Chapter 7

Analytic measures

This chapter considers ways in which the usefulness of micro-level data on household wealth produced using the sources and methods discussed in Chapters 4 and 6 can be maximised through statistical analysis and presentation. The discussion covers a range of analytic measures that can be derived from the basic data. Empirical examples are provided where appropriate.

The chapter discusses the importance of considering a life-cycle perspective when analysing wealth statistics, followed by a consideration of units of analysis. It then presents basic measures such as means and medians, and tools to analyse distributions, such as frequency distributions, quantile measures, Lorenz curves, Gini coefficients and other inequality measures, ratios and percentage shares. In addition, the chapter provides suggestions on adjusting for price differences over time and across geographical areas. Finally, it provides a list of wealth indicators that can be used for international comparisons.

7.1. Life-cycle perspective and analysis by population subgroups

A life-cycle perspective is particularly important when analysing wealth data. Young individuals at the beginning of their working careers tend to have low (or negative) levels of wealth. As they grow older, they save and accumulate wealth, creating a stock that can be drawn upon during retirement. As a result, older households, near retirement, are expected to have wealth levels close to the maximum of their life-time wealth. As they enter retirement, individuals begin decumulation and use up some of their wealth in order to supplement their income and maintain their desired level of consumption. At some point during their life, inheritance may be passed on to them, increasing their stock of wealth.

Given the various roles that wealth can play, household-level data allow for an examination of a wide range of topics that are of interest to researchers, central bankers and policy-makers, such as studying the wealth effect on consumption, housing indebtedness, housing prices, retirement income and pension reforms, access to credit and credit constraints, financial innovation, consumption smoothing, household portfolio choice, and wealth inequality. Micro data on wealth make it possible to evaluate the impact of policies and changes in institutional arrangements, and allow for a better understanding of the effect of shocks on macroeconomic variables, hence providing important information for monetary policy and financial stability.

Analysing the behaviour of population sub-groups can also be very important. Having adequate data allows analysts to perform a variety of tasks, including identifying vulnerable groups such as those that are asset (and income) poor, assessing the adequacy of retirement portfolios, and gaining a better understanding of the onset of a crisis or of its impact on economic well-being. Aggregate statistics can also be affected by changes in the distribution of wealth, as the consumption, saving and investment behaviour of households differs substantially across wealth levels and population groups. For example, the 1% of households in the United States with the most wealth hold more than one-third of total wealth, implying that changes in their portfolios can exert significant effects on aggregate statistics. Another population sub-group that holds a large share of household wealth is the elderly, whose behaviour can also drive changes in the aggregate statistics.

7.2. Unit of analysis

Chapter 3 makes recommendations on the unit of analysis and identifies the household as the preferred unit for wealth statistics. Although it is usual practice to produce micro statistics on the distribution of income and consumption by individual as well as by household unit, micro statistics on the distribution of wealth are usually produced only for household units. However, some particular types of wealth analysis may target individual persons, since the intra-household distribution of resources can be very unequal and average household size and composition vary considerably, particularly between population sub-groups and across countries.[1]

To produce statistics pertaining to individuals as the unit of analysis, wealth estimates for households need to be adjusted in a way that reflects the differences in household size and composition and the economies that arise from the sharing of resources. For some types of analysis, adjustments of this kind can be calculated using adjustment factors determined by an equivalence scale. The use of equivalence scales for wealth statistics is discussed later in this chapter.

When analysing people, each person should be attributed the characteristics of the household to which they belong. Based on this assumption, household wealth can be presented for the household or reweighted so that it represents the number of individuals instead of the number of households. These latter are sometimes known as person-weighted estimates, because the unit of analysis is now the person. When person-weighted estimates are compiled, the weight in the distribution of each person in a household is the same, whatever the size of the household to which they belong. Further information on weighting methodologies is provided in Chapter 3.

The distinctions mentioned above allow for different type of analyses, such as wealth distribution across different types of households and geographic areas; changes in wealth levels and distributions over time; differences in the level and composition of assets and liabilities of households with different characteristics; the number and characteristics of households holding particular types of wealth; joint patterns of income and wealth inequality; and studies of household economic well-being.

7.3. Specific analytic measures and their use

This section describes those analytic measures that are most commonly used in countries that produce micro statistics on household wealth. For each measure, the section discusses the issues that need to be considered in deriving and presenting it, including its usefulness and limitations. The importance and implications of negative wealth holdings for the summary measures are also discussed. Much of the content of this section draws on Chapter 6 of the *2011 Canberra Group Handbook on Household Income Statistics*.

The discussion that follows takes into account the conceptual framework for micro statistics on household wealth presented in Chapter 3 to characterise the level of composition and distribution of wealth. It should also be noted that wealth consists of several components, some of which augment the level of wealth (assets) and some of which diminish it (liabilities). Consequently, the specific characteristics of wealth data are somewhat different than for income data. Some components of wealth (i.e. assets) are always non-negative, but aggregate net worth is likely to be zero or negative more commonly than is the case for income. These and other wealth data characteristics will affect some of the measures traditionally used for analysing household income.

7.3.1. Means and medians

Estimates of wealth and its components are often summarised in the form of mean or median measures, such as the mean or median household net worth for different types of households.

The mean is frequently used to measure *wealth levels*. The arithmetic mean, or average, is defined as the sum of all components divided by the number of observations. Advantages of the mean are that it is easy to calculate and interpret, and that the means of the different components of wealth will sum to the mean of total wealth. Its main drawbacks are its sensitivity to outliers and to asymmetry of the distribution, both of which are common characteristics of the wealth distribution.

The mean value of a data item is usually calculated by selecting all the survey records for the population of interest, multiplying the value of the data item in each record by the weight of the record, summing the resulting products, and then dividing the total by the sum of the weights of the records. For example, the mean net worth of a particular sub-group of households is the weighted sum of net worth of each household belonging to the group considered divided by the sum of the corresponding weights.

For some purposes, the mean for a household variable may be required with respect to all people in a population group, including children. Such measures are referred to as person-weighted measures. Person-weighted means are obtained by multiplying the data item of interest for each household by the number of people in the household (including children) and by the weight of the household, summing across all households and then dividing by the estimated number of people in the population group.

An alternative measure of the central tendency is the *median*. Compared to the mean, the median is more stable and robust and is less affected by values at the lower and upper extremes of the distribution and by sample fluctuations that may occur between two observation points. It is therefore often preferred to the mean as an indicator of a typical level of wealth for the whole population.[2]

For wealth analysis, the median is often provided alongside the mean (Table 7.1). The difference between the mean and the median is a simple measure of wealth inequality. In most countries, the mean (average) household wealth will be higher than the median household wealth, reflecting the usual situation that most households have low wealth compared to the mean and a smaller number of households have wealth above the mean. The greater the asymmetry, the greater the degree of inequality is likely to be. However, this is not always the case, as a symmetrical distribution could contain great inequality if it has very long tails in both directions.

Table 7.1. **Mean, median and mean of the median person wealth in the United States, 2007**

US dollars

Mean	Median	Mean of median person (inter-quartile mean)	Difference (mean less median)
556 846	120 780	383 490	436 066

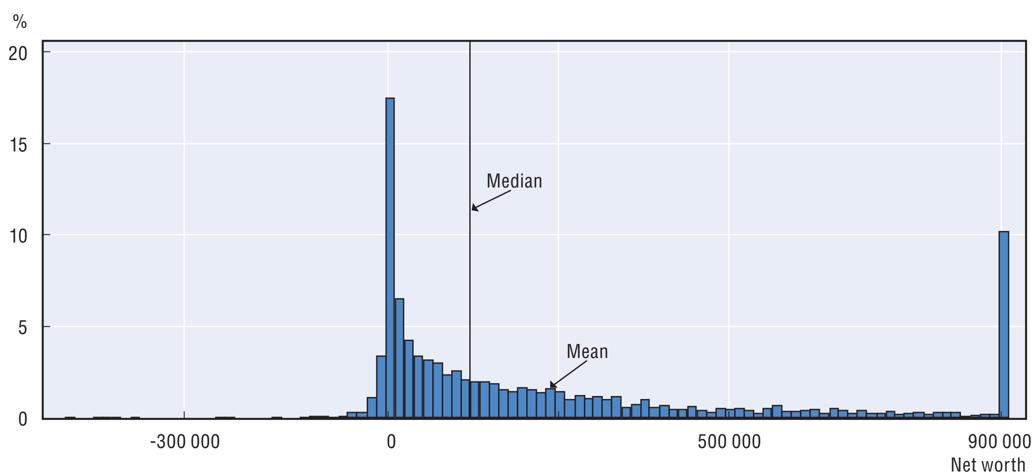
Note: The mean median person is a group defined as being between the 25th and 75th percentile of the wealth distribution.
Source: 2007 Survey of Consumer Finances.

A mean value can also be derived after discarding the upper and lower extremes of the population, giving what is sometimes called the mean of the median person. One example is the inter-quartile mean, which is the mean of the values lying between the first and third quartiles of the population.

7.3.2. Frequency distributions

In order to get a basic idea of the distribution of wealth across the population, the frequency diagram (histogram) can be used to illustrate the location and spread of the distribution. This is particularly important for wealth variables in order to identify extreme values. The frequency diagram is often accompanied by estimates of the mean and median, and it can throw light on the situation at the bottom of the distribution (important for poverty analysis) as well as at the top (which is important for wealth concentration). In Figure 7.1, the population has been grouped into "bins" by the size of wealth, with the vertical axis showing the proportion of people in each net worth range in the United States. The top 10% of households has been recorded to the value at the 90th percentile. Figure 7.1 highlights some of the distinct features of wealth distributions: the presence of negative values, the spike at zero, the asymmetry or skewness of the distribution.

Figure 7.1. **Distribution of net worth in the United States, 2007**

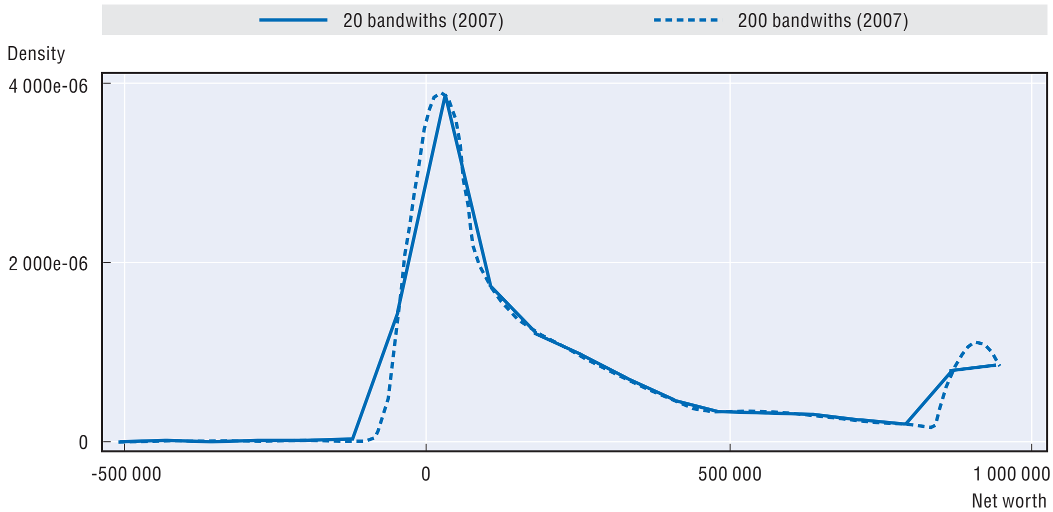


Source: 2007 Survey of Consumer Finances.

The distribution is also asymmetrical, with a small number of units having relatively high net worth and a larger number of units having relatively low wealth with a few having negative values. The greater the asymmetry, the greater the difference between the mean and median values (as shown by the fourth column of Table 7.1).

The problem with frequency distributions (or kernel density estimates) is that the shape is determined by an arbitrary assumption about the optimal number of bins (or bandwidth in the case of kernel density estimates). Although the shape theoretically should not be relevant, it does influence how people interpret the results. Using the same US data used for Figure 7.1, Figure 7.2 shows kernel estimates for 20 and 200 bandwidths. The dashed line indicates a larger clustering around zero, while the solid line shows a clustering around small values of wealth. These two presentations can alter the type of conclusion one can reach regarding the distribution of wealth among low-wealth households.

Figure 7.2. **Kernel density estimates of net worth in the United States**



Source: 2007 Survey of Consumer Finances.

Kernel density estimation is a non-parametric way of estimating the probability density *f(x)* of a random variable, in this case wealth. This function is estimated as follows:

$$\tilde{f}(x) = \frac{1}{nh}\sum_{i=1}^{n} K(\frac{x - x_i}{h})$$

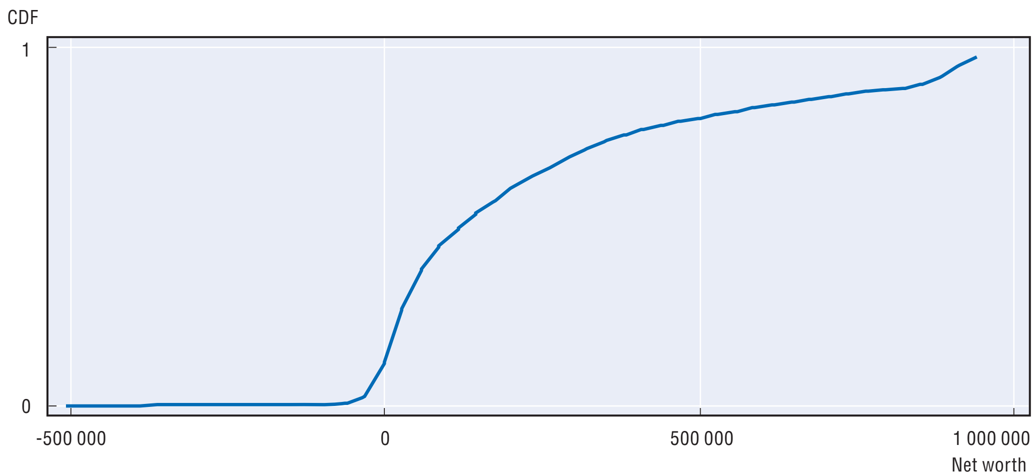
where *K(.)* is the kernel function.

There are many choices for these functions (Deaton, 2000; Pagan and Ullah, 1999), although the literature indicates that choice of the kernel function is not a critical one. The choice of the bandwidth is more important. A large bandwidth will provide a smoother estimate but risks biasing the distribution by bringing observations from other parts of the density, while a small bandwidth allows readers to pick specific features of the underlying density but risks producing an unnecessarily variable plot. Hence, kernel density methods can be used to smooth raw observations into an estimated density, with the bandwidth controlling how much smoothing is done.[3]

7.3.3. Distribution function

In order to look at the distribution of assets or liabilities, or to compare net worth for different countries or groups, another mode of presentation, which does not require making a decision regarding the number of bins, is to use the *cumulative distribution function* (CDF). The CDF describes the probability (shown on the vertical axis) that the variable of interest (e.g. wealth levels, shown on the horizontal axis) will have a value of X or lower. In this case, one can ascertain the relevant percents by looking at differences in percentile points on the y-axis for a given interval – as the probability that X lies in the *interval* (*a*, *b*), where $a < b$ is defined $P(a < X \le b) = F_X(b) - F_X(a)$. Figure 7.3 presents the same US data as shown in previous figures. It highlights the low share of negative outliers, a sharp increase in the share of households with wealth values around 0, and the spike in the shares of the distribution at the top, reflecting the top coding of the last 10% of the population.

Figure 7.3. **Cumulative distribution function for household wealth in the United States, 2007**



Source: 2007 Survey of Consumer Finances.

7.3.4. Quantile measures

Another approach used in income analysis that can be applied to wealth data is based on a ranking of the units of analysis from the lowest to the highest, then dividing them into equally sized groups and finally calculating the shares of wealth accruing to a given proportion of the units (e.g. household or persons). The generic term for such groups is *quantiles*. When the population is divided into four equally sized groups, the quantiles are called quartiles; if there are 5 groups, they are called quintiles, if there are 10 groups they are called deciles, and 100 groups gives percentiles. Thus the first quintile will comprise the first two deciles and the first 20 percentiles.

In some analyses, the statistic of interest may be a particular percentile point, i.e. the boundary between two quantiles. The latter is usually expressed in terms of the upper value of a particular percentile. For example, the upper value of the first quintile is also the upper value of the 20th percentile and is usually denoted as P20. The upper value of the ninth decile is denoted as P90. The median of a whole population is denoted as P50, which is also the median of the third quintile, while the median of the first quintile is denoted as P10, etc.

Percentile ratios

Ratios of percentile points may be used to summarise the relative distance between two points on the distribution. The full spread of the wealth distribution is given by the difference in the upper and lower values, but such measures are likely to be unstable when the tails of the distribution are thin. If net wealth is negative or zero at the chosen lower value, the measures may be difficult to interpret or even undefined. Statistics such as the P90/P10 ratio or the P80/P20 ratio may provide a more robust indication of spread. In some situations, other indications of the spread, such as the P90/P20 ratio, may be appropriate. Other common ratios relate the extremes of the distribution to the midpoint or median (e.g. P80/P50, P50/P20). All these measure will provide meaningful results only if the asset of interest is held at those percentiles.

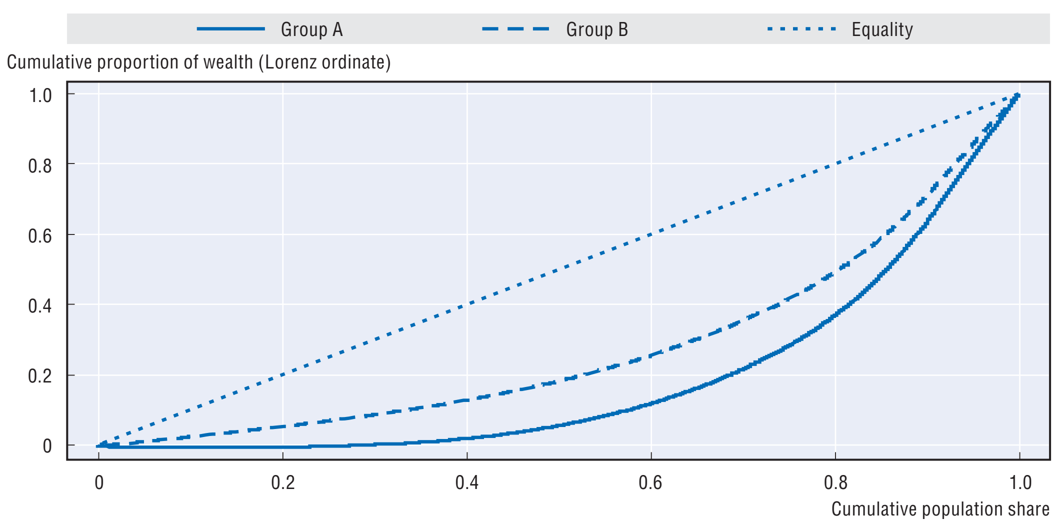
Wealth shares

As mentioned above, focusing attention on the top of the distribution is necessary to capture the majority of wealth held by households. Simple descriptions can be made by calculating the shares of total wealth held by the richest 1%, 5% or 10% of the population. In this case, the aggregate wealth of the units in each quantile is divided by the overall wealth of the entire population to derive wealth shares. Reporting wealth shares held by the richest 1%, 5% and 10% is the inverse of reporting ordinates of the Lorenz curve, in this case the shares of the poorest 99%, 95% and 90% respectively. Table 7.7 provides an example of top shares.

7.3.5. Lorenz curve

Another graphical tool used to describe income inequality that can also be applied to wealth data is the Lorenz curve. The Lorenz curve is a graph with the horizontal axis showing the cumulative proportion of the population ranked according to their wealth and with the vertical axis showing the corresponding cumulative proportion of household net worth. The diagonal line represents a situation of perfect equality, i.e. all households have the same net worth. Figure 7.4 shows the Lorenz curves for two population groups in the United States; the continuous line shows the net worth for all households (Group A), while the dashed line refers to households with net worth exceeding USD 100 000 (Group B).

Figure 7.4. **Lorenz curves for household wealth in the United States, 2007**



Note: Group A refers to all households; Group B refers to all households with net worth above USD 100 000; the “Equality” line refers to a situation where all households have equal net worth.
Source: 2007 Survey of Consumer Finances.

All points of the Lorenz curve for Group B are closer to the line of perfect equality than the corresponding points for Group A.[4] In this situation, Group B is said to be in a position of Lorenz dominance and can be regarded as having a more equal net worth distribution than Group A. The slope of the Lorenz curve at each value of net worth is equal to the value of net worth at that level divided by mean net worth. Note that if some households have negative net worth, the first part of the Lorenz curve will drop below the horizontal axis and have a negative slope (assuming mean wealth for the whole population is positive). For households that have zero net worth, the Lorenz curve will be horizontal. This situation is likely to be more significant for wealth statistics than for income statistics, as the incidence of negative and zero values is much higher in wealth statistics (Cowell, 2010; Amiel et al., 1996).

The negative slope of the Lorenz curve may signify two things: either the household is in a very dire position and has negative wealth values, or it is at a point in its life cycle where it is accumulating debt and expects to increase its wealth levels in the future. An example could be education loans taken out by young college students; the extent to which these would be prevalent in a country depends on the institutional environment.

Another form of Lorenz curves, known as the Generalised Lorenz curves, depict the cumulative wealth of populations after adjusting for differences in averages between the populations. Therefore, if mean wealth is negative, the Generalised Lorenz curve will not be affected in the way the Lorenz curve is. Generalised Lorenz curves can be used to analyse differences in the level of wealth as well as differences in the distribution, but do not show differences in inequality (Deaton, 1997). The slope of the Generalised Lorenz curve at each wealth value is the value of net wealth itself. One cautionary note is that the ordinates of Generalised Lorenz curves are not unit free as in the case of Lorenz curves. Comparisons over time or between countries may therefore be sensitive to the choice of price deflators or exchange rates.

7.3.6. Equivalence scales

In the case of household income, there are internationally recognised equivalence scales that are used to standardise the estimates with respect to household size and composition while taking into account the economies of scale that arise from living together, in particular through the sharing of dwellings. In the case of household wealth, however, no internationally agreed equivalence scales exist, and there is no consensus on whether the scales used for income are appropriate for wealth. In studies jointly analysing income and wealth, the equivalence scale applied to income is also applied to wealth (OECD, 2013).

The use of equivalence scales in the case of wealth depends on the purpose of the analysis. Equivalence scales should not be used when analysing the characteristics of individual components of wealth. If, on the other hand, wealth is treated as a source of income streams that can be used to finance consumption and contribute to economic well-being in the household, wealth might be equivalised just as income. Equivalised estimates are often expressed in terms of single-person household equivalents (i.e. the level of wealth that would be required by a lone person household to have the same level of economic well-being as the household in question).

Failure to equivalise could provide a misleading picture of the distribution of wealth, for example by overstating the share of single-person households at the bottom of the distribution. Table 7.2 provides an example of three types of equivalence scales and their effect on the levels and inequality of the wealth distribution in the United States. “No scale” assumes that larger households require no more resources than smaller households to achieve the same standard of living; the so-called modified OECD scale assigns a value of 1 to the household head, of 0.5 to the remaining adults, and of 0.3 to children; the square root scale divides household wealth by the square root of the household size, without differentiation between children and adults; and, finally, the per capita approach assumes there are no economies of scale as household size increases, i.e. the needs of a household are directly proportionate to the number of people in the household.

Table 7.2. **The effect of equivalence scales on the levels and inequality of household wealth in the United States, 2007**

US dollars

	Italy				Germany				United States			
	No scale	OECD modified scale	Square root scale	Per capita	No scale	OECD modified scale	Square root scale	Per capita	No scale	OECD modified scale	Square root scale	Per capita
Mean	171 312	92 395	101 922	63 994	106 847	64 793	69 110	47 329	219 149	127 528	135 874	89 447
Median	113 707	59 267	66 446	36 660	23 629	14 707	15 284	10 219	42 010	21 874	23 799	13 644
Gini	0.59	0.60	0.59	0.62	0.79	0.80	0.80	0.81	0.84	0.85	0.85	0.86
½CV^2	1.03	1.14	1.11	1.34	3.62	4.19	4.07	4.96	13.41	14.56	14.39	16.38

This example indicates that equivalising affects the levels as well as top sensitive inequality measures such as ½CV^2 (half the square of the coefficient of variation), but has less impact on the Gini coefficient (½CV^2 and the Gini coefficient are explained in the next section).
Source: 2008 Survey of Households Income and Wealth (SHIW); 2007 German Socio-Economic Panel (SOEP); 2007 Survey of Consumer Finances from Luxembourg Wealth Study, accessed October 2012.

Table 7.2 indicates that equivalising wealth affects the levels and those inequality measures that are most sensitive to the top of the distribution, such as ½CV^2 (half the square of the coefficient of variation), but has less impact on other inequality measures such as the Gini coefficient (see the next section).

7.4. Inequality indices

As most inequality measures are defined for non-zero values, the same measures that are used in the case of income can be applied to wealth. This is the case when the focus is on positive holdings of many assets and debts. However, a common characteristic of wealth data is that at various points in the life-cycle households may have negative (due to higher debts) or zero values of net wealth. Inequality measures are of most interest with respect to net wealth. This implies that only a subset of inequality measures can be used to describe wealth inequality, such as the Gini coefficient, the coefficient of variation, the relative mean deviation, and the exponential measures described below.[5]

7.4.1. Gini coefficients

The Gini coefficient can be defined by referring to the Lorenz curve. It is the ratio of the area between the Lorenz curve and the diagonal (or line of equality), compared to the total area under the diagonal. The Gini coefficient equals zero when all people have the same level of wealth and equals one when one person receives all the wealth. In other words, the smaller the Gini coefficient, the more equal is the distribution. The Gini can also be computed as the ratio to the mean of half the average over all pairs (i, j) of absolute deviations of wealth (w) between households. Mathematically, the Gini coefficient can be expressed as:

$$G = \left[\frac{1}{2n^2\mu}\right]\sum_{i>j}^{n}\sum_{j}^{n}\left|w_i - w_j\right|$$

where n is the number of people in the population and μ is the mean of household wealth in the population.

The Gini coefficient is a summary of the differences between each household and all other households in the population. The differences are the absolute arithmetic differences, implying that a difference of USD 10 000 between two relatively high-wealth households contributes as much to the index as a difference of USD 10 000 between two low-wealth households.

An increase in wealth of a person with wealth above the median will always lead to an increase in the Gini coefficient, and a decrease in wealth of a person with wealth below the median will also always lead to an increase in the Gini coefficient. The extent of the increase will depend on the proportion of people that have wealth in the range between median wealth and the wealth of the households with the changed wealth, both before and after the change in wealth.

The Gini coefficient is sometimes criticised as being too sensitive to changes around the middle of the income distribution. This sensitivity arises because the Gini coefficient reflects the ranking of the population, and ranking is most likely to change the densest part of the distribution, which is likely to be around the middle.

The Gini coefficient is well defined when wealth values are negative, but estimates of the coefficient in this case may be greater than one. In this case, the Lorenz curve will lie below the horizontal axis, and the area between the curve and the line of equality may be greater than one. The Gini is one of the more commonly used measures in wealth analysis.

7.4.2. Coefficient of variation

Half of the square of the coefficient of variation (½CV^2) is defined for all values of wealth, but may be substantially affected by the inclusion/exclusion of just one very high person. The coefficient of variation is the ratio of the standard error to the mean.

7.4.3. Exponential measure

A less-known measure that is defined for zero and negative values is the exponential measure discussed by Wolfson (1997). This measure is computed as follows:

$$E = \sum_{i>j}^{n} p_i \exp(-y_i / \mu)$$

where p_i is the proportion of the population in the i-th group, y_i is the average wealth in that group, and μ is the overall mean.

7.4.4. Theil and Atkinson indices

For non-negative values of assets and debts, the Theil index is particularly useful where analysts wish to decompose the measure of inequality in a population into the inequality that exists within sub-groups and the inequality that exists between those sub-groups. The Atkinson indices, on the other hand, highlight that summary measures of inequality depend on the underlying assumptions made, and assist the user in varying some of those assumptions. For more information on these measures, the reader is referred to Chapter 6 of the 2011 *Canberra Group Handbook on Household Income Statistics* or to Cowell, 2011.

7.4.5. Comparison of summary measures

Tables 7.3 and 7.4 show the sensitivity of summary measures of inequality to the treatment of outliers at the low and high-end of the wealth distribution. In the second column of Table 7.3, the top and bottom 1% of the distribution are "shaved" from the sample based on weighted observations, while in the third column both the top 1% and the bottom 0.5% are shaved. The measures of wealth inequality and the mean are sensitive to this treatment; this implies that care must be taken when analysing wealth distributions, as varying conclusions may be reached depending on which measure is examined.

Table 7.3. **Effect of the treatment of outliers on summary measures of wealth inequality in the United States, 2007**

	Raw	Shave top and bottom 1%	Shave top 1% and bottom 0.5%
Mean	556 846	378 215	559 361
Median	120 780	120 780	123 800
Gini	0.82	0.74	0.81
½CV²	18.1	2.4	14.6
P90/P10	30 000	3 369	3 061
P75/P25	26.3	24.5	24.3
P90/P50	7.6	7.0	7.4
n	4 418	3 698	4 359

Source: 2007 Survey of Consumer Finances.

Table 7.4. **Effect of the inclusion and exclusion of households with zero and negative wealth and of top and bottom coding in the United States, 2007**

	Raw	Bottom 1%	> 0	Top 1%	Both 1%
Mean	556 846	557 321	618 403	453 526	454 001
Median	120 780	120 780	154 700	120 780	120 780
Gini	0.8	0.8	0.8	0.8	0.8
½CV²	18.1	18.1	16.2	3.2	3.2
P90/P10	30 000	30 000	167	30 000	30 000
P75/P25	26.3	26.3	12.6	26.3	26.3
P90/P50	7.6	7.6	6.5	7.6	7.6
n	4 418	4 418	4 087	4 418	4 418

Source: 2007 Survey of Consumer Finances choice.

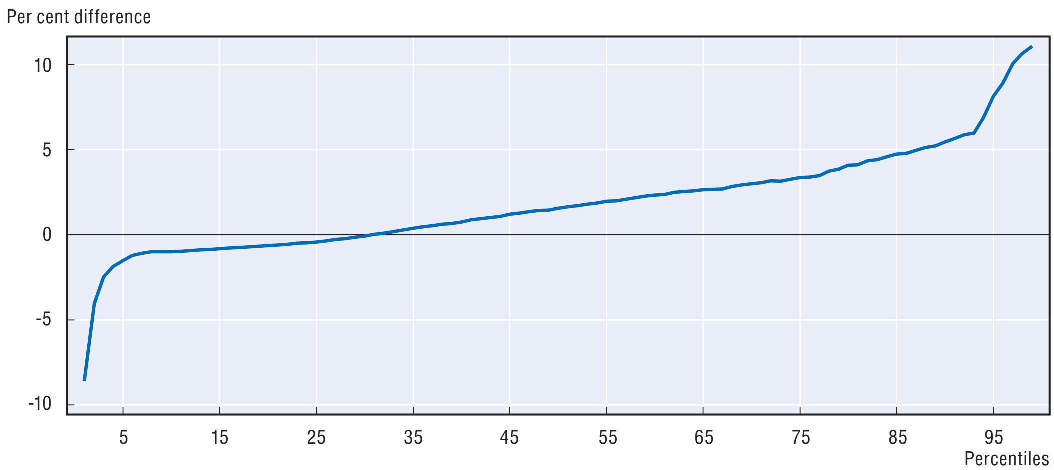
Apart from shaving, one may decide to top or bottom code wealth values above/below a certain threshold. This has no influence on the median, but affects inequality measures that are more sensitive at the top of the distribution (Table 7.4). Alternatively, zero and negative values could be excluded. However, in the data set used in this example, omitting zero and negative values result in 7.5% of the population being excluded. Since negative and zero values are much more common in wealth statistics than in income statistics, this approach excludes a significant proportion from the bottom of the distribution and may have a serious impact on any analysis.

Choice of summary measures

Rather than considering just one summary measure, analysts will often look at a range of measures to see whether they give a consistent indication about wealth inequality, especially if there is no Lorenz dominance among the distributions compared. Comparisons can be made for the same population over time, or between different populations at a point in time.

A model-free way to do this would be to compare CDFs or "quantile-difference plots" (Q-D). A Q-D plot shows the numerical difference in two distributions at each percentile point of the distributions, as a percent of the values for one of the distributions (Kennickell 1999, 2009). Figure 7.5 shows the difference between wealth and income as a share of income at each percentile of the population. This indicator can also be computed for different wealth measures, either at a different point in time or for different countries. If the two distributions are identical, the plot would appear as a horizontal line at zero.

Figure 7.5. **Relative quantile-difference plot for the United States, 2007**



Note: This figure shows a steep upward sloping curve at low percentiles, where wealth quantiles are lower than corresponding income quantiles. The equality between income and wealth levels occurs around the 34th percentile. The positive upward slope for most of the percentile values above the 34th percentile is followed by a steep increase for the highest percentiles. Both patterns reflect the higher dispersion of net worth, and indicate the presence of very large values for net worth at the top of the distribution.
Source: 2007 Survey of Consumer Finances.

7.4.6. Ratios and percentage shares

Presenting shares or ratios are a common way of summarising many aspects of household wealth. They can be useful to show change over time and to compare different geographic areas or population groups, and can refer to asset and debt participation rates, portfolio composition (percentage share of asset values on total assets), debt intensity (share of indebted households with a specified debt-to-asset ratio [leverage ratio], loan-to-value ratio, or debt-to-income ratio), wealth distribution (quintile share ratios, share of wealth held by top percentage of the households). Tables 7.3 and 7.4 provide examples of ratios, and Table 7.6 of shares.

Table 7.5. **Mean and median values of the main components of household wealth in Italy, Germany and the United States**

Euros

	Italy			Germany			United States		
	Mean	Median	Difference	Mean	Median	Difference	Mean	Median	Difference
Total assets	*178 437*	*123 728*	*54 709*	*143 177*	*45 002*	*98 175*	*310 200*	*124 567*	*185 633*
Financial assets	19 101	6 416	12 685	19 353	2 206	17 147	84 173	3 653	80 520
Main residence	126 022	91 650	34 372	91 794	0	91 794	166 615	101 553	65 062
Other assets	33 314	0	33 314	32 031	0	32 031	59 412	0	59 412
Total debt	*7 124*	*0*	*7 124*	*36 330*	*0*	*36 330*	*91 051*	*38 357*	*52 694*
Mortgage	6 048	0	6 048	20 455	0	20 455	62 077	16 804	45 273
Net worth	*171 313*	*113 707*	*57 606*	*106 847*	*23 629*	*83 218*	*219 149*	*42 010*	*177 139*

Note: Most of financial assets and other debt for Germany are recorded only for values exceeding EUR 2 500.
Source: Luxembourg Wealth Study.

Table 7.6. **Share of households by type of assets and debt in Italy, Germany and United States**

Percentages

	Italy	Germany	United States
Financial assets	83.7	57.8	91.1
Risky assets	22.5	n.a.	34.3
Other assets	22.4	15.1	19.5
Total debt	27	45.2	82.4
Housing debt	14.7	25.2	53.6
Other debt	16	25.5	71.7

Note: Most of financial assets and other debt for Germany are recorded only for values exceeding EUR 2 500.
Source: Luxembourg Wealth Study.

Table 7.7. **Inequality measures and top shares by type of assets and debt in Italy, Germany and the United States**

	Italy	Germany	United States		Italy	Germany	United States
	Total assets				Total debt		
Gini	0.6	0.7	0.7		0.9	0.8	0.7
½CV^2	1.0	3.0	7.6		4.9	5.1	2.7
Top 10%	40	53	61		88	75	52
Top 5%	27	38	49		66	55	37
Top 1%	10	18	25		24	27	16
	Net worth						
Gini	0.6	0.8	0.8				
½CV^2	1.0	3.6	13.4				
Top 10%	41	58	70	NW > 0	90.1	67.7	74.7
Top 5%	27	42	58	NW = 0	6.0	18.2	3.6
Top 1%	10	19	31	NW < 0	4.0	14.1	21.6

Note: Most of financial assets and other debt for Germany are recorded only for values exceeding EUR 2 500.
Source: Luxembourg Wealth Study.

7.5. Adjusting for price differences

In order to make comparisons over time, wealth data should be adjusted for price changes. Similarly, when comparing wealth data across geographical areas in the same time period, adjustment for differences in price levels across regions should be made. Estimates adjusted for price changes over time are often referred to as "real" measures (e.g. "real" net worth or net worth "in real terms").

If there is no adjustment for price differences, the validity of such comparisons may be undermined. The need to adjust for price differences increases with the magnitude of these differences. Hence, when comparing wealth in periods of high inflation or over longer periods of time, the need to adjust for price changes increases. Similarly, when there are large price variations between regions, the need to adjust for differences in price levels becomes more important.

The next section describes the main issues that should be addressed when adjusting wealth for price differences over time, or over regions or groups of households. Consultation should be undertaken with the statistical office about the availability of suitable price indices for these purposes.

7.5.1. Adjusting for price changes over time

To obtain valid estimates of changes in "real" levels of wealth over time, wealth data need to be deflated, or adjusted by appropriate price indices. The price indices to be used depend on the analysis to be undertaken.

When time series of income estimates are deflated, it is usual to use a price index that measures the prices of goods and services that households consume. The deflated income data then provide an indication of changes in real living standards that can be supported by household income over time. Consumer price indices are appropriate price indices for this purpose, although some adjustments may be needed to obtain a better match between the scope of the income estimates and the scope of the consumer price index.[6]

When the analysis is focused on wealth, then it is appropriate to deflate aggregate estimates of wealth with the same consumer price index (or similar deflator) used to adjust income estimates.

It is also possible to adjust the value of non-financial assets according to changes of prices of those assets, if the focus of the analysis is the assets themselves rather than the ability of wealth to support consumption. For example, the value of dwellings could be adjusted by a dwelling price index, while the value of consumer durables could be adjusted by a consumer durable index. However, there are no price indices reflecting the prices of financial assets or liabilities, in the sense of the value of an underlying single unit of these variables. Therefore, it is possible to deflate them only by using a more general price index of the goods and services that might be purchased with a corresponding amount of cash. The consumer price index might be used for this purpose, or an aggregate index of producer prices, or a more broadly based indicator of prices in the economy, such as the implicit price deflator of Gross Domestic Product or domestic final demand, which are available from the national accounts.

To consider the appropriateness of price indices for deflating wealth estimates, analysts need to consider the purpose of the analysis to be undertaken and to consult with the compilers of the price index that is used. The index compilers will also be able to provide more information on the availability of price indices for types of households or by region, where this may be of relevance.

7.5.2. Adjusting for price and currency differences between countries

In some studies, wealth data are presented in relative terms, e.g. showing ratios or percentages. Such presentations are not made in monetary terms and thus the question of adjusting for differences in price levels does not arise. Similarly, when comparing such distributions across countries there is no need to convert data to a common currency. However, analysts and policy makers are also interested in the relative standards of living in different locations in real terms.

For comparisons between countries in the same time period, monetary data should be adjusted to take into account differences in price levels and currencies. To this end, a measure of the relative prices needs to be applied, such as purchasing power parity (PPP). The PPP compares the price of a product or a group of products in one location to the price of the same product or group of products in another location and at the same period in time, and thus can be used to measure the relative purchasing power of incomes in the locations compared. For example, if prices in region A are 10 % higher than in region B, the same nominal income will be worth more in region B than in region A. To make "real comparisons, it is hence necessary to adjust for these price differences.

PPPs have been developed primarily to facilitate international comparisons of economic data, in particular national accounts and their aggregates. They are therefore usually compiled at country level, and cannot be broken down by regions or types of households. However, in some (usually larger) countries, PPPs may be compiled also at a regional level; in other countries, PPP surveys that allow the construction of regional aggregates may be conducted on an *ad hoc* basis.

In most countries, PPPs are compiled to cover a wide range of goods and services beyond household consumption. When PPPs for individual consumption by households are available, they should be used for wealth (and income) distribution, since PPPs for GDP also include in the basket of goods and services used for calculation government services, investment goods and construction projects. PPP sub-indices that exclude goods and services such as health care, education and housing, which may be purchased by households rather than provided by government in different countries, may also be available.

PPPs are regularly compiled by the OECD and Eurostat for their member countries and some additional countries. PPPs are compiled less frequently by the World Bank for a wider range of countries as part of the International Comparison Programme. When PPPs are not available annually, those which are as close as possible to the years for which the household data are to be compared should be used.

For international comparisons, it is highly recommended that PPPs be used, rather than exchange rates, for conversion into a common currency. This is because exchange rates are often influenced by more factors than just the relative price levels in the two countries concerned. When an economic aggregate is converted using PPPs for household consumption expenditure, the conversion is made on the basis of the goods and services likely to be purchased by households for consumption purposes, as well as by taking account of differences in national price levels. This allows comparisons in real terms, or purchasing power, of the converted amounts.

The PPPs are compiled by comparing the average price of groups of goods and services in different countries. However, it may not always be possible to obtain identical products in different countries, or the products found may be of different economic importance in the countries compared. Thus, PPPs for countries with similar structure and income level may provide fairly good indices for adjusting wealth (and income) data, while the accuracy of the PPPs is likely to decrease the more the countries differ in structure and income level.

Differences in climate and natural resources also play a role, e.g. heating is important in colder climates, while air-conditioning is not. Food is another area where comparisons are difficult, since a staple in one country may be a somewhat exotic article elsewhere.

7.5.3. Wealth indicators

Discussions continue on which type of household wealth indicator is more useful on a regular basis. This section draws on country experiences to identify those indicators that are considered to be the most useful for such comparisons.

Studies on wealth have focused on examining the portfolio composition of households, with a particular focus on participation rates and values (assets and liabilities). This type of analysis also considers the incidence of debt as well as the intensity of debt (debt burden of indebted households). Other studies have looked at the distribution of wealth, savings and access to finance, intergenerational transfers, and pension and insurance policies. These indicators could be presented for different household types, e.g. according to household size, age of head of the household, education level, family type, employment status, tenure status, or income or wealth decile group.

Common indicators that have been used are as follows:

- Median and mean values. Median is a more robust measure of central tendency, but when presented alongside the mean is also an indication of the inequality of the distribution.
- Share of households by type of assets and debt.
- Structure of assets and debts.
- Debt-to-income ratio.
- Debt-to-asset ratio (loan-to-value ratio).
- Debt service-to-income ratio.

To measure wealth distribution, indices are borrowed from the income literature. Care must be taken, as not all indices are defined for negative or zero values:

- Gini coefficient, Lorenz curves, relative mean deviation, $\frac{1}{2}CV^2$ (half of the square of the coefficient of variation).
- Theil coefficient (only for positive values).
- Share of households with negative/zero and positive wealth.
- Wealth shares.
- Ratio of mean to median.
- Percentile and quantile ratios.

These indicators can be used in addition to those on income to assess the economic well-being and economic adequacy of households.

Examining low-wealth and high-wealth individuals may call for different types of measures. High-wealth individuals are best captured using measures of top shares. Low-wealth individuals can be identified using the concept of asset poverty. Asset poverty can be defined as a household's wealth that is insufficient to provide for basic needs over a specified period of time (e.g. three to six months). By taking into account wealth and not just income, this measure provides a more accurate account of the financial state of the household (Shapiro and Wolff, 2001; Brandolini et al., 2010). Asset poverty is generally more prevalent and persistent than income poverty.

7.6. International statistical comparisons

The value of statistical comparisons across countries is illustrated below by presenting some of the findings from research based on the Luxembourg Wealth Study. For a detailed description of the study, see Sierminska et al. (2006).

The analyst needs to spend some time thinking about the following issues in order for the comparisons to be sound: whether the wealth definitions and unit of analysis are comparable; whether price adjustments have been made; whether outliers have undergone similar treatment; what are the key differences in data collection methods; the effect of pension wealth (and other missing components) on the results; and other institutional differences that may impact on the results. All of the analytic measures described in the previous section can be useful in making these comparisons.

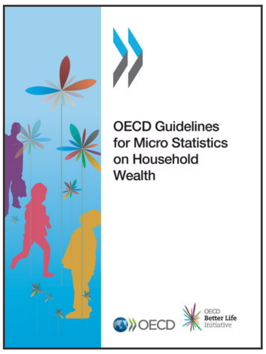
7.7. Summary

The key highlights from this chapter can be summarised as follows:

- A life-cycle perspective is particularly important when analysing wealth data. Young individuals at the beginning of their working careers tend to have low (or negative) levels of wealth. As they grow older, they save and accumulate wealth, creating a stock that can be drawn upon during retirement. As a result, older households near retirement are expected to have wealth levels close to the maximum of their life-time. As they enter retirement, individuals begin decumulation and use up at least some of their wealth in order to supplement their income and maintain their desired level of consumption.
- The availability of data about population sub-groups supports analysis to identify vulnerable groups (e.g. those that are asset-poor), assess the adequacy of retirement portfolios, and gain a better understanding of the onset of a crisis and its impact on economic well-being.
- The household is the main unit of analysis of household wealth, since the number of households with particular characteristics is generally the focus. However, where there is interest in analysing wealth data on the basis of the number of persons in households with particular characteristics, the unit of analysis is the person and person-weighted estimates are needed.
- The mean is frequently used to measure wealth levels. For some purposes, means for a household variable may be required with respect to all people in a population group, including children. Such measures are referred to as person-weighted measures and are the preferred approach when analysing equivalised household wealth.
- An alternative measure of central tendency is the median. Compared to the mean, the median is a more stable and robust measure. The mean and median together provide a simple indicator of wealth dispersion.
- Wealth dispersion can also be described using frequency distributions, cumulative distribution functions, Lorenz curves, and quantile-based measures such as percentile ratios and the percentage of wealth held by the richest 1% of the population.
- In the case of household income, equivalence scales are widely used to standardise the estimates with respect to household size and composition, while taking into account the economies of scale that arise from living together in a household, in particular sharing dwellings. The same approach can be taken when analysing wealth as a potential stream of income that can be used to finance consumption and contribute to economic well-being in the household. Failure to equivalise could provide a misleading picture of the structure of the distribution of wealth, for example by overstating the share of single-person households at the bottom of the wealth distribution.
- There are a number of inequality indices that can be useful in analysing household wealth, including the Gini coefficient, the coefficient of variation and the exponential measure.
- In order to make comparisons over time, data should be adjusted for price changes. Similarly, when comparing data across geographical areas in the same time period, adjustment for differences in price levels across regions should be made. For international comparisons, prices should be adjusted by the use of purchasing power parities rather than exchange rates.

Notes

1. The distinction between counting households or individuals can be illustrated by the statement that "the top 10% of the wealth distribution hold 66% of total wealth". If referring to households, this would mean that the top 10% of households, who might constitute more or less than 10% of the population, hold 66% of the total wealth, whereas if the statement refers to persons, it means that the top 10% of persons hold 66% of the total wealth.
2. To identify the median record, the population is first ranked in ascending order according to the data item of interest. For household-weighted measures, the weights of the records are then accumulated until half the households are accounted for. The record at which this occurs is the median record, and its value for the data item of interest is the median value. For person-weighted measures of household variables, the household weights are multiplied by the number of persons in the household before accumulation. Accumulation takes place until half the number of persons is accounted for, and the record at which this occurs is the median record.
3. Kernel density estimates can easily be calculated in Stata using the command kdensity or akdensity (for an adaptive kernel density estimator).
4. If the Lorenz curves of two groups cross over, there is no Lorenz dominance and no generally accepted way of defining which of the two groups has the more equal distribution.
5. Inequality measures differ in their sensitivity to different parts of the distribution. The coefficient of variation is more sensitive to the top, the Gini is more sensitive to the middle, and the exponential measure is more sensitive to the bottom.
6. For example, when the income definition chosen is disposable income, the price index should capture those consumption items that can be purchased out of disposable income; if income is measured net of local government/property taxes, then local government/property taxes should not appear in the price index; or if a broader definition of income is used, such as including imputed rent, social transfers in kind or income from own account production, then ideally the weights of the price index should be expanded to reflect the consumption of the goods and services obtained in these ways as well as the consumption of goods and services purchased in the market.



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