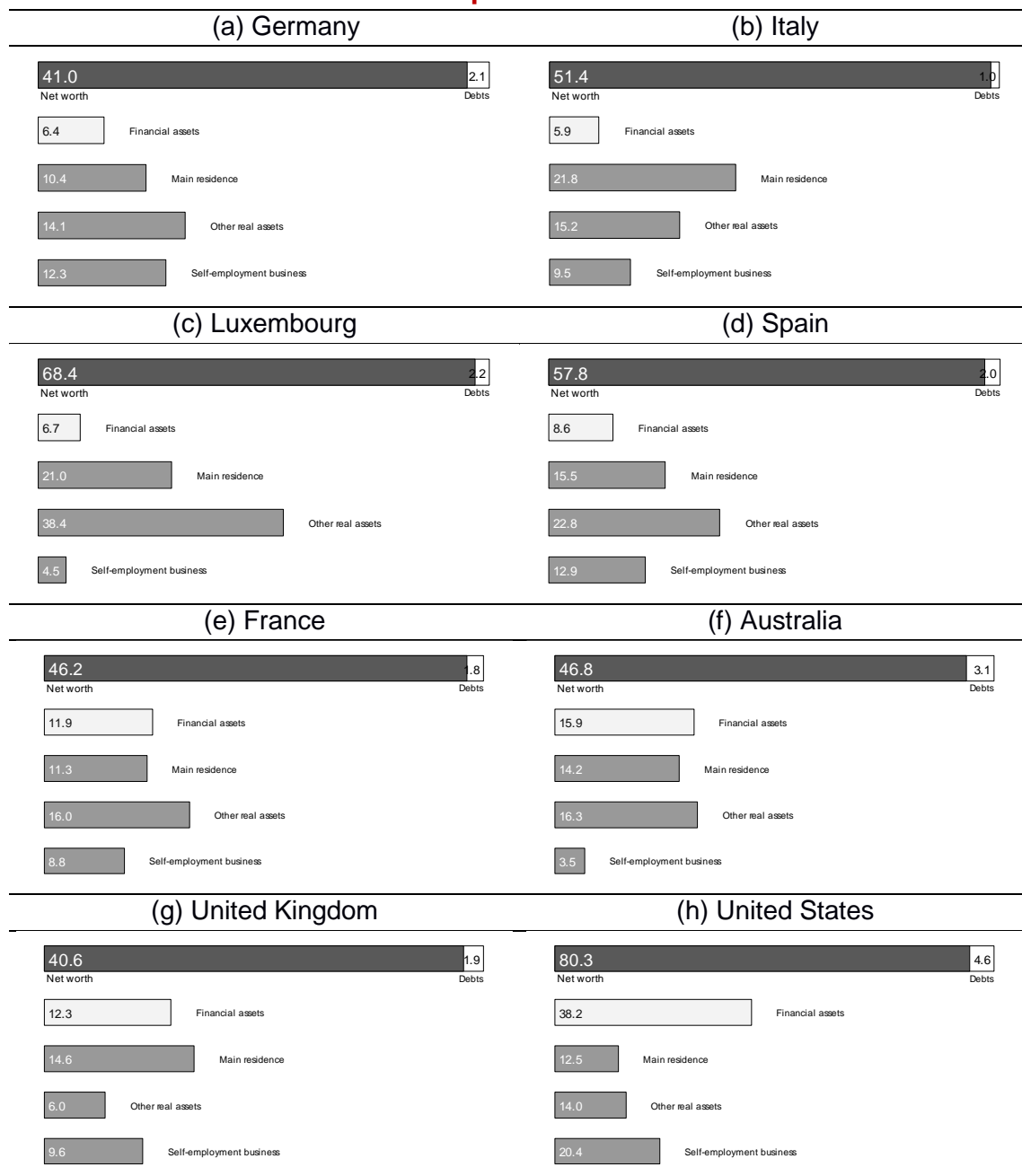
4. Evidence on wealth vs. income inequality

As is well-known, wealth is much more unequally distributed than income.

Figure 3 displays Lorenz curves and Gini coefficients for gross household income, total assets and net worth. The Lorenz curve plots cumulative wealth (or income) shares against cumulative population shares. The further apart the Lorenz curve is from the main diagonal the more unequally distributed is wealth, that is, the smaller is the share of wealth held by poor households relative to the share held by rich households. Notice how the Lorenz curve for net worth briefly cumulates below zero since households with the lowest net worth actually have *negative* net worth (their liabilities exceed the value of their assets). The Gini coefficient is defined as (twice) the area between the 45 degree line and the Lorenz curve. It summarizes the degree of inequality in the distribution of wealth and is a most popular measure of inequality. The Gini coefficient is prominent among the many alternative measures of inequality in the context of wealth analysis because it remains appropriately defined in the presence of negative values, unlike many other measures based on logarithmic or fractional power transformations of the data (e.g., the Theil index, the mean log deviation, Atkinson inequality measures). See Cowell & Van Kerm (2015) for further discussion. The implication of the presence of negative data for the Gini index is that the index is not bounded above at 1, but can take any positive value; notionally, there is no theoretical maximum for inequality when poor households can borrow infinitely to finance regressive transfers to rich households.

It has become popular to examine top wealth or income *shares*. These can naturally be read off the Lorenz curve directly: this is equivalent to reading the Lorenz curve from the top-right corner down instead of from the bottom-left corner up. Top shares can also be connected to Gini coefficients (G) quite easily: $(1+G)/2$ gives the average wealth share of the richest $100p$ percent, for a randomly chosen p.

The much larger inequality in wealth than in income is clear from Figure 2: Lorenz curves for wealth are further away from the 45 degree line and their Gini coefficients are larger. This holds even though we look at inequality in gross income (direct taxes further reduce inequality). The *degree* to which wealth is more unequally distributed however varies across countries. The difference is smallest in Australia, Spain or the UK (where the Gini of net worth is still around 19 points larger than the Gini of income) and it is largest in Germany, Spain or France (where the net worth Gini is about 30 points larger than the income Gini).

Countries also differ remarkably in terms of the level of inequality: from the lowest net worth Gini of 0.580 in Spain to the highest of 0.758 in Germany and 0.852 in the United States. These cross-country variations are bigger than those observed for income inequality which range between 0.384 (in France) and 0.440 (in the UK) or 0.548 (in the USA).
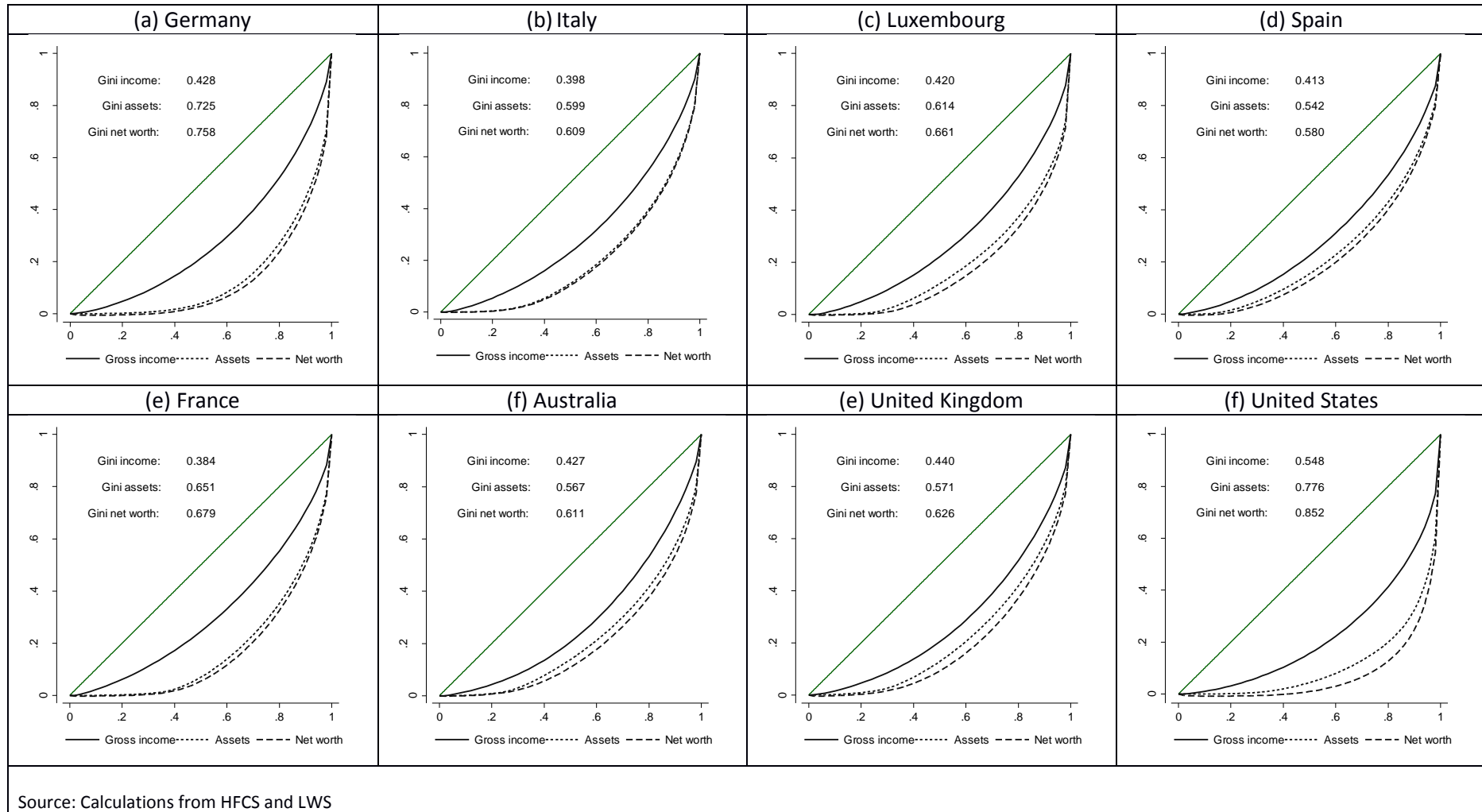
Reassuringly, we note that our Gini coefficient estimates are very close to those reported in Sierminska et al. (2006) for the three countries examined in both our work and theirs, namely

Germany, Italy and the United States. This is remarkable since the data cover different years (2001/2002 vs. 2011) and the underlying data are completely different surveys for Germany and Italy.

We believe it fair to claim that Gini coefficients for net worth are large, especially in the USA. Using the formula mentioned above, a Gini of 0.852 means that on average the share of total net worth held by the richest p percent for any random p is 92 percent! (In a perfectly equal distribution, this average would be 50 percent.) Even for the lower, Spanish value of 0.580, the corresponding share would be 79 percent.

We have not yet discussed the difference between the Lorenz curves for total assets and for net worth. The difference between these curves gives us indication of how much liabilities reduce or exacerbate inequality of assets. In all countries, inequality of net worth is higher than inequality of assets. This means that deducting liabilities from household assets further exacerbates inequality: the burden of debts is disproportionately carried by households with lower assets too. It is again in the USA that this effect is the strongest while it is hardly noticeable in Italy, Germany or France.

Figure 3. Lorenz curves and Gini coefficients for gross household income, total assets and net worth

	(a) Germany	(b) Italy	(c) Luxembourg	(d) Spain
Gini income:	0.428	0.398	0.420	0.413
Gini assets:	0.725	0.599	0.614	0.542
Gini net worth:	0.758	0.609	0.661	0.580

	(e) France	(f) Australia	(e) United Kingdom	(f) United States
Gini income:	0.384	0.427	0.440	0.548
Gini assets:	0.651	0.567	0.571	0.776
Gini net worth:	0.679	0.611	0.626	0.852

Source: Calculations from HFCS and LWS

Popular debates tend to emphasize the gap between "the top" and "the bottom rest". How much does the distance between the wealthiest and the rest of the population drive overall inequality? Inequality is not just a matter of differences between two homogeneous groups of "wealthy" and "poor" households; there is much heterogeneity in wealth levels across many different the segments of the population. One way to quantify this is to use a decomposability property of the Gini coefficient. Given a partition of the population into two groups – the top p percent and the bottom (100-p) percent – we can express the Gini coefficient as

$$G = p*mt*Gt + (1-p)*mb*Gb + GB$$

where mt (resp. mb) is mean wealth among the wealthy top (resp. the "bottom") divided by overall mean wealth, Gt is the Gini coefficient of wealth within the top p percent, Gb is the Gini coefficient within the bottom 100-p percent and GB is the 'between-group' Gini coefficient. So we can examine how much of the overall Gini coefficient can be attributed to inequality *within* the groups and how much can be attributed to inequality *between* the groups. Inequality *between* groups is one that would be observed if all people in the groups received the average wealth of their group.

Table 2 shows decomposition components for a partition into the richest 5% and the bottom 95%. The first four columns report Gini coefficients (overall, within bottom, within top and between group) while the last four show contributions of each component divided by overall Gini. Clearly overall inequality is not just a matter of inequality *between* groups. There is more inequality within the bottom 95% (see column (2)) than between the two groups (column (4)).

Table 2. Decomposition of Gini coefficients of net worth by groups: the bottom 95% versus the top 5%

|	Gini coefficients				Contributions			
	All	Within bottom 95%	Within top 5%	Between	All	Within bottom 95%	Within top 5%	Between
	(1)	(2)	(3)	(4)	(5)=(6)+(7)+(8)	(6)	(7)	(8)
Germany	0.758	0.661	0.442	0.406	100	45	1	54
Italy	0.609	0.516	0.334	0.271	100	55	1	44
Luxembourg	0.661	0.531	0.436	0.349	100	46	1	53
Spain	0.580	0.480	0.374	0.259	100	54	1	45
France	0.679	0.591	0.386	0.315	100	53	1	46
Australia	0.611	0.500	0.386	0.291	100	51	1	48
United Kingdom	0.626	0.529	0.396	0.286	100	53	1	46
United States	0.852	0.742	0.486	0.565	100	32	2	66

Also inequality within the top 5% is substantial. Inequality within the bottom 95% accounts for between 45 and 55 percent of overall inequality while inequality between groups accounts for between 44 and 54 percent. The outlier is the US where between group inequality's share goes up to 66 percent (for only 32 percent attributed to inequality within the bottom 95%). Inequality within the top 5% only accounts for a very small share of overall Gini – this is largely due to the relatively small inequality within that group and, especially, to the small population size of this group.

5. Accumulation over the life-cycle: age profiles in wealth holdings

The sheer nature of wealth accumulation makes it important to examine the age profile of net worth. At least in part, households accumulate assets during their working life to provide income security and finance consumption in old age. This is the prediction of life cycle accumulation models. One may be tempted to argue that overall wealth inequality is not particularly relevant but that one should instead examine wealth inequality *within* cohorts for people at the same stage of their lives (Paglin, 1975; Almas & Mogstad, 2012).

The underlying story is straightforward. Figure 4 illustrates a highly simplified version of the person's economic life. He or she is "born" economically at time t_0, on entry into the world of work; earnings follow a rising path until time t_R, retirement, after which there may be a small amount of earnings from doing casual jobs: this is the broken line $e(t)$. Imagine that consumption $c(t)$ is broken down into expenditure on needs $c_N(t)$ and discretionary expenditure $c_D(t)$, that is largely determined by tastes (we do not need a precise, scientific definition of the boundary between the two components). We can imagine that $c_N(t)$ starts out modestly, jumps upwards at t_F when a family is formed and falls again at t_E, when the nest is empty again. Everything stops at t_D, death. Of course one can put additional bends and kinks into both lines, but the sketch is enough to interpret what is going on in the basic dynamics of the life cycle.

Figure 4. The life cycle: a stylised picture
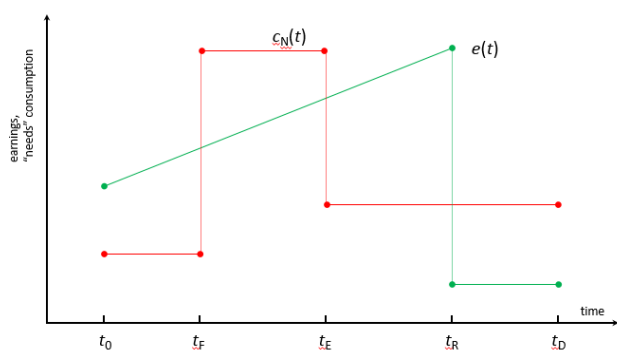
At any moment t in the lifetime net worth $w(t)$ is accumulating/decumulating according to the following equation:

$$\frac{\mathrm{d}w(t)}{\mathrm{d}t} = y(t) - c(t),$$

where $y(t)$ is total income and $c(t)$ is consumption expenditure. We have income defined as

$$y(t) = r\,w(t) + e(t) + z(t),$$

where r is the interest rate on net worth (for simplicity we are assuming that it is the same in cases where $w(t)$ is positive and where the person is in debt so that $w(t)$ is negative, $e(t)$ is earnings and $z(t)$ is any form of transfer income. We have consumption defined as

$$c(t) = c_{\mathrm{N}}(t) + c_{\mathrm{D}}(t)$$

Obviously the exact path that $w(t)$ follows from t_0 to t_D depends on the initial conditions at t_0, wealth inherited from the past. But if $w(t_0)=0$, and if the person tries to plan $c_D(t)$ so that consumption is fairly smooth over the life cycle we can imagine that $w(t)$ might start rising at first, then go substantially negative (mortgage on the house and so on), gradually recover and become positive again as the person heads in the direction of t_R; after retirement $w(t)$ might be expected to decumulate, but probably might not go back to zero.[3] Let us see how this works out in practice.

Figures 5 and 6 display average and median household net worth by age of the household head. Again, we express net worth in units of average annual income in each country.[4]

As is expected, wealth displays a hump shape when plotted against age. Of course, because we use a single cross-section of the population, the age profiles that we show here may possibly reflect a generational pattern (a cohort effect) or a genuine household-level life-cycle accumulation process. But the similarity of age profiles across countries is worth pointing out: it is interesting to stress that a hump shape predicted by basic life-cycle models is observed

[3] Obviously this elementary intragenerational story will be affected by events that are essentially intergenerational: inheritances that bump $w(t)$ upwards and planned bequests that bump $w(t)$ downwards. These events may occur at any time between t_0 and t_D. We discuss the intergenerational part of the story in section 7.
[4] Technically, estimates are obtained by local smoothing techniques: to calculate statistics "at age A" we first reweight all households in our sample according to the distance between the age of the household head and target age A. A familiar, bell-shaped, Epanechnikov kernel weighting function with bandwidth of 3.75 years is used in all countries---this means that only households whose head is +-/ 8 years age older/younger than age A are used for calculations, and the further apart from A, the smaller the household weight. Average and median net worth, as well as 'conditional' Gini coefficients were then calculated using 'age-reweighted' household for a range of values of A between 25 and 85.

in all eight countries. Peaks in average or median net worth are observed at 60 or 65 years of age, with only very few exceptions.

The steepness of the 'accumulation phase' of the age profile varies somewhat across countries, with Australia and Luxembourg seemingly exhibiting the fastest growth of average and median net worth between the ages of 25 and 65 (or 55 in Australia). The growth is also fast in the United States if we examine average net worth, but it disappears completely if one examines median net worth which grows at a slow, but continuous pace. There is also some cross-country variation in the 'decumulation phase' after 60-65: in most countries, average net worth at age 80 is about the same as at age 40-45. Notable exceptions are Australia and the United States that display a much slower decline in net worth – both in the average or the median.

Systematic variations in average net worth by age are indicative of "between (age) group inequality". Countries with steep accumulation and decumulation profiles, such as Luxembourg and possibly Spain or Italy, can plausibly be seen as displaying the largest between group inequality, but such inequality may well be interpreted as 'legitimate' to the extent that it reflects household accumulation and decumulation patterns.

To capture inequality that is not driven by age profiles in wealth accumulation, Figure 7 shows *within group* Gini coefficients by age, that is Gini coefficients calculated on the 'age reweighted households'. In general inequality tends to decline with age: inequality among households younger than 35-40 tends to be higher than overall, unconditional inequality, sometimes largely so. However the profile differ across countries for older ages: it keeps declining in most countries (notably in the UK or the US) but it may also flatten out (in Spain or France) or even increase in very old age. Peak to trough differences in Gini coefficients approximately range from .2 to .3 'Gini points'.

In the previous section we contrasted the net worth of the top 5% percent and of the bottom 95%. Figure 8 shows where the top 5% are distributed by age groups: it plots the probability to be in the top 5% by age of household head. The hump shape observed in average net worth is clear here again. The similarity of this plot across countries is again striking. The peak is achieved at age 60-65 in all countries.

Figure 8 also shows the probability to be in the top 5% of *income* distribution. This probability is also hump shaped but with a peak at earlier ages at around 50. With the exception of France, older households have a very low probability to be in the top 5% of the income distribution. On the contrary, they are largely over-represented in the top 5% of the net worth distribution in all countries (except in Germany or Spain). At the other end of the age range, households whose head is younger than 35 are under-represented in both the top of income and of the net worth distribution. Such shapes make it plain to see how policies about top marginal tax rates on income and wealth affect (or would affect) different populations.

Figure 5. Average net worth by age of household head
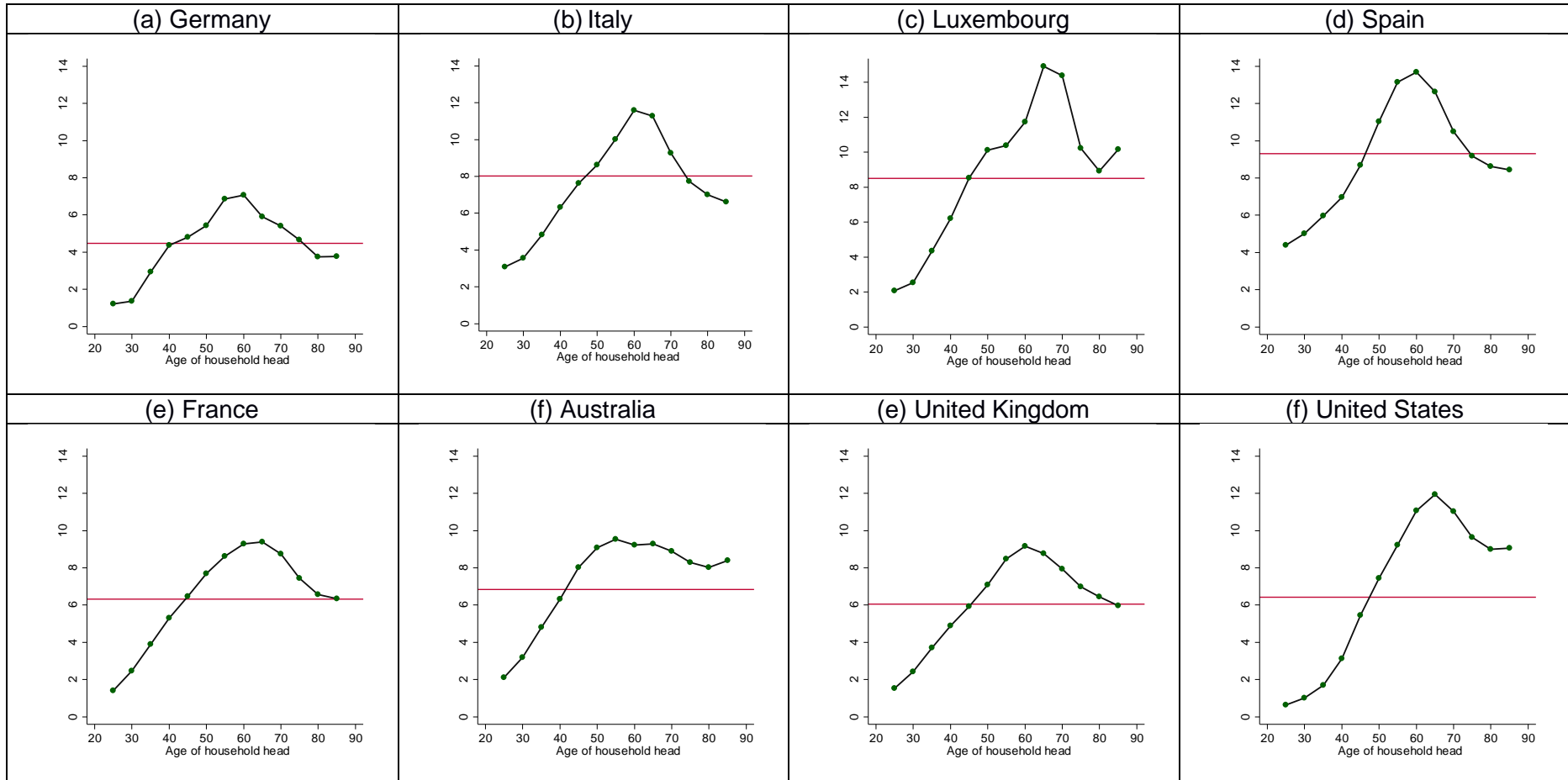
Note: Estimates obtained by kernel smoothing. The horizontal line gives the population average.
Source: Calculations from HFCS and LWS

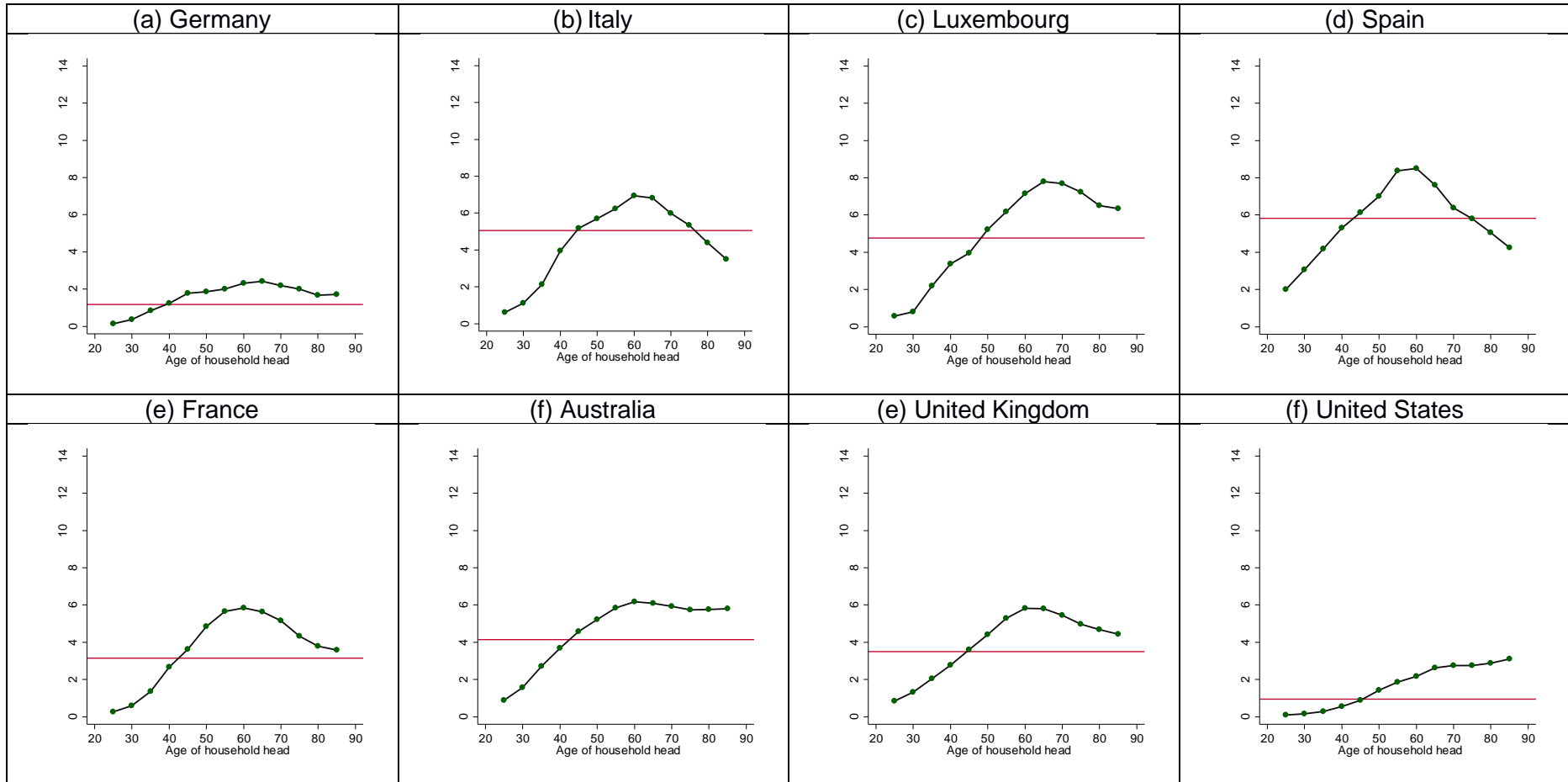## Figure 6. Median net worth by age of household head

Figure 5. Median net worth by age of household head

Note: Estimates obtained by kernel smoothing. The horizontal line gives the population median.
Source: Calculations from HFCS and LWS

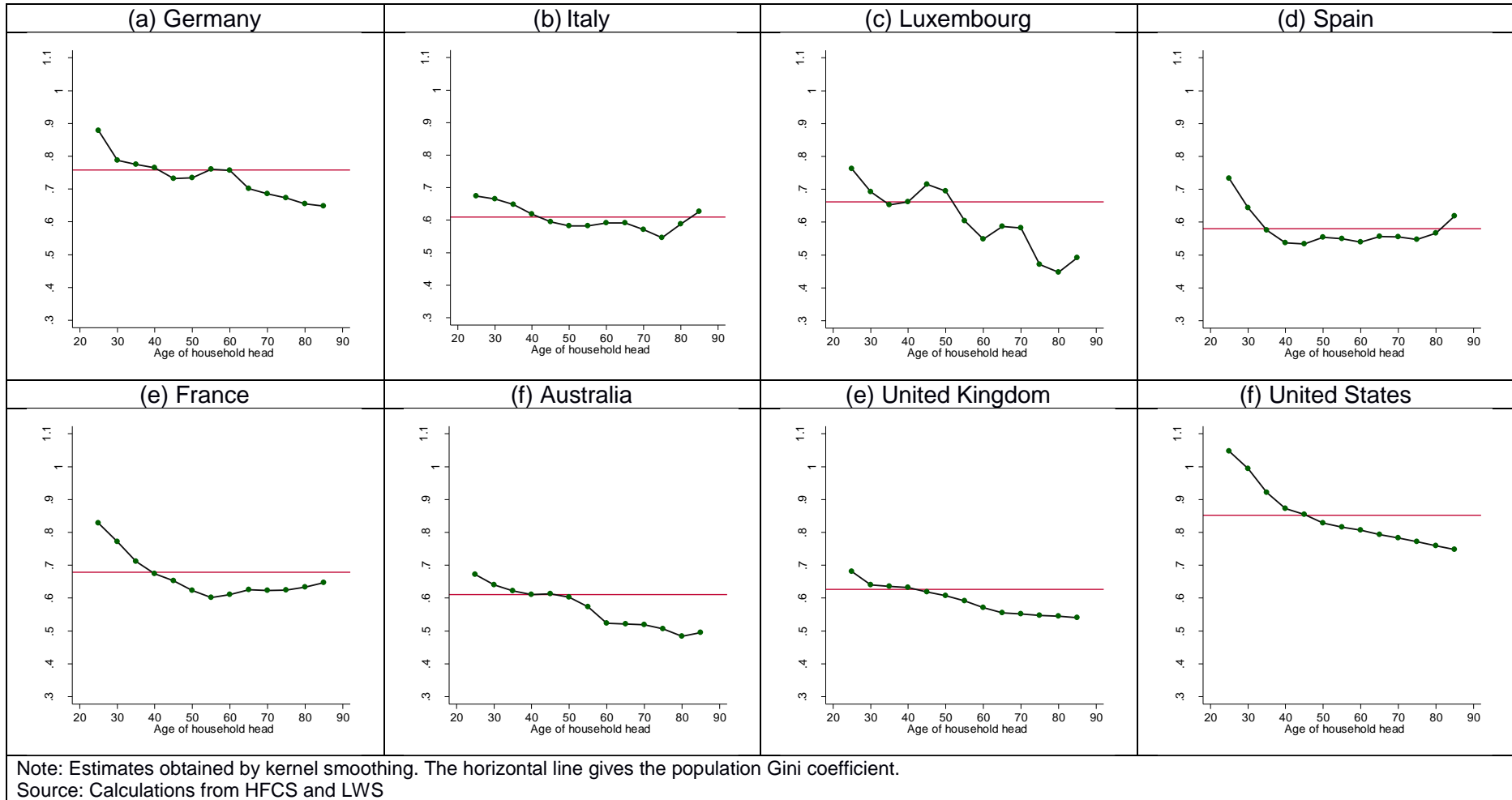# Figure 7. Within cohort Gini coefficient

Note: Estimates obtained by kernel smoothing. The horizontal line gives the population Gini coefficient.
Source: Calculations from HFCS and LWS

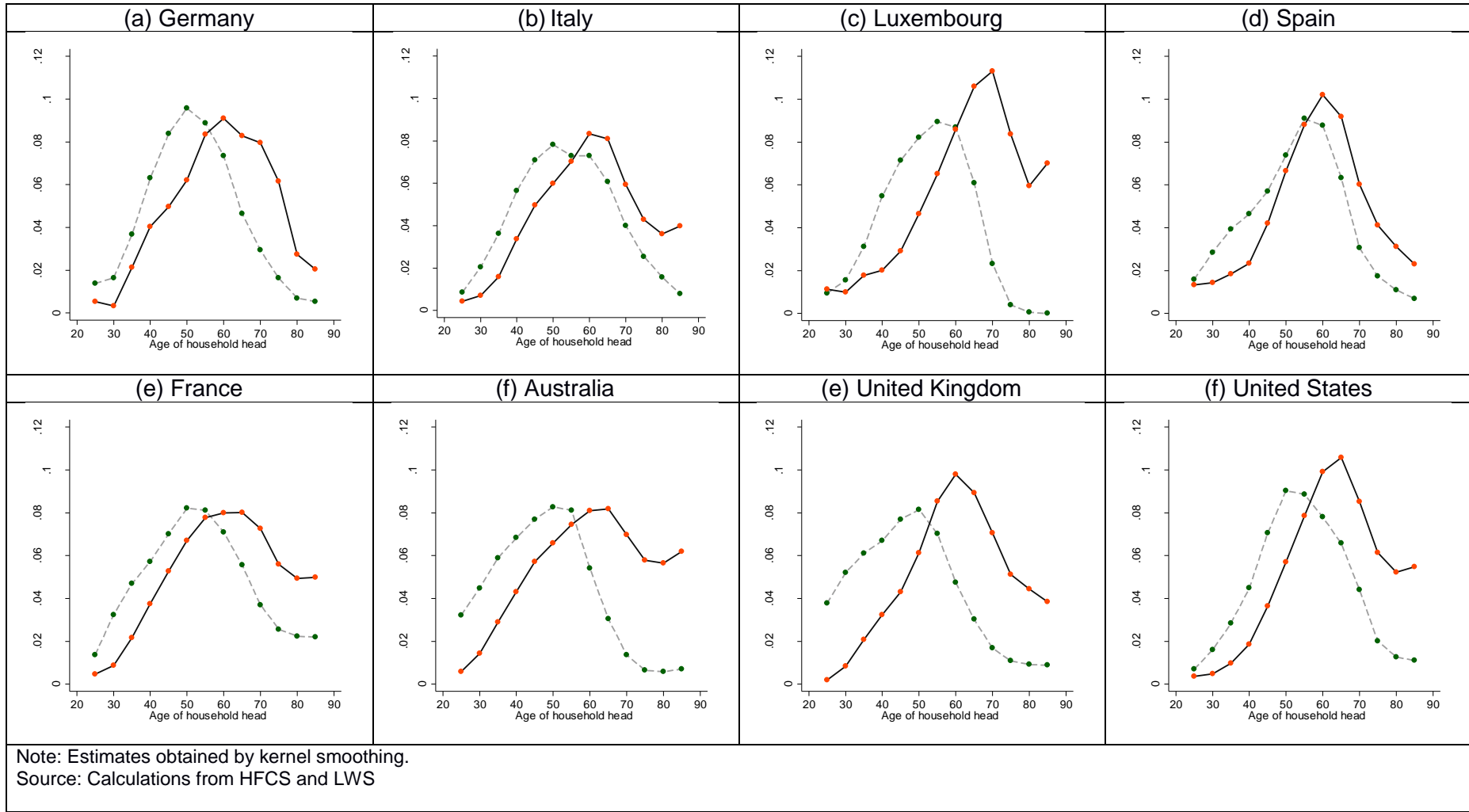**Figure 8. Share of households belonging to the richest 5% of the overall income or net worth distribution by age of household head**

Note: Estimates obtained by kernel smoothing.
Source: Calculations from HFCS and LWS

6. Pension wealth and inequality

Standard measures of household wealth only include marketable wealth, i.e. the value of actual holdings such as savings, bonds, housing and loans, and sometimes the value of private pension balances. The expected income from pensions is generally unaccounted. However, this practice can mislead the analysis of wealth distribution because of the well-known crowding-out effects of public transfers on private wealth. Feldstein (1974) was one of the first authors to document the extension of the crowding-out effects and estimated that social security wealth reduces personal saving by 30%-50% in the U.S. Although these effects have been contested or confirmed in later studies, it is generally accepted that pension wealth reduces private savings. Recent evidence from the Survey of Health, Ageing and Retirement in Europe (SHARE) shows that pension wealth has a displacement effect of 17%-31% on household savings for the individuals aged 60 and more (Alessie *et al*. 2013).

Given that the levels of wealth observed today have been affected by the accumulation of social security contributions, it seems reasonable to include pension wealth in the measures of household wealth. This addition will, certainly, have consequences on the measurement of the distribution of wealth. In one of the first papers dealing with social security wealth inequality, Feldstein (1976) found that the Gini index of net wealth was 0.72, while the Gini index of augmented wealth (adding social security wealth) was 0.51. It is also important to consider public and private pensions in the computation of pension wealth. In this respect, public pensions are mostly Defined Benefit (DB), while occupational pension plans offer Defined Contribution (DC) pensions which can be publicly and/or privately managed. The former type of pensions are generally more equally distributed than the latter. Wolff (2015) illustrates this with US data of 2010 for the 47-64 years old households by showing that the Gini index of net wealth falls from 0.83 to 0.80 after private pension wealth is added, and it is further reduced to 0.66 with the inclusion of public (Social Security) pension wealth.

The relative size of pension wealth with respect to total wealth in the household can be considerable. For example, Frick and Grabka (2013) show that pension wealth amounts to 57% of the wealth of German retirees, while the rest is mostly composed of housing wealth. The contribution of pension wealth also differs considerably along the distribution of wealth. For the total population, these authors find that within the fourth and fifth decile of the distribution of wealth, the participation of pension wealth is 95% and 87%, respectively; while this is 42% and 21% within the ninth and tenth decile, respectively. A recent study by Crawford and Hood (2016), employing a sample of retirees aged 65-79 from the English Longitudinal Study of Ageing (ELSA), shows that both private and public pensions are very important in the augmented measure of household wealth and in its distribution. From Crawford and Hood (2016)'s Table 1 it is possible to infer that private and public pension wealth represent about 19% and 22%, respectively, of an augmented measure of household wealth that includes both types of pensions. The equalization effects of pension wealth are

also important. The Gini index of household wealth falls from 0.524 to 0.489 after private pensions are included, and this is further reduced to 0.382 with the inclusion of public pensions.

The ideal database to compute pension wealth and its contribution to wealth inequality is one that includes social security administrative records and household wealth holdings. Such databases are scarce, and hence studies must rely on household surveys inquiring for wealth holdings and employ alternative methods to compute pension wealth. For the retirees, the computation of pension wealth is much less complex because the benefit is reported by the individual. In the case of workers, some studies have employed various forms of statistical matching between survey information and social security data (Frick and Grabka 2013; Engelhardt and Kumar 2011), self-reported social security information (Wolff 2007), and self-reported retrospective and subjective information (Alessie *et al.* 2013).

Studies such as the ones by Frick and Grabka (2013), Wolff (2007) and Banks *et al.* (2005) define pension wealth as the present value of expected pension streams, which involves the use of discount rates and survival probabilities. Generally, the official life tables of the country are used to compute individual survival probabilities disaggregated by sex. However, other alternatives include the estimation of individual subjective survival rates (Gan *et al.* 2015, Bissonnette *et al.* 2014, Peracchi and Perotti 2014) which facilitate the simulation of life-cycle models, and the estimation of life tables by socio-economic status such as in Brown *et al.* (2002).

In this section, we explore the distributional effects of including public and private pension wealth in an augmented measure of household wealth in 13 European countries participating in the first and available round (circa 2010) of the Household, Finance and Consumption Survey (HCFS)[5]. In order to simplify the computation of pension wealth and reduce the abuse of *ad-hoc* assumptions, the analysis is focused on elderly households. In this way, all households will be in the same section of the life-cycle, so that the inequality measures will be less affected by life-cycle effects. In particular, we restrict the analysis to all households whose reference person is aged 65-84 and the spouses are younger than 85. This is done because the age is top coded at 85 in HFCS. Individual survival probabilities are country, age and sex specific and are drawn from Eurostat's life tables[6]. We assume that future pensions keep their real value, i.e. future increases in pensions and inflation are balanced out. Similar to Frick and Grabka (2013) and Crawford and Hood (2016) the discount rate is assumed to be 2%, but instead of simply employing the expected life expectancy as the horizon to receive pensions, we compute 'annuity prices' for each individual and multiply it by the corresponding

---

[5] Malta is left out of the analysis due to unavailability of the specific age of the individuals (only age groups), while Cyprus is discarded because the variable sex has many missing points.
[6] Because the last age with survivors' information for these tables is 85, we had to estimate the number of survivors from age 86 to 110 with Gompertz equations for each country and sex.

pension. It is also assumed that surviving spouses receive 50% of the partner's pension. The computation of pension wealth employs the following formula:

$$A_z = \sum_{t=0}^{M-z} \frac{p_{z,z+t}}{(1+r)^t} \qquad (1)$$

$$A_{z,y} = A_z + \theta \sum_{t=0}^{M-y} \frac{q_{y,y+t}(1-p_{z,z+t})}{(1+r)^t} \qquad (2)$$

$$W_z = A_{z,y}P \qquad (3)$$

Table 3. Gini indices and means of household wealth (Euros, circa 2010)

Country	sample		net worth		including public pension wealth		including public & private pension wealth		diff in Gini (1 - 3)
	n	N	mean	Gini (1)	mean	Gini (2)	mean	Gini (3)	
AT	524	794,743	238,141	0.696	604,245	0.450	651,690	0.485	0.211
BE	620	1,062,455	477,203	0.559	782,970	0.411	787,675	0.412	0.147
DE	1,022	9,860,230	210,224	0.681	516,755	0.430	540,263	0.436	0.245
ES	2,242	4,170,933	300,627	0.554	443,503	0.481	443,503	0.481	0.073
FI	1,887	524,541	199,119	0.516	228,812	0.453	548,247	0.379	0.138
FR	4,169	6,271,336	287,467	0.626	632,385	0.432	633,723	0.432	0.194
GR	546	911,786	124,338	0.507	300,943	0.361	301,860	0.359	0.148
IT	2,592	6,914,360	292,248	0.581	567,111	0.431	574,544	0.435	0.146
LU	159	36,472	1,067,059	0.564	1,686,588	0.450	1,714,426	0.448	0.116
NL	381	1,653,892	237,626	0.561	425,977	0.358	676,730	0.357	0.204
PT	1,406	1,101,183	154,443	0.656	294,621	0.509	297,802	0.511	0.145
SI	79	169,154	101,549	0.484	190,796	0.424	197,207	0.408	0.076
SK	181	357,333	71,099	0.379	140,693	0.258	141,771	0.261	0.118

Source: first round of HFCS (circa 2010) and Life tables from Eurostat year 2010.

The annuity price A_z is the necessary amount of capital, in present value, to finance a monetary unit of life pension for a single person at age z. $p_{z,z+t}$ is the probability of survival

from age z to $z + t$ according to official life tables; M is the maximum survival age (assumed to be 110); r is the discount rate; y is the age of the pensioner's spouse and $q_{y,y+t}$ represents the probability of survival from age y to $y + t$. The fraction θ indicates the percentage of pension that a spouse will receive upon the death of the pensioner. $A_{z,y}$ is the annuity price for the individual that will be used to compute pension wealth. In order to consider cases of single and married individuals, the parameter θ will be either 0% or 50%, respectively. The value of pension wealth is simply the product of the annuity price of the individual and the value of the yearly pension (equation 3). The pension wealth is computed for the reference person of the household and the spouse if she/he also receives a pension. Then, we sum up the pension wealth of both the reference person and spouse to obtain the measure of pension wealth at the level of the household. The results are reported in next tables and figures.

**Table 4. Distribution of household wealth by quartiles**

Country	net worth				including public pension wealth				including public & private pension wealth			
	bottom 25%	next 25%	next 25%	top 25%	bottom 25%	next 25%	next 25%	top 25%	bottom 25%	next 25%	next 25%	top 25%
AT	0.01	0.06	0.18	0.76	0.07	0.14	0.23	0.57	0.06	0.13	0.21	0.60
BE	0.03	0.11	0.21	0.65	0.07	0.16	0.24	0.53	0.07	0.15	0.24	0.53
DE	0.00	0.05	0.20	0.75	0.07	0.14	0.24	0.55	0.07	0.14	0.24	0.55
ES	0.03	0.12	0.21	0.64	0.05	0.13	0.24	0.58	0.05	0.13	0.24	0.58
FI	0.02	0.13	0.25	0.60	0.05	0.14	0.25	0.56	0.08	0.16	0.26	0.50
FR	0.01	0.09	0.21	0.69	0.07	0.14	0.24	0.55	0.07	0.14	0.24	0.55
GR	0.03	0.14	0.24	0.59	0.09	0.17	0.25	0.49	0.09	0.17	0.25	0.49
IT	0.02	0.11	0.21	0.66	0.07	0.14	0.24	0.55	0.07	0.14	0.23	0.55
LU	0.04	0.12	0.18	0.66	0.07	0.14	0.23	0.56	0.07	0.14	0.24	0.55
NL	0.01	0.09	0.27	0.63	0.09	0.16	0.27	0.48	0.09	0.17	0.26	0.49
PT	0.01	0.08	0.18	0.73	0.06	0.12	0.20	0.62	0.06	0.12	0.20	0.62
SI	0.04	0.12	0.33	0.51	0.07	0.14	0.25	0.54	0.07	0.15	0.25	0.52
SK	0.08	0.16	0.25	0.50	0.13	0.20	0.26	0.41	0.13	0.19	0.26	0.41

Source: first round of HFCS (circa 2010) and Life tables from Eurostat year 2010.

The results show a sharp fall of wealth inequality when pension wealth is included in the measure of household wealth. Germany is the country that experiences the largest drop in the Gini index, which decreases from to 0.681 to 0.436, i.e. 0.245 points. Then, Austria, Netherlands and France report a decrease in the Gini index of about 0.19-0.21 points. Spain is the country that reports the most modest decrease in the Gini index, which decreases by 0.073 points, from 0.554 to 0.481. Public pensions have a sizeable and clear equalization effect on the distribution of wealth. The effect of private pension wealth in the distribution of wealth is, in general, not very important after public pension wealth has been included, although Austria and Finland are exemptions. The Gini index of wealth in Austria falls from 0.696 to 0.450 when public pension are added, but it increases to 0.485 when both public and private are included in the measure of household wealth. The opposite effect is found in

Finland where both public and private pension wealth reduces wealth inequality. In that country, the Gini index drops from 0.516 to 0.453 and to 0.379 after public and private pension wealth is included, respectively, in household wealth. One of the distinctive characteristics of the Finish pension system is the existence of a state pension for all citizens and a well-developed system of compulsory occupational pension plans. A similar case is Netherlands, although the occupational pensions have a negligible effect on the distribution of household wealth. In other European countries, the pensions are mostly based on public schemes, while the market for occupational pensions is limited.

Figure 9. Size and equalization power of pension wealth
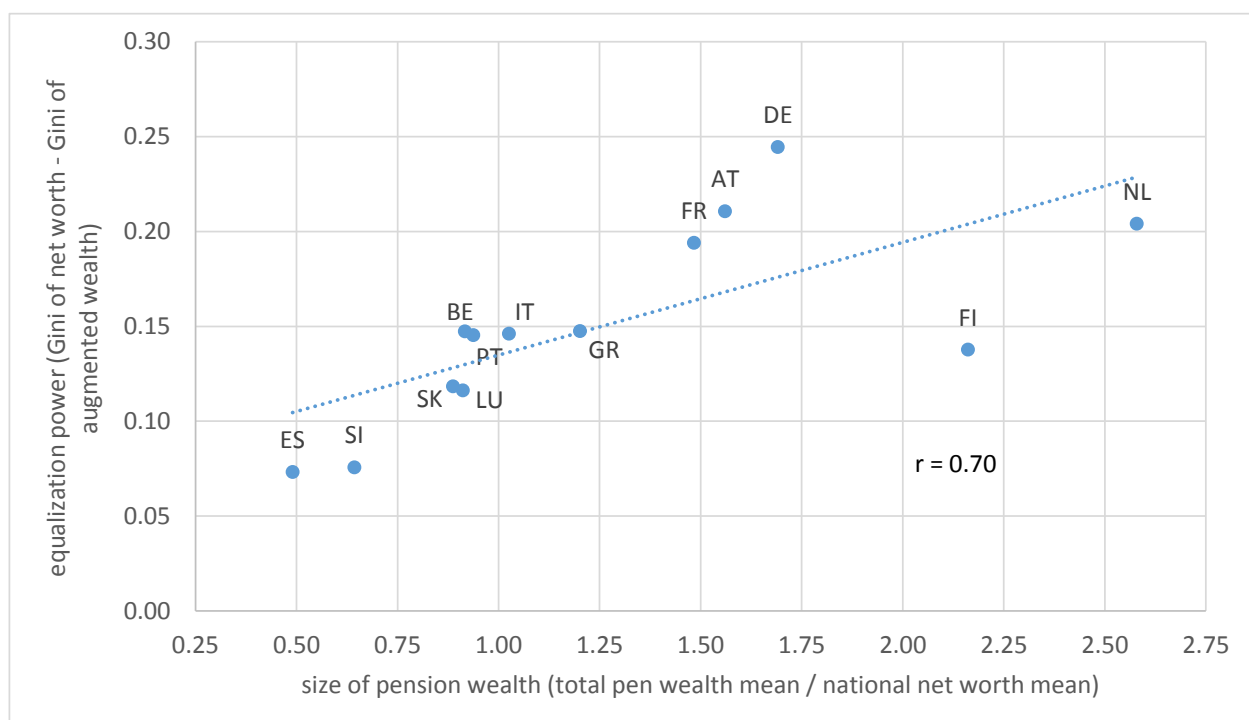
In line with what is indicated in Marx *et al.* (2015), that a low level of inequality in rich economies cannot be achieved with a low level of social spending, it is interesting to note in our results that countries that expend more in pensions are also able to reduce wealth inequality by larger values. In this respect, Figure 9 plots the difference between the Gini indexes of net worth and augmented wealth (last column of Table 3, which we call 'equalization power') against the relative size of pension wealth, which is measured as the ratio of the means of total pension wealth over national net worth. The correlation between the equalization power of pensions and the size of pension wealth is large at r=0.70. Interestingly, the correlation becomes stronger (r=0.97) after removing Finland and Netherlands, which are the countries with the most developed systems of occupational pensions in our sample.

7. Inheritance

In a recent study, Crawford and Hood (2016) find that inheritances and financial gifts have an equalizing effect on wealth distribution when standard measures of marketable wealth are used. However, these effects disappear when the authors employ augmented measures of wealth, which include estimates of state and private pension wealth. These results shows the importance of considering both pension wealth and bequests for a more comprehensive analysis of wealth distribution. Once marketable wealth is 'augmented' with pensions and bequests, one can be in a better position to evaluate lifetime income distribution, which may useful to derive some policy recommendations.

The importance of bequests in the accumulation of wealth has been widely acknowledged, but there is no agreement whether they have equalizing or dis-equalizing effects on the distribution of wealth. Inheritances may reduce wealth inequality because they represent a larger share of the holdings of poorer households, but they can also significantly increase the wealth of individuals who are already wealthy and therefore increase inequality. Wolff and Gittleman (2014) report that about 20%-30% of household wealth in the U.S. stems from bequests and other forms of wealth transfers and find that inheritances have equalizing effects on wealth distribution. Boserup *et al.* (2016) use information from Danish wealth registers and find that bequests reduce top wealth shares. Inheritances can also reduce wealth inequality according to the simulations by Gokhale and Kotlikoff (2002) and Gokhale *et al.* (2001) but they have a limited role on the generation of wealth inequality, with earnings inequality being a much more important determinant of wealth inequality. In the same line, Hendricks (2007) points out the importance of accounting for the joint distribution of wealth and earnings in order to build a satisfactory theory of wealth inequality, and the survey by Benhabib and Bisin (2016) identify stochastic earnings as one of the key factors to generate wealth distributions (together with stochastic returns and exploding wealth accumulation).

There is no consensus regarding the effects of bequest motives on the distribution of bequests and wealth, nor which motives are more prevalent. Indeed, Gale and Perosek (2001) and Cigno *et al*. (2011) suggest that households can have different motives or the importance of each motive differs across households. For example, it has been found that accidental bequests can increase wealth inequality (Gokhale and Kotlikoff 2002, Gokhale *et al.* 2011) and also reduce wealth inequality (Nishiyama 2002), or have little effect (Hugget 1996), while intended bequests may increase wealth inequality (Cataneda *et al.* 2003, Laitner 2002, De Nardi 2004). For Cremer and Pestieau (2011) only altruistic bequests contribute to social immobility, while accidental bequest have uncertain effects.

We can exploit our data to examine the potential role of inheritance in the build up of the measures of net worth inequality that we reported earlier in this chapter. Our HFCS data contain information about inheritance elicited from the following question: "Have you/has any member of the household ever received an inheritance or a substantial gift, including money or any other assets (from someone who is not part of your current household)?" For the three

most significant transfers, we also know the amount received.[7] We use this information to assess the total value of those transfers and inheritances. Similar information is available in the three LWS countries.

Table 5: Inheritance and gifts. Share of households having received a gift or inheritance (top), average value of inheritance and gifts (middle), share of households expecting inheritance in the future

	All population	Bottom 20% of wealth	Middle 20-90% of wealth	Between top 90% and top 95% of wealth	Top 5% of wealth
Share of households having received inheritance or substantial gift					
Germany	0.27	0.07	0.30	0.47	0.51
Italy	n/a	n/a	n/a	n/a	n/a
Luxembourg	0.27	0.07	0.30	0.56	0.45
Spain	0.24	0.10	0.24	0.44	0.59
France	0.40	0.15	0.42	0.69	0.74
Australia	n/a	n/a	n/a	n/a	n/a
United Kingdom	0.13	0.08	0.13	0.18	0.19
United States	0.20	0.07	0.21	0.43	0.45
Average value of inheritance or gift received (in average annual income)					
Germany	0.7	0.0	0.4	2.2	5.9
Italy	n/a	n/a	n/a	n/a	n/a
Luxembourg	0.6	0.0	0.5	2.5	2.5
Spain	0.6	0.0	0.4	1.8	4.6
France	0.9	0.1	0.7	2.6	6.1
Australia	n/a	n/a	n/a	n/a	n/a
United Kingdom	0.1	0.0	0.1	0.2	0.4
United States	0.5	0.0	0.3	1.4	4.3
Share of households expecting to receive inheritance 'in the future'					
Germany	0.13	0.07	0.15	0.12	0.13
Italy	n/a	n/a	n/a	n/a	n/a
Luxembourg	0.20	0.13	0.22	0.26	0.25
Spain	n/a	n/a	n/a	n/a	n/a
France	n/a	n/a	n/a	n/a	n/a
Australia	n/a	n/a	n/a	n/a	n/a
United Kingdom	n/a	n/a	n/a	n/a	n/a
United States	0.11	0.10	0.11	0.14	0.19

The HFCS also asks whether the household's main residence has been inherited or received as a gift, and if so for what share. Because the valuation of such a transfer is problematic and

---

[7] We also often know the year the transfer was received and could therefore make a valuation to current values by assuming, e.g., 2.5% percent constant annual return. Unfortunately the prevalence of missing data on the year of the transfer makes this problematic.

because such information is not readily available in the LWS database, we ignore this source of transfer in-kind in our analysis.

Table 5 displays the share of households that report having inherited and the estimated total value thereof for different levels of current net worth. The last panel of the table also report the share of households who *expect* to receive income in the future (although this information is only available for three countries).

The share of households having received inheritance or a substantial gift goes from a low 13% in the UK up to as high as 40% in France. For the other six countries with available data it is in the range of 20-27%. Variations are of similar magnitudes if we consider the mean value of those inheritances, from a low 0.1 year of average annual income in the UK up to 0.9 year of annual income in France. These amounts are low compared to the average values of net worth from Table 1 – 1/60th of average net worth in the UK and 1/7th in France. But of course, these are valued at the time of the transfer whereas net worth is valued at current prices. Unfortunately missing information on the timing of the transfer limits the possibility to convert the nominal value of transfers to current values.

However, an indirect indication that inheritance plays a significant role in building up of wealth is that the share of people receiving inheritance increases with the position of households in the distribution of net worth. The share of people having inherited among the 20% least wealth is much lower than average, from 7% to 18%. On the contrary the share of households having received some transfer among those in the top 5% of the net worth distribution ranges from 45% (in the US or Luxembourg) to 74% in France (the UK is exceptional here with only 19%). The value of inheritance is also much higher among those in the top 5%.

This gradient partly reflects an age effect as older households are more likely to have received inheritance in the past *and* to have accumulated wealth through own savings. Looking at the share of people who *expect* to receive inheritance nevertheless shows that households in the bottom 20% are also less likely to inherit in the future. In the US, those in the top 5% are also substantially more likely to inherit in the future. These numbers suggest that inheritance reinforces inequality in net worth, at least in the tails of the distribution and has implications for intergenerational transmission of inequality.

We now use "Gini recentered influence function" (Gini-RIF) regression to substantiate this claim somewhat more directly; see Firpo et al 2007, 2009 or Choe and Van Kerm, 2014. In a nutshell, Gini-RIF regression is a two-stage procedure. First we calculate the "influence" on the net worth Gini coefficient of each household in our samples as a function of their net worth and of the distribution of net worth in their country – this is the influence function calculation (Hampel et al, 1986). Intuitively, households in the tails of the net worth distribution will tend to have positive influence on inequality – all else equal, more of them will tend to increase the Gini coefficient – whereas households in the middle of the distribution will have negative influence – more of them will tend to reduce the Gini coefficient. In a second stage, we regress

households' Gini influence on the age of the household head and either a dummy for having received inheritance in the past (model 1) or the inverse hyperbolic sine transformation of the total value of the transfers (model 2). The transformation is similar to a log transformation with the key difference that it is defined over zero (and possibly negative) data. A positive coefficient on either of those variables suggests that inheritance increases inequality: that is, households who have received inheritance (or the amount thereof) tend to have net worth levels in the segments of the net worth distribution that have positive influence on the Gini coefficient.

Because the receipt of inheritance is also largely determined by the age of households we add controls for the age of household heads in the regression and also ran separate Gini-RIF regressions 'locally' for different age levels using the age-reweighting described in Section 5. These local regressions thereby capture the influence of inheritance on the *conditional* within cohort Gini coefficients reported in Figure 7. Figure 10 shows the coefficient estimates on the inheritance dummy (model 1) in our Gini-RIF regressions along with estimates of their confidence intervals. The horizontal line gives the coefficient estimate for the overall regressions. Figure 11 shows coefficients on the transformation of the value of transfers received (model 2).

All results consistently point to a *positive* contribution of inheritance towards net worth inequality. The coefficient estimates on the inheritance dummy is positive and significant in all countries at the overall population level. It is almost always positive and often significantly so within age groups too. So this indicates that households who have received inheritance tend to be more concentrated in areas of the net worth distribution that tend to increase inequality, that is, in the tails. This holds true even conditionally on age.

There does not appear to be any systematic relationship between the impact of inheritance and age. Only in the US do we observe a positive age gradient in the impact of inheritance on inequality, from an exceptional negative value among younger households towards positive impacts for older households.

These results are almost the same in model 2, in which we examine the value of inheritance, not just a dummy for receipt.

Of course these exercises remain far from providing proper counterfactuals of what the net worth distribution would be, say, in the absence of inheritances. But the results suggest a positive impact of inheritance, unlike what other approaches have suggested (e.g., Wolff and Gittleman, 2014). All else equal, a marginal increase in inheritance would lead to higher Ginis of net worth.

Figure 10. Gini-RIF regression coefficients on inheritance dummy by age of household head (model 1)
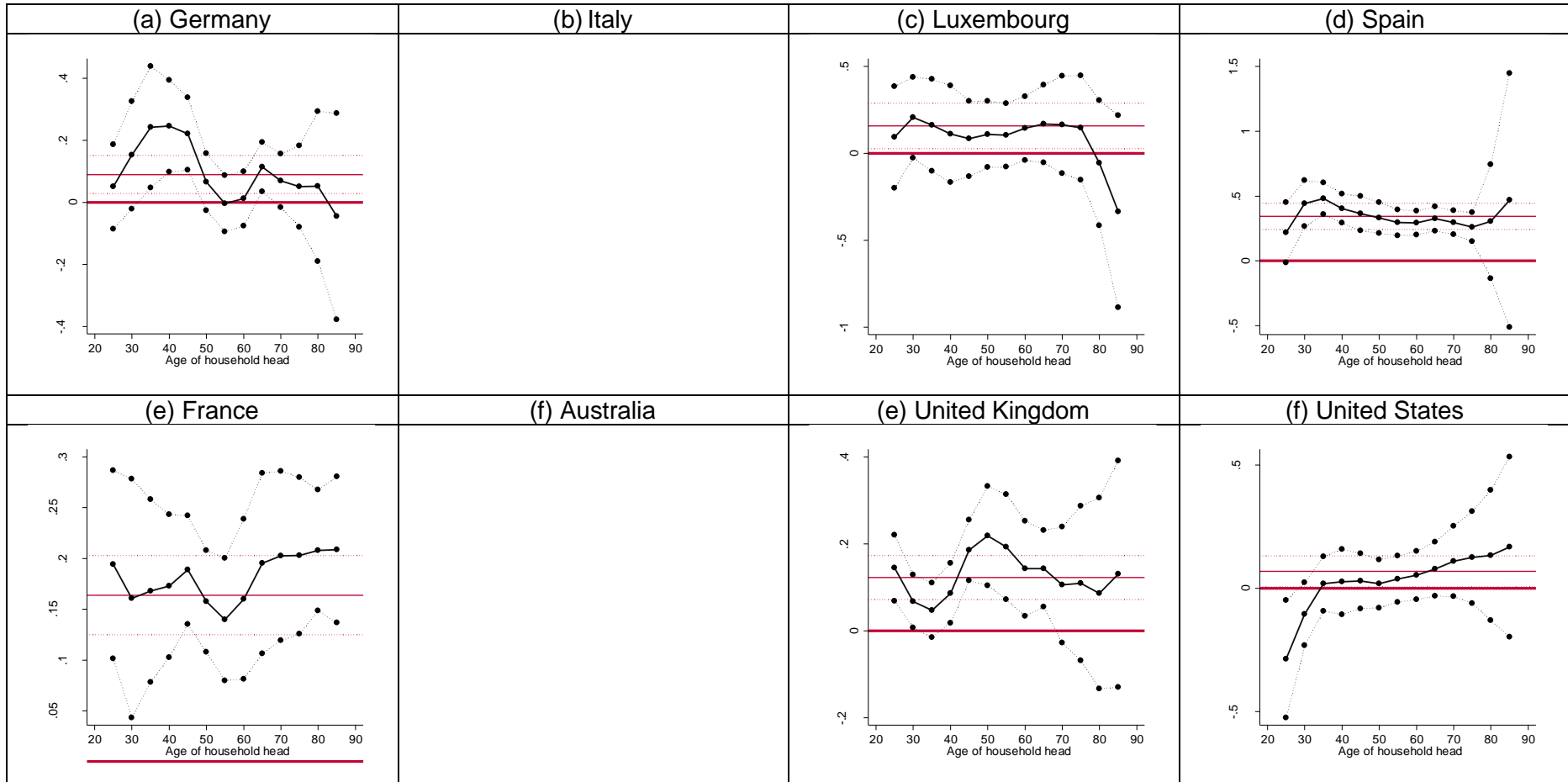
Note: Estimates obtained by kernel smoothing. The horizontal line gives the population coefficients..
Source: Calculations from HFCS and LWS

Figure 11. Gini-RIF regression coefficients on inheritance value by age of household head (model 2)

(a) Germany	(b) Italy	(c) Luxembourg	(d) Spain

(e) France	(f) Australia	(e) United Kingdom	(f) United States

Note: Estimates obtained by kernel smoothing. The horizontal line gives the population median.
Source: Calculations from HFCS and LWS
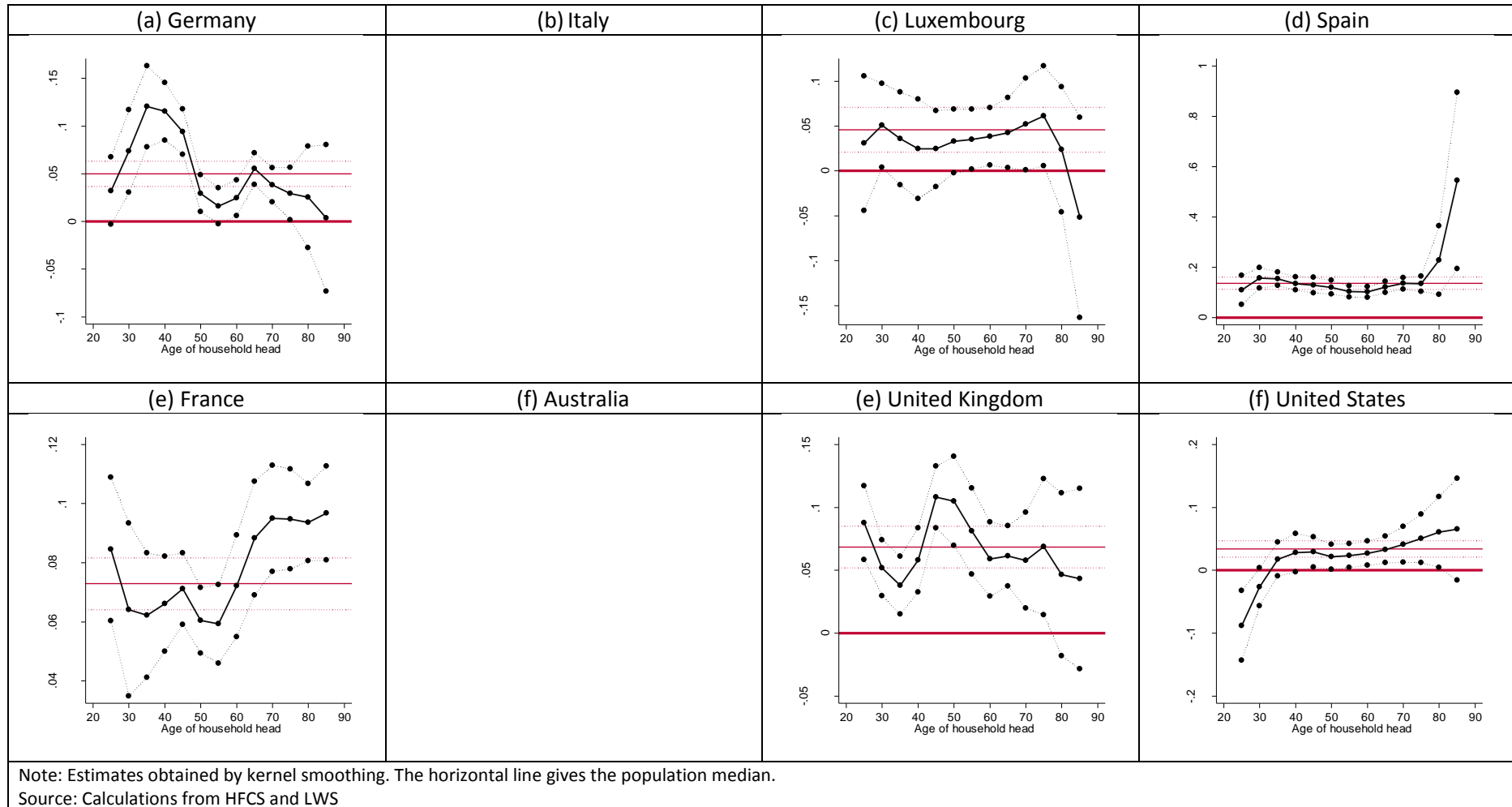
8. Top incomes and wealth inequality

The production of estimates for a wide range of countries of the share of total income going to the top of the income distribution by an international collaborative effort led by Atkinson and Piketty has played a major role in focusing attention on that part of the income distribution. The estimates brought together in the World Top Incomes Database show that dramatic changes have been seen over time (see especially Atkinson and Piketty eds., 2007 and 2010, and Atkinson, Piketty and Saez, 2011). Broadly speaking, a sharp decline in top income shares has been seen across the rich countries through much of the 20th century, with both world wars having a major impact. This reduction in top income shares continued up to around 1980, when it either flattened out or went into reverse depending on the country. The increase since 1980 has been substantial in the English-speaking rich countries, less so in the Nordic and Southern European countries, and very modest or non-existent in continental European countries such as France, Germany, the Netherlands and Switzerland.

The linkages between these trends in top incomes and the distribution of household wealth has received some recent attention but many questions about this relationship remain open. While information on the changing role of income from capital over time is available only for a limited number of countries, for Canada, France, Sweden and the USA a sharp drop in the importance of income from capital was seen around the time of World War II, when a decline in the concentration of wealth was also seen. However, no clear uniform trend across these countries is seen for recent decades: in the USA the importance of capital incomes appears to have declined whereas in France and Sweden it increased and for Canada no clear trend is discerned (Roine and Waldenstrom, 2015). Whereas top incomes a century ago were dominated by income from capital and much of the decline in their share was associated with declines in income from that source, in recent decades the upturn in top income shares has been mainly due to increased earnings in the UK and the US, but with income from capital also contributing. Capital gains are important in this context but very difficult to trace, but realised capital gains do appear to have become more important in the USA and Sweden where they have been the subject of particular study (see for example Armour, Burkhauser and Larrimore, 2013, and Roine and Waldenstrom, 2012).

The explanations advanced for the evolution of top income shares in recent decades have often focused strongly on skill-biased technical change and globalisation, changing executive compensation and 'superstar' effects, in contrast to the emphasis on wealth shocks and redistributive taxation in accounting for the decline in top shares over the previous 70 years. The interplay with wealth, and the role of taxation of income and wealth (including capital gains), clearly needs to be better understood. The difficulties in doing so arise in the first place from the nature of the data available: the data underlying the top incomes estimates are for the most part drawn from administrative data arising from income tax systems, which may not be readily aligned with data on incomes for the entire distribution from household

surveys, much less with data on wealth from similar household surveys or administrative sources. The World Top Income Database has recently been extended to go beyond income and include series on wealth-income ratios and the distribution of wealth, as well as the different forms of capital assets, and renamed the Wealth and Income Database (see http://www.wid.world/#Home). This will facilitate the analysis of long-term trends in both income and wealth distributions, but needs to be complemented by efforts to study these distributions jointly.

The data sources we are employing here provide an interesting comparative window on this joint distribution of wealth and income, allowing the role of income from capital in the income distribution to be studied alongside the distribution of the assets giving rise to such income. What we can do is subject to the major limitation that the household surveys involved would not be expected to reliably capture the very top of the income distribution – the top 1% which has been the subject of so much attention. It is also limited in the sense that we are studying a cross-sectional picture and cannot capture dynamics over time directly. However, the analysis of up-to-date data for a set of rich countries covering both wealth and income can be illuminating, keeping in mind the points made earlier about the coverage and reliability of the data on wealth.

Table 6: Net Wealth to income ratios by income category by country

Income category	Germany	Spain	France	Italy	Luxembourg	Australia	UK	USA
Bottom 20%	5.2	24.3	9.5	17.0	17.7	32.8	18.5	11.2
Between 20-90%	4.2	9.2	5.6	7.5	8.0	6.4	6.1	4.7
Between 90-95%	4.2	8.5	6.4	7.8	6.3	5.2	5.0	6.0
95% or greater	5.6	8.8	8.5	9.4	10.2	7.3	5.4	9.2
All	4.5	9.3	6.3	8.0	8.5	6.8	6.0	6.4

We saw earlier the extent of cross-country variation when average net worth is expressed in terms of years of average household income: this went from a low of 4.5 years in Germany to between 6 and 7 years in France, Australia, the UK and the USA, about 8 years in Italy and Luxembourg, and as high as 9.3 in Spain. We look in Table 6 at how these ratios vary across the income distribution, with the mean net wealth of the households in different parts of the distribution expressed as a ratio of the mean annual income of that set of households. We see that in each country this ratio is higher for the bottom quintile and top 5% of the distribution than for households between the 20% and 95% percentile. The relatively high ratio for the bottom reflects the fact that mean net wealth is often as high or higher than for those between the 20% and 90% percentile, largely due to the value of own residences, and is being expressed as a ratio of the much lower mean incomes of the bottom quintile. Focusing on the top 5% of the income distribution, we see that Spain is distinctive in its relatively high wealth/income ratios across the rest of the distribution but not at the top. For the top 5%, Germany is still at the lower end with a net wealth/mean income ratio of about

5.5 for the top 5%, but so is the UK. Australia is next at 7.3, but Spain is now similar to France at about 8.5 while Italy, Luxembourg and the USA have ratios over 9.

These wealth/income ratios must of course be interpreted in light of the underlying distribution of income and the varying extent across countries to which income is itself concentrated at the top. As Table 4 brings out, mean income for the top 5% is generally about 4 times the mean income across all households, with Italy and Australia having slightly lower figures and Luxembourg and the UK slightly higher; the USA is a striking outlier in that regard, however, with mean income of the top 5% being 6.7 times the overall mean. So if one expresses the mean net worth of the top 5% as a ratio of mean income across all households rather than mean income for that top group, the picture looks quite different. The mean net worth of the top 5% represents about 22 years of income for the average household in Germany or the UK, 27 years for Australia, about 35 years in Spain, France and Italy, 43 years in Luxembourg, and strikingly over 60 years in the USA.

Table 7: Net Wealth to income and ratios

top 5% by income	Germany	Spain	France	Italy	Luxembourg	Australia	UK	USA
mean NW/top 5% mean income	5.6	8.8	8.5	9.4	10.2	7.3	5.4	9.2
mean income/ overall mean income	4.0	4.1	3.9	3.7	4.2	3.8	4.3	6.7
mean NW/overall mean income	22.3	35.8	33.5	34.8	43.2	27.3	23.0	61.3

The composition of the wealth held by those towards the top of the income distribution is distinctive, though rather less so than if one ranks households by wealth and examines top wealth-holders as we did earlier. The value of the main residence generally accounts for only 25-30% of total gross assets; the outliers in this respect are the UK at one extreme, where it comprises 40%, and the USA at the other where it is only 17% of the total. The USA is distinctive in the share made up of financial assets, which is over 40%, whereas in the other countries that figure is generally about 20-25% (except in Luxembourg where it is only about 10%, with other real assets making up an exceptionally large share there). Outstanding debt represents 10% or below of gross assets for the top 5% in most of the countries, including the USA, but in Australia and the UK that figure is closer to 15%.

The extent to which the net wealth of the top 5% (by income) is reflected in their incomes merits examination. The income generated from these wealth holdings takes the form of interest and dividends earned from financial assets, together with rent on property. (Note that imputed rent for owner-occupied housing, which reflects the benefits from ownership of one's principal residence, could also be included in principle but is not available in the data being used here). The top 5% receives a considerably higher proportion of its income in the form of interest and dividends than other households: as a percentage of mean gross household income, this varies from about 3% in Spain and Luxembourg up to 5% in Germany and Italy

and 8-9% in Australia, the UK and the USA. This is generally about twice the corresponding percentage for the households between the 90-95 percentiles, except in the UK where the latter group also receives about 8% of its income in this form. Rent accounts for a widely varying percentage of total income for the top 5% across these countries, and is not separately identified in the data we are using for the USA.

Relating the flow of income from interest and dividends to the underlying stock of financial assets reported by these households, this flow represents 3-4% of the stock for most of the countries covered, but less than 2% in the case of the USA. As Table 8 shows, this 'return' is generally higher than the corresponding figures calculated for households between the 90-95th percentiles, although the UK is an exception in that respect; the return for the latter income group is even lower in the USA than was the case for the top 5%.

Table 8: Interest and dividends as % of financial assets by income category by country

Income category	Germany	Spain	France	Italy	Luxembourg	Australia	UK	USA
Between 90-95%	2.7	1.8	6.1	1.3	2.0	2.7	5.5	0.8
95% or greater	3.8	3.1	8.4	1.7	2.6	3.6	4.4	1.7

9. Conclusion

This chapter draws on recently collected cross-nationally comparable survey data on household wealth to present international comparative evidence on the distribution of household net worth. Notably, this is one of the very first studies to exploit the new release of the Luxembourg Wealth Study database available since May 2016 from the LIS Cross-National Data Center in Luxembourg and the opportunity to combine data from LWS and from the Household Finance and Consumption Survey.

The countries examined differ in institutional settings such as public pension schemes and generosity, public provision of health insurance, or private costs of higher education which influence incentives for private wealth accumulation in order to finance future consumption, or as an insurance against future adverse shocks. They also differ in the tax treatment of assets and liabilities, such as for tax rebates on interest payments on mortgages, for taxes on the imputed rent of owner-occupied housing, for tax deductibility of private pension plans, as well as in terms of direct taxation of wealth or of bequests. The housing market is another source of heterogeneity across countries. One striking feature from examination of our data is however that, in spite of these differences, there is much similarity in many facets of the distribution of net worth across countries, at least from a high level perspective. The

composition and levels of assets and liabilities (when expressed in terms of average incomes) are generally similar, as is their distribution.

There is often one exception however. Of all countries examined, the United States is the one that stands out in several respects. (One may always be suspicious that data quality is what makes the US net worth distribution look different, a potential ironic consequence of the high quality of the US data on wealth, in particular its capacity to cover the very rich more satisfactorily). Germany, with low values for real estate (and housing wealth) tends to have low levels of net worth *and* a quite unequal distribution thereof. Finally the similarity of the UK and France in many aspects that we examined is noteworthy and merits further investigation, given the differences in underlying economic structures and performance, in trends in income inequality, and in taxation of wealth and wealth transfers.

The increasing availability of harmonized sources to measure household wealth is not only good news in facilitating comparative studies, but also in enhancing the capacity to elucidate the very concept of wealth. In this chapter, we have explored the consequences of extending the definition of net worth, by including pension wealth, for some measures of wealth inequality. The motivation to include pension wealth is that the present value of private and public pension streams are sizeable and may have important incentive effects on saving behaviour along the life-cycle. Our results show a much lower level of wealth inequality when pension wealth is included in net worth. There are also important differences in the equalizing effects of pensions across countries, but the exploratory analysis seems to confirm that countries spending more on pensions also reduce wealth inequality by more.

Introducing pension wealth into net worth is just one of the avenues that it is important to pursue in extending the concept of household wealth. Other priorities include, for example, the correction of prices for housing assets, though these options need more detailed data that is not always at one's disposal when comparative studies are carried-out. The estimation of public pension wealth in a comparative fashion can also shed some light on the implications of the so-called 'hidden liability' of unfunded public pension systems and motivate policy discussion by relating this to the power of public pensions to equalize wealth holdings in the society.

Our analysis has also been able to cast some light on patterns of inheritance and their role in wealth accumulation, though this is once again a priority for further investigation. The share of households reporting receipt of an inheritance or substantial gift went from a low of 13% (in the UK) up to as high as 40% (in France), with similar variation in the mean value of those inheritances. The share of households having received some transfer, and the mean value of the transfer, was well above average for those in the top 5% of the net worth distribution. The frequency of missing information in the surveys on the timing of the receipt of the transfer constrains one's ability to apply a rate of return and estimate the contribution transfers may have made to the current stock of wealth, but this merits further analysis with some imputation approaches perhaps worth considering.

Finally, the question of the relationship between wealth and top incomes, on which we also touched, is an extremely important one. We saw that for the top 5% of the income distribution, the net wealth/mean income ratio ranges from 5.5 (for Spain and the UK) up to over 9 for Italy, Luxembourg and the USA; the US figure relates to a mean income level that is itself exceptionally high relative to the overall average income, so the mean net worth of the top 5% represents over 60 years of income for the average household there. We saw that the composition of the wealth held by those towards the top of the income distribution is distinctive, though rather less so than if one ranks households by wealth itself. The USA is distinctive in the share of the wealth of high-income households made up of financial assets, which is over 40%, whereas in the other countries that figure is generally about 20-25%. The top 5% receives a considerably higher proportion of its income in the form of interest and dividends than other households: as a percentage of mean gross household income, ranging from about 3% in Spain and Luxembourg up to 5% in Germany and Italy and 8-9% in Australia, the UK and the USA. This flow represents 3-4% of the underlying stock of financial assets reported by these households for most of the countries covered (although that figure is less than 2% in the case of the USA); this is generally higher than the corresponding 'return' even for households between the 90-95th percentiles. The dynamic interactions between increasing top income shares and the concentration of wealth and income from it towards the top is a critically-important topic for further analysis, with the joint analysis of data from household surveys and administrative/tax sources representing one fruitful strategy to employ.

References

Alessie, R., Angelini, V., van Santen, P. (2013) Pension wealth and household savings in Europe: evidence from SHARELIFE. European Economic Review 63, 308-328.

Almas, I. and Mogstad, M. (2012) Older or wealthier? The impact of age adjustment on wealth inequality. *Scandinavian Journal of Economics* 114: 24–54.

Atkinson, A. B. (1974) *Unequal Shares: Wealth in Britain*, Penguin Books, Harmondsworth, UK.

Atkinson, A. B. and Harrison, A. J. (1978) *Distribution of Personal Wealth in Britain*, Cambridge University Press, Cambridge UK

Banks, J., Emmerson, C., Tetlow, G. (2005) Estimating Pension Wealth of ELSA Respondents. Institute for Fiscal Studies and University College London, WP05/09.

Bastagli, F. and J. Hills (2013). Wealth accumulation, ageing and house prices. In J. Hills, F. Bastagli, F. Cowell, H. Glennerster, E. Karagiannaki, and A. McKnight (Eds.), Wealth in the UK: Distribution, Accumulation, and Policy. Oxford: Oxford University Press.

Benhabib, J. Bisin, A. (2016) Skewed Wealth Distributions: Theory and Empirics. NBER Working Paper No. 21924.

Bissonnette, L., Hurd, M.D., Michaud, P.C. (2014) Individual survival curves comparing subjective and observed mortality risks. IZA Discussion Papers 8658.

Boserup. S.H., Kopczuk, W., Kreiner, C.T. (2016) The role of bequests in shaping wealth inequality: evidence from Danish wealth records. NBER Working Paper No. 21896. Forthcoming in: the American Economic Review: Papers and Proceedings.

Bover, O. (2010) (2010). Wealth inequality and household structure: U.S. versus Spain. *Review of Income and Wealth 56*(2), 259–290.

Castaneda, A., Diaz-Gimenez, J. and Rios-Rull, J.V. (2003) Accounting for the US earnings and wealth inequality. Journal of political economy 111(4), 818-857.

Choe, C. and Van Kerm, P. (2014), Foreign Workers and the Wage Distribution: Where Do They Fit in? Luxembourg Institute of Socio-Economic Research Working Paper Series 2014-02, Esch/Alzette, Luxembourg.

Cigno A., Pestieau P., Reesz, Z.R. (2011) Introduction to the symposium on taxation and the family. CESifo Economic Studies 57(2), 203-215.

Cowell, F. and Van Kerm, P. (2015), Wealth Inequality: A Survey, Journal of Economic Surveys, 29(4), 671-710.

Crawford, R., Hood, A. (2016) Lifetime Receipt of Inheritances and the Distribution of Wealth in England. Fiscal Studies 37(1), 55-75.

Cremer H., Pestieau, P. (2011) The Tax Treatment of Intergenerational Wealth Transfers. CESifo Economic Studies 57(2), 365-401.

Davies, J. B. (2009). Wealth and economic inequality. In W. Salverda, N. B., and T. M. Smeeding (Eds.), *The Oxford Handbook of Economic Inequality*, Chapter 6. Oxford University Press.

De Nardi, M. (2004) Wealth Inequality and Intergenerational Links. Review of Economic Studies 71, 743-68.

Engelhardt, G., Kumar, A. (2011) Pensions and household wealth accumulation. Journal of Human Resources 46(1), 203-236.

European Central Bank (2013) The eurosystem household finance and consumption survey: Results from the first wave. Statistics Paper Series 2, European Central Bank, Frankfurt am Main, Germany

Feldstein, M. (1974) Social security, induced retirement, and aggregate capital accumulation. Journal of Political Economy 82(5), 905-26.

Feldstein, M. (1976) Social Security and the distribution of wealth. Journal of the American Statistical Association, 71 (356), 800-807.

Firpo, S., Fortin, N. M. and Lemieux, T. (2007), Unconditional quantile regressions, Technical Working Paper 339, National Bureau of Economic Research, Cambridge MA, USA.

Firpo, S., Fortin, N. M. and Lemieux, T. (2009), 'Unconditional quantile regressions', *Econometrica* 77(3), 953–973.

Frick, J.R., Grabka, M.M. (2013) Wealth Inequality and the Importance of Public Pension Entitlements. In: Gornick, J.C., Jantti, M. (Eds.) Income Inequality: Economic Disparities and the Middle Class in Affluent Countries. Stanford University Press.

Gale, W.G., Perozek, M.G. (2001) Do estate taxes reduce saving? Rethinking Estate and Gift Taxation. Brookings Institute.

Gan, L., Gong, G., Hurd, M., McFadden, D. (2015) Subjective mortality risk and bequests. Journal of Econometrics 188, 514-525.

Gokhale, J., Kotlikoff, L.J., Sefton, J., Weale, M. (2001) Simulating the transmission of wealth in equality via bequests. Journal of Public Economics 79, 93-128.

Gokhale, J., Kotlikoff, L.J. (2002) Simulating the Transmission of Wealth Inequality. The American Economic Review 92(2), 265-269, Papers and Proceedings of the One Hundred Fourteenth Annual Meeting of the American Economic Association.

Hampel, F.R., Ronchetti, E.M., Rousseeuw, P.J. and Stahel,W.A. (1986) *Robust Statistics: The Approach Based on Influence Functions*. New York: John Wiley.

Hendricks, L. (2007) Retirement and lifetime earnings. International Economic Review 48(2), 421-456. HFCS (2014)

Household finance and consumption survey. Statistical micro-level database, European Central Bank, Frankfurt am Main, Germany, https://www.ecb.europa.eu/home/html/researcher_hfcn.en.html. Accessed June 2, 2015.

Huggett, M. (1996) Wealth distribution in life-cycle economies. Journal of Monetary Economics 38, 469-494.

Jäntti, M., E. Sierminska, and P. Van Kerm (2013). The joint distribution of income and wealth. In J. C. Gornick and M. Jäntti (Eds.), *Income Inequality: Economic Disparities and the Middle Class in Affluent Countries*, Chapter 11. Palo Alto, California: Stanford University Press.

Jäntti, M., Sierminska, E. and Van Kerm, P. (2015) Modelling the Joint Distribution of Income and Wealth, in *Research on Economic* Inequality, vol.23, Emerald Publishing, pp. 301-327.

Laitner, J. (2002) Wealth Inequality and Altruistic Bequests. The American Economic Review 92(2), 270-273.

LIS Cross-National Data Center in Luxembourg (2016), The LWS database: User guide, http://www.lisdatacenter/org/.

Marx, I., Nolan, B., Olivera, J. (2015) The welfare state and anti-poverty policy in rich countries. In: Atkinson, A.B., Bourguignon, F. (Eds.) Handbook of Income Distribution, Elsevier, pp. 2063-2140.

Miller, R. K and McNamee, S. J. (1997) *Inheritance and Wealth in America*, Plenum Press, New York

Nishiyama, S. (2002) Bequests, inter vivos transfers, and wealth distribution. Review of Economic Dynamics 5(4), 892–931. OECD (2013).

OECD Framework for Statistics on the Distribution of Household Income, Consumption and Wealth. OECD publishing, Organisation for Economic Cooperation and Development, http://www.oecd.org/statistics/302013041e.pdf.

Paglin, M. (1975) The measurement and trend of inequality: A basic revision. American Economic Review 65: 598–609.

Peracchi, F., Perotti, V. (2014) Subjective survival probabilities and life tables: Evidence from Europe, 2014 Living to 100 Monograph, Society of Actuaries.

Revell, J. (1967) *The Wealth of the Nation*. The National Balance Sheet of the United Kingdom, 1957 -1961, Cambridge University Press, Cambridge.

Sierminska, E., A. Brandolini, and T. M. Smeeding (2006). The Luxembourg Wealth Study - a cross-country comparable database for household wealth research. *Journal of Economic Inequality 4*, 375–383.

Sierminska, E., Brandolini, A. and Smeeding, T.M. (2008) Comparing wealth distribution accross rich countries: First results from the Luxembourg Wealth Study. In Household Wealth in Italy. Rome: Banca d'Italia.

Sierminska, E. and Smeeding, T. (2005) Measurement issues in wealth: Equivalence scales, accounting framework, and reference unit. "Construction and usage of comparable microdata on wealth: the LWS" workshop paper, LWS, Perugia, Italy.

Vermeulen, P. (2014). How fat is the top tail of the wealth distribution? Working Paper Series European Central Bank No. 1692 / July 2014.

Wolff, E. N. (1995) *Top Heavy: A study of the increasing inequality of wealth in America*, 20th Century Fund Press, New York

Wolff, E.N. (2007) The retirement wealth of the baby boom generation. Journal of Monetary Economics 54, 1-40.

Wolff, E. N. (2012). The asset price meltdown and the wealth of the middle class. Working Paper 18559, National Bureau of Economic Research.

Wolff, E.N. (2015) U.S. pensions in the 2000s: the lost decade? Review of Income and Wealth 61(4).

Wolff, E.N., Gittleman, M. (2014) Inheritances and the distribution of wealth or whatever happened to the great inheritance boom? The Journal of Economic Inequality 12(4), 439-468.