# 1 About this study

Since the early 1990s, Australia has experienced its longest period of continuous economic growth on record and associated rise in household incomes. It has also avoided some of the more severe effects of the global financial crisis.

Average real household incomes in most OECD countries have grown over the past 20 years — a notable exception is United States for which median real household incomes have fallen over the past decade (OECD 2012a). Rising income levels, however, have been accompanied by a widening of the distribution of income in most OECD countries (and many developing countries). As noted by the OECD (2011):

Over the two decades prior to the onset of the global economic crisis, real disposable household incomes increased by an average 1.7% a year in OECD countries. In a large majority of them, however, the household incomes of the richest 10% grew faster than those of the poorest 10%, so widening income inequality. Differences in the pace of income growth across household groups were particularly pronounced in some of the English-speaking countries, some Nordic countries and Israel. (p. 22)

The OECD (2011) reports that Australia’s experience has been similar, albeit with higher rates of growth in both income (across the entire distribution) as well as inequality. Understanding these trends requires an examination of changes observed in sub-groups (such as full-time versus part-time workers), different units of analysis (such as between individual versus households) and types of income (such as market income and government payments). For convenience, these are referred to as ‘proximate factors’ in this paper. This is the focus of this paper.

This area of inquiry is of ongoing relevance to the Commission’s work. In analysing the overall effectiveness and efficiency of government policies, the Commission is often asked to also consider the distributional impacts (for example, PC 2005 and 2009). Distribution changes, and specifically trends in inequality, are important because:

* growth in average income is a widely used indicator of economic and social progress. Yet aggregate measures can conceal important information about the experience of different groups and different individuals. Understanding distributional trends and what lies behind them enriches our knowledge of the performance of the economy.
* people care about inequality, and it influences government policy. Better information about factors underlying changes in measured inequality can help better inform future policy.

## 1.1 What this paper is about

This staff working paper examines the recent trends in Australia’s individual and household income distributions. It examines the proximate factors that help explain aggregate trends to provide a more detailed understanding of the composition of the income distribution (in terms of both the groups represented within it and the different kinds of income they receive). It also examines whether the Australian experience mirrors general trends across OECD countries.

The approach of this paper is to ‘build-up’ from basic units of analysis and income measures to more comprehensive ones (detailed in the following section). The remainder of this chapter outlines the data used and ‘tool kit’ of techniques typically used in distributional analysis and some of their limitations.

Chapter 2 examines trends in the distribution of individual market income. The market incomes of different groups are analysed, with a particular focus on full-time, part-time and self-employed workers. This chapter breaks market income down into its two main sources — labour and capital, with a particular focus on the former (which is the largest source of market income). The unit of analysis throughout chapter 2 is the individual.

Chapter 3 examines how changes in different types of income contribute to the distribution of household final equivalised income (this concept is explained in the following section). This involves examining how the distribution (and its trends) changes when government transfers, taxes and the effects of household size are considered. Several different population groups are considered including family types (such as single, dependent children amongst others), working and non-working age and jobless households. The unit of analysis throughout chapter 3 is the household.

The final chapter places these findings in context by comparing Australia with broader OECD trends. It also suggests possible areas of future work.

## 1.2 Measuring income and its distribution

Measuring the distribution of income is not straightforward. First, ‘income’ needs to be defined. Second, the aspects of the distribution to be measured and how these should be estimated need to be determined. These issues are briefly discussed below.

### ‘Building up’ to household income

People receive income from a number of sources. At the most basic level, income comprises the remuneration *individuals* receive in exchange for their labour (paid employment or self-employment), earnings on investments (such as property, shares or from funds held in interest bearing deposits) and other private transfers. The former is referred to as *labour income* and the latter is referred to as *capital & other income*. Combined, these form *market income*.

Many people also receive direct transfers from government. These include the Aged Pension, the Disability Support Pensions, unemployment benefits, Family Tax Benefit A and Family Tax Benefit B, amongst others. Market income combined with direct transfers is referred to as *gross income*.

As many of these payments are calculated based on household level characteristics (for example, some depend on the number of children present or household income) it is useful to analyse *gross income* (and subsequent measures of income) at the household level. Additionally, using households as the unit of analysis is a better guide to the financial resources that individuals have access to than their individual market income. This is because many households share income and divide paid (employment) and unpaid (such as caring for children) labour differentially among household members (for example, the labour income of the primary carer of a newly born child will often be less than the financial resources to which that person has access to).

As people are required to pay tax on their income, the amount of money they actually receive is generally less than their gross income (providing their income exceeds tax free thresholds). Gross income minus direct taxation obligations is known as *disposable income*.

In addition to direct payments, governments also supply a range of public services either free of charge or at subsidised rates which can be considered as ‘income in-kind’. This represents an indirect transfer. At the same time, the amount of goods and services individuals can purchase with their disposable income is reduced by taxes that occur at the point of sale (indirect taxes). To account for these factors the Stiglitz-Sen-Fitoussi Commission (Stiglitz et al. 2009) noted that when examining household income, the most comprehensive measure is one that takes:

… account of payments between sectors, such as taxes going to government, social benefits coming from government, and interest payments on household loans going to financial corporations. Properly defined, household income and consumption should also reflect in-kind services provided by government, such as subsidized health care and educational services. (p. 13)

In practice, detailed measures of in-kind services are often unavailable (this is a motivating factor in the data set chosen for this study, which is discussed in the following section).

Income measures which take into account in‑kind services in addition to taxes and transfers are usually termed ‘adjusted disposable household income’ or *final income*. The later term is used by the Australian Bureau of Statistics (ABS) and is adopted in this paper.

Finally, in order to link the total income available to each household to actual resources available to its members, the size and composition of the household (that is, the number of people and their age) needs to be taken into account. The material requirements of households grow with each additional member. However, due to economies of scale in consumption, these requirements are not necessarily proportional to the number of household members.[[1]](#footnote-1) Equivalising household income attempts to account for this.[[2]](#footnote-2)

*Final* e*quivalised household income* provides a more complete picture of the resources available to people, how they are distributed, and how this distribution has changed. However, understanding changes in this measure requires analysis of changes in its constituent parts. This building up of the income distribution in Australia is illustrated in figure 1.1.

Figure 1.1 Building up to the distribution of equivalised final incomea

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| This figure shows the various sources of income analysed in this study. Income is analysed at the individual level first, examining labour income of workers and then market income (labour plus capital and other income) of recipients. Household income is then explored, with gross (labour plus capital and other plus direct government payments), disposable (gross income less direct taxes) and final (disposable less indirect taxes plus indirect benefits) examined. |

a Labour income estimates from the HES do not include compulsory superannuation payments. Instead, as per international convention, superannuation is treated as income when it is drawn upon and treated as such by individuals.

### Data on the distribution of income in Australia

This paper draws on the Household Expenditure Surveys (HESs), undertaken by the ABS. This survey collects detailed information about the expenditure, income, assets, liabilities and characteristics of households resident in private dwellings throughout Australia. The survey was undertaken in 1984, 1988-89, 1993-94, 1998-99, 2003-04 and 2009-10. In the most recent year the sample size was 9774 households. Due to issues with data consistency, this working paper has only examined HESs from 1988-89 onwards. In some cases, data items were not collected in earlier years, further limiting the period considered (for example, information on imputed private rent is only available in the 2009-10 survey and the measurement of hours worked by individuals is too coarse prior to 1998-99 to estimate hourly wage rates).

The HES has a number of attractive features for examining the distribution of income in Australia. The Survey of Income and Housing (SIH) and the Household Income and Labour Dynamic in Australia (HILDA) survey are frequently used in the analysis of Australia’s income distribution. There has been relatively little analysis of the HES (in particular prior to it merging with the SIH in 2003-04).

The HES was chosen for this study as it contains a richer set of forms of income, from market (labour and capital) to government payments (direct and indirect) along with taxes (direct and indirect). The inclusion of indirect taxes and transfers allows for the construction and analysis of final income, which offers a more complete picture of household income. Final household income can then be contrasted with other measures of income or units of analysis (such as individual income) as all data are gathered at the same time using the same methodology. This facilitates a richer analysis of distributional trends than would otherwise be possible.

That said, there are also some limitations in using HES data.

* As with other long running income surveys (such as the SIH), there have been changes that affect the consistency of the data. Over time, the ABS has improved its methodology, providing estimates of income items that are closer to their conceptual definition (box 1.1). While such changes improve the quality of data over time, it does mean that data across various surveys are not exactly the same. This increases the uncertainty of inferences about trends over periods where the definitional changes occur. However, in general, these effects appear to be relatively small (appendix B). Changes in survey design over time are discussed in more detail in appendix B.
* The HES is collected infrequently compared to the SIH (every two years) and HILDA (collected every year from 2001). This makes it difficult to identify key ‘turning points’ in trending data. It also means that any trends identified will be influenced by unusual factors affecting data at the start and end points of series (though this problem affects all time series analysis). Nevertheless, summary indicators derived from the HES appear to display trends consistent with those in the more frequent SIH and HILDA data.
* Information on individuals and households in the lowest income deciles is subject to some degree of ambiguity as many report expenditures greater than incomes and, on average, greater than those in higher incomes. This is also true of the SIH.
* Incomes for the top 1 per cent of earners are likely to be less accurate due to lower survey response rates amongst this group which are not accounted for in sample weighting procedures.
* The treatment of compulsory superannuation payments is likely to complicate changes in employee earnings between 1988-89 and 2009-10. As per international convention, superannuation is treated as income when it is drawn upon and treated as such by individuals. Superannuation reforms have taken place during the period examined by this study which would influenced labour incomes and therefore the distribution of income.

It should also be noted that research making use of HILDA data has found differing patterns in income inequality compared to research making use of ABS data (see Wilkins 2013). As discussed in appendix B, survey design and sample size are likely to account for some of these differences, but further work is required to reconcile the differences found.

Nevertheless, the HES remains a valuable information source for developing a better understanding of the distribution of income in Australia, particularly when complemented with analysis based on other surveys. Where possible, estimates derived from the HES have also been checked against estimates in alternative ABS series.

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| Box 1.1 Summary of recent changes to income measurement in HES |
| * 2003-04 * Change in measurement of current income from own unincorporated business and investments from reported income for the previous financial year to respondents' estimates of expected income in the current financial year. * Inclusion in employment income of all salary sacrificed income and non-cash benefits received from employers. * Collection of a more detailed range of income items and information on all assets and liabilities of respondents.   2009-10   * Questions added to the survey on the amount of ‘additional’ overtime respondents expect to earn in the given year (in addition to ‘usual’ overtime). * Netting off of interest paid from interest earned on borrowed funds to purchase shares or units in trusts. Previously only gross interest earned was recorded for investments other than rental properties. * Inclusion of termination payments and workers’ compensation lump sums, with an upper boundary of three months wages. * Inclusion of irregular bonuses in employment income (in addition to regular bonuses). * Expansion of family financial support from regular cash payments, mainly child and spousal support, to also include other forms of financial support including goods, services, rent, education (capital transfers, e.g. cars, remain excluded). |
| *Source*: Appendix B. |
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### Representing the distribution of income

Income distributions are generally skewed to the right. That is, the mean or average income is greater than the mode (the most commonly occurring level of income). This skewing of the distribution of income tends to be greater for individual income than for household income as household formation exerts an equalising force. The same measures of the distribution of income can be applied to individual and household income. Such measures seek to provide information on the shape of the distribution of income (whether wage, market, gross or final) for the population of interest (workers, individuals or households).

There are a range of different measures of the distribution of income. Some focus on the income share for specific groups — such as the proportion of income held by the top decile (or percentile) of the population. Others focus on characteristics of the distribution or seek to estimate the distribution itself — as with estimates of the probability density function of income obtained from kernel density estimation methods (box 1.2).

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| Box 1.2 Kernel density estimation |
| There are several methods that can be used to depict the distribution of income, ranging from histograms (frequency counts within defined income ranges) to attempts to estimate the shape of the distribution itself via kernel density estimation.  Kernel density estimation can be used to estimate the probability density function of a random variable, such as income (which is observed randomly within income surveys). It is a non-parametric approach that estimates the shape of the distribution by calculating the relative density of the number of observations for any given value of the variable of interest. Density estimates are produced using a similar method to histograms, with the exception that intervals are allowed to overlap. In this way estimates are produced by collecting ‘centre point densities’ through ‘sliding’ the interval, or window, across the data range.  The estimated functions allow the income distribution to be presented graphically, providing one lens through which to view changes over time. It remains important that other aspects of the distribution are also explored (including its moments: mean, median, mode amongst others) to understand the nature of the shifts observed.  Kernel density functions have the advantage over histograms in that they can be estimated as continuous smooth functions (histograms provide estimates over discrete ranges). For this study, kernel density estimation has been done in Stata using the Epanechnikov kernel function. Density estimates obtained have been converted to population proportions. |
| *Source*: StataCorp (2009). |
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Commonly used summary measures include those which examine income shares or ratios. Share measures include the share of income (or average income) of those within intervals defined by the share of the population — deciles (groups making up 10 per cent of the population), quintiles (20 per cent), and quartiles (25 per cent) are the most common.

The income estimate at any given percentile represents the value of income below which that per cent of incomes fall. For example, the income value at the 50th percentile means that 50 per cent of people earn less than that income (the 50th percentile is the same as the median income). Income at the 90th percentile means that 90 per cent of the population earn less than that amount.

The availability of income data from taxation records has allowed income shares to be used to examine historical changes in the distribution of individual incomes over long time periods (see, for example, Atkinson, Piketty and Saez 2011). This provides only a limited picture of trends in the distribution of income. The data needed to measure the characteristics of household income distributions are more detailed and is usually collected through household surveys. Improvements in data collection and availability have supported the more thorough examination of trends in the distribution of household equivalised income in the recent literature (for example Johnston and Wilkins 2006, Pavcnik 2011, Bray 2012, and Wilkins 2013).

#### Measures of inequality

Much of the analysis on income distributions focuses on the *dispersion* of the distribution (the second moment of the distribution). That is, the spread of income between those at the bottom and those at the top. Such measures, usually called measures of inequality, summarise the spread of incomes across the entire population (unlike percentile or decile measures which present point estimates).

There are several widely used measures of inequality, the most common being the Gini coefficient and the standard deviation of log income. Other measures capture particular aspects of the distribution such as percentile or decile ratios. Commonly used ratios include the 90th to 10th percentile (‘P90:P10 ratio’), the P90:P50 ratio and the P50:P10 ratio. These measures are particularly useful for data sets where high and low incomes are coded or where issues of under reporting exist. (The HES does not include coded income data and with a large data set, along with the ABS’s quality assurance processes, misreporting error is minimised as much as possible.) However, such measures focus on the percentiles (or deciles) examined and therefore do not reflect information about the spread of incomes that occur elsewhere in the distribution.

Ideally, inequality measures are designed to conform to a set of axioms to avoid measures that can behave in perverse ways (box 1.3). For example, measuring dispersion by the variance of the distribution is not independent of income scale, meaning a doubling of all incomes leads to a quadrupling of measured inequality.

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| Box 1.3 Five key properties of inequality measures |
| * The Pigou-Dalton transfer principle — any measure of inequality must, in response to a mean preserving redistribution, rise (or at least not fall) for an income transfer from a lower income to a higher income person and fall (or at least not rise) for a counter transfer (Pigou 1912; Dalton 1920). * Income scale independence — any measure of inequality should be invariant to uniform proportional changes in income. That is, if each individual’s income changes by the same proportion then measured inequality should not change. * Principle population — any measure of inequality should be invariant to replications of the population. If two identical income distributions are merged, measured inequality should not change. * Anonymity — the inequality measure should be independent of any characteristic of individuals other than their income (or the indicator whose distribution is being measured). For example, measured inequality in an economy with two individuals, A and B, whose income shares are 60 and 40 per cent respectively should be invariant if the income shares are swapped. * Decomposability — overall measured inequality should be related consistently to constituent parts of the distribution. That is, if inequality increases amongst all sub-groups of the population then overall inequality would also be expected to increase. |
| *Source*: Litchfield (1999). |
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Much of the literature concerning income inequality focuses on the Gini coefficient (see box 1.4 and appendix A). In short, this measure depicts the difference in the observed income distribution to one in which income is equally distributed. This measure satisfies the axioms of inequality measures but is not without its limitations. First, there is not an unambiguous interpretation of changes in the Gini (see following section). Second, the Gini is only decomposable if the partitions of a distribution are non-overlapping (Litchfield 1999) — that is, if the income distributions of the sub-group populations for which the decomposition is sought do not overlap. For example, the Gini coefficient would only be decomposable between the effect of part-time and full-time earners if the maximum income from part-time workers does not exceed the minimum earnings of full-time workers. If this is not the case, some of the variation in the Gini coefficient cannot be attributed to a particular sub-group as it will be correlated to both.

This paper does not seek to advance the large volume of literature that surrounds the measurement of the dispersion of income. Instead, a ‘practitioners approach’ is taken, which focuses on graphical depictions of distributional change using probability density functions, decile analysis and the commonly used Gini coefficient as the summary measure of inequality.

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| Box 1.4 The Gini coefficient |
| The Gini coefficient can be graphically represented using the Lorenz curve, which depicts the cumulative income shares against cumulative population shares (see example in figure below). The curvature of the Lorenz curve depicts the level of inequality. If all individuals (or households) had the same income (perfect equality), then the curve would lie along a 45 degree ray from the origin.  The Gini coefficient is the ratio of the area enclosed by the Lorenz curve and the perfect equality line (A) to the total area below that line (A+B). It ranges from 0 (perfect equality, A=0) to 1 (perfect inequality B=0).  This figure depicts the calculation of the Gini coefficient graphically using the Lorenz curve. The Gini coefficient value is the ratio of the area under the Lorenz curve (which depicts the cumulative income shares against cumulative population share) to the area under a 45 degree ray from the origin. |
| *Source*: Jenkins and Van Kerm (2008). |
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#### Measures of inequality and distributional changes

The link between distributional shifts observed in probability density functions and summary measures of income inequality such as the Gini coefficient is not straightforward. Distributional shifts can be characterised into four components:

* sliding — a ceteris paribus shift to the right or left along the income line
* stretching — a ceteris paribus increase in spread around a constant mean
* narrowing — a ceteris paribus decrease in spread around a constant mean
* flattening — a ceteris paribus disproportionate increase in density (or proportion or the population) on one side of the mode (Jenkins and Van Kerm 2004).

A ceteris paribus (rightward) sliding of a distribution along an income line (figure 1.2, top left panel) represents a situation where incomes of all individuals within a population have increased. In this instance, the Gini coefficient will remain unchanged as the spread of incomes across the population has also remained unchanged.

Figure 1.2 Types of distribution change and changes in Gini coefficient

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| Sliding change No change in Gini coefficient  Income  % | Stretch change  Increase in Gini coefficient  Income  % |
| Narrowing change decrease in Gini coefficient  Income  % | Flattening change Increase in Gini coefficient  Income  % |

A ceteris paribus stretching of a distribution will occur in instances of growing tails (figure 1.2, top right panel). Both the proportion of individuals on low incomes increases, and the proportion of individuals with high incomes increases (or upper point increases). In this instance, the spread of incomes has increased and the Gini coefficient will also increase. A ceteris paribus narrowing of the distribution is the reverse of this and will decrease the Gini coefficient (figure 1.2, bottom left panel).

A ceteris paribus flattening of the distribution is the most complex change and can take several forms. It can occur with a shift in the proportion of the population from the left side of the mode to the right, where these individuals become dispersed across the income ranges on the right of the mode (as depicted in figure 1.2, bottom right panel). Such a shift will increase the Gini coefficient even where the highest observed income remains unchanged.

Even more complex than links between probability density functions and the Gini coefficient are those between these measures and changes in social welfare (box 1.5). It should be noted that any specific Gini value is neither ‘good’ nor ‘bad’ in the sense that a different Gini result would be welfare enhancing.[[3]](#footnote-3) Instead, it represents a measure of the dispersion of the distribution of income and, if viewed over time, provides a way to summarise changes in income dispersion.

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| Box 1.5 Distributional shifts, the Gini coefficient and welfare |
| The four stylised distributional changes — sliding, stretching, narrowing and flattening can, in part, be related to assessments of social welfare.  Assuming that assessments are based on a social welfare function that satisfies the property of monotonicity — that is, more income is better than less regardless of relative income — then a sliding to the right of an income distribution implies an increase in welfare (no change, all else remaining equal, in the Gini coefficient). In other words, real increases in incomes for all means the population is better off than before.  Further, assuming a social welfare function that is increasing and S-concave in income — that is, where higher incomes increase welfare but the welfare improvement of an additional dollar of income for those with initially high income is less than the impact on those with initially low incomes — a stretching of the distribution (increase in Gini) implies a decrease in social welfare. A narrowing confers the opposite.  The social welfare implications for a flattening or squashing of the distribution are less clear. In essence, a flattening or squashing of the distribution is likely to be driven by changes in the skewness and kurtosis in the distribution. Jenkins and Van Kerm (2004) show these effects are generally driven by changes in sub-groups which should be evaluated independently.  This highlights that for some welfare-enhancing changes, the Gini coefficient remains unchanged or could even increase. Further, it is likely that changes in a distribution over time incorporate most of these facets. Given these considerations, welfare inferences from changes in aggregate Gini coefficient estimates are not possible. |
| *Source*: Jenkins and Van Kerm (2004). |
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To address the question of whether welfare is affected by a change in the distribution of income, the underlying factors determining the distribution and reasons behind observed changes must be understood. Social welfare must also take into account the effects of non-market changes associated with changes in measured income. The importance to the individuals in the population of their relative income position and attitudes to inequality must also be known.[[4]](#footnote-4) Such questions are beyond the scope of this paper.

1. For example a two-person household may use less than twice the electricity of a one person household. [↑](#footnote-ref-1)
2. The equivalisation approach in this study follows that of the ABS. The equivalising factor applied to household income is calculated using the ‘modified OECD’ equivalence scale. The equivalising factor is determined by applying a score of 1 to the first adult in the household, with each additional adult (those 15 years or older) allocated 0.5 points, and each child under the age of 15 allocated 0.3 points. [↑](#footnote-ref-2)
3. For example, two societies with the same Gini coefficients can have very different distributions of income. Consider a hypothetical country (country A) in which 50 per cent of the population receives all the income earned in equal amounts (that is, total income is distributed equally amongst 50 per cent of the population. The Gini coefficient for country A would be 0.5. Another country (country B) where 25 per cent of all income is earned equally by 75 per cent of the population with the remaining income earned by 25 per cent of the population would also have the same Gini coefficient — 0.5. Despite having the same Gini coefficient, these countries have very different underlying income distributions. [↑](#footnote-ref-3)
4. Research has indicated that not only do attitudes to both own relative position and inequality in general differ across countries, gender, age and cultural background (Austen 2002), they also change over time (Meagher and Wilson 2008). [↑](#footnote-ref-4)